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Investigation of Parasitic Contaminants in Ready-to-Eat Fruits at Madina Market, Ghana

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Abstract

Ready-to-eat fruits are a vital component of a healthy diet but may pose significant health risks when contaminated. This study assessed the parasitic contamination of selected ready-to-eat fruits mangoes, oranges, bananas, watermelons, and apples sold at Madina Market in the La Nkwantanang Madina Municipality, Ghana. A total of 31 fruit samples from open market vendors and 30 control samples from grocery shops were examined using sedimentation and zinc sulfate concentration techniques. Microscopic examination revealed intestinal parasites such as Ascaris lumbricoides, Trichuris trichiura, Enterobius vermicularis, Loa loa, and unidentified rind worm eggs in the market samples, while no parasitic organisms were detected in the grocery shop samples. Watermelon exhibited the highest contamination rate (75%), followed by banana (62.5%), apple (57.14%), and mango (40%). Oranges showed no detectable contamination. The presence of these parasites is likely attributed to unhygienic handling, washing with contaminated water, and poor storage practices. The findings highlight a substantial public health concern and emphasize the need for improved hygiene practices, proper fruit washing techniques, and public education. These measures are crucial to minimizing the risk of parasitic infections linked to fruit consumption in urban markets.

Keywords*: Ascaris Lumbricoides, Food Safety, Loa Loa, Public Health, Parasitic Infection, Trichuris Trichiura.*

Introduction

Fruits are defined as the edible parts of plants that typically contain seeds and are surrounded by pulpy tissue. They often have a sweet or tart flavor and are commonly consumed as beverages, side dishes for breakfast or lunch, snacks, or desserts [1]. In contrast, vegetables refer to edible plant parts, including stems, stalks, roots, tubers, bulbs, leaves, flowers, and even some fruits. This category may also encompass seaweed and sweet corn, and in some contexts, mushrooms and pulses. Vegetables are usually consumed raw or cooked, either as part of a main dish, in salads, or as appetizers [1].

Raw or unprocessed fruits and vegetables are rich in essential nutrients such as carbohydrates, proteins, vitamins, and minerals, all of which are critical to human health [2]. Globally, the regular consumption of fruits and vegetables is encouraged due to their significant role in disease prevention, including reducing the risk of cancer, diabetes, cardiovascular conditions, and stroke [3].

Beyond their nutritional value, fruits and vegetables also contribute economically, especially in developing countries where they provide employment opportunities, particularly for women. However, these foods can become contaminated with various microorganisms during cultivation, harvest, and post-harvest handling. Although many of these microorganisms are harmless epiphytes, fruits and vegetables are often exposed to soil, water, and handling practices that can introduce pathogens, especially under unsanitary conditions [4].

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In Ghana, the risk of microbial contamination is heightened by practices such as cultivation in areas exposed to sewage, animal waste, and potentially toxic materials [5]. Additionally, in many low- and middle-income countries where unemployment is high, vendors frequently sell produce with minimal regulatory oversight regarding hygienic handling. As a result, the microbiological safety of fruits and vegetables is often compromised.

While much attention is given to foodborne illnesses linked to meat, fish, and dairy, contaminated fruits and vegetables also pose significant public health risks. Globally, food- and waterborne illnesses are responsible for over 2 million deaths annually, with Ghana alone accounting for an estimated 65,000 of these cases each year [6, 7]. Beyond health impacts, foodborne diseases contribute to substantial economic losses; Ghana reportedly spends approximately $65,000 annually managing such outbreaks [7].

To mitigate these risks, the U.S. Food and Drug Administration (FDA) released the *Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables* in 1998, advocating for the adoption of Good Agricultural Practices (GAPs) by producers, packers, and shippers [8].

Additionally, pre-cut fruits and vegetables—those that have been peeled, sliced, and packaged while retaining freshness—are increasingly offered at retail outlets. These products, though convenient, require strict safety protocols due to their higher vulnerability to contamination [9].

The World Health Organization (WHO), the Food and Agriculture Organization (FAO) of the United Nations, and the World Cancer Research Fund (WCRF) recommend a daily intake of 400 to 600 grams of fruits and vegetables to promote optimal health and reduce the risk of chronic diseases [10].

The global demand for fresh produce has surged due to increased consumer awareness and year-round availability of fruits and vegetables [11]. However, emerging risks such as climate change and global trade introduce additional challenges to food safety management [12]. Temperature fluctuations and extreme weather events can influence pathogen prevalence on crops [13]. Furthermore, cross-border trade can introduce contaminants from one region to another, posing a risk of transboundary foodborne outbreaks [14].

The nutritional composition of fruits and vegetables not only supports physical health but also cognitive function and mental well-being [15]. Research indicates that antioxidants in fruits and vegetables help neutralize harmful free radicals, thereby slowing cellular aging and reducing oxidative stress [16]. Additionally, polyphenols and flavonoids present in many fruits exhibit anti-inflammatory properties, contributing to reduced risks of chronic inflammation-related diseases [17].

Despite the recognized benefits, inadequate post-harvest practices, including improper washing, storage, and packaging, significantly contribute to the microbial contamination of produce [18]. Studies highlight that contamination with parasites, bacteria, and fungi can occur at various stages, from field to table [19]. Moreover, human handling without proper sanitation has been identified as a key factor in cross-contamination of fresh produce [20].

In recent years, innovative technologies such as ozone treatment and ultraviolet (UV) irradiation have shown promise in reducing microbial contamination on fresh fruits and vegetables [21]. Nonetheless, the adoption of such technologies remains limited in many low-resource settings [22]. Education and training of vendors and consumers are critical to enhancing food safety awareness and reducing health risks associated with contaminated produce [23]. Collaborative efforts between governments, industry stakeholders, and consumers are essential to address these challenges effectively [24].

Finally, the integration of food safety protocols with sustainable agricultural practices is crucial for ensuring long-term food security and public health [25].

Methodology

Study Site

The study was conducted in Madina Market, located in the La Nkwantanang Madina Municipal District of the Greater Accra Region, Ghana. Madina is a populous urban suburb of Accra and serves as a significant commercial hub, particularly for fresh produce and ready-to-eat fruits. The market is characterized by high human traffic and informal trading activities, where fruits are displayed and sold under varying hygienic conditions. The area lacks consistent regulatory oversight regarding food safety practices, making it a relevant location for assessing potential parasitic contamination.

Additionally, comparative control samples were obtained from the Accra Mall, a modern retail center with regulated sanitary conditions. This provided a baseline for evaluating the difference in contamination levels between open market vendors and retail grocery outlets. Laboratory analyses for the study were conducted at the Microbiology Laboratory of New Crystal Hospital in Ashaiman, Accra.

Study Population

The study population consisted of ready-to-eat fruits commonly consumed raw, specifically mangoes (*Mangifera indica*), oranges (*Citrus sinensis*), bananas (*Musa acuminata*), watermelons (*Citrullus lanatus*), and apples (*Malus domestica*). A total of 70 fruit samples were collected for the study. Of these, 40 samples were randomly purchased from various fruit vendors operating within Madina Market, and 30 control samples were obtained from the Accra Mall, a commercial retail outlet with better sanitary standards.

Fruit vendors at Madina Market were selected through random sampling to reflect the diversity of handling and storage practices typical in open markets. The inclusion criteria required that fruits be ready-to-eat, commonly consumed raw, and available for purchase during the study period. Exclusion criteria included fruits subjected to visible washing or preservation treatments by vendors prior to sale.

The study aimed to compare the parasitic contamination levels in fruits from open markets with those from a more controlled retail environment, thereby providing insights into the impact of handling and environmental conditions on food safety.

Laboratory Analysis

The laboratory analysis was conducted to detect and quantify parasitic contamination in selected ready-to-eat fruit samples. The procedures were carried out at the Microbiology Laboratory of New Crystal Hospital, Ashaiman, using standard parasitological techniques.

Each fruit sample (approximately 0.8 grams) was washed in 25 mL of normal saline solution (0.85% NaCl) in a sterile plastic container. The fruits were thoroughly agitated to dislodge potential parasitic elements adhering to their surfaces. The resulting wash solutions were filtered using fine mesh and then centrifuged at 3,000 rpm for 5 minutes. The supernatant was discarded, and the sediment was re-suspended in saline and centrifuged again until a clear supernatant was obtained.

Two diagnostic methods were employed:

1. Direct Wet Mount Microscopy: A drop of the final sediment was placed on a clean glass slide, stained with a drop of Lugol's iodine, and covered with a cover slip. The slide was examined microscopically under ×10 and ×40 objectives for the presence of ova, cysts, or larvae of intestinal parasites.
2. Zinc Sulphate Flotation Technique**:** For enhanced detection, a 1 mL aliquot of the wash solution was mixed with a zinc sulphate solution (specific gravity 1.18)

and centrifuged. A clean cover slip was placed on top of the test tube for 15–30 minutes to allow parasite eggs or cysts to adhere. The cover slip was then mounted on a slide and examined microscopically.

Tables and Data Analysis

Quantitative and qualitative data from the parasitological examination of fruit samples were analyzed using descriptive statistical methods. The presence of parasite ova, cysts, or larvae was recorded and expressed as frequencies and percentages. The level of contamination across different fruit types was calculated using the formula:

Contamination Rate (%) =Total Number of Samples Examined / Number of Positive Samples) ×100

Table 1. Presents the distribution and scale of sample collection for the study. Mangoes were the most sampled fruit, with 15 collected and 10 examined. The average weight of each fruit sample was standardized at 100 g to ensure consistency in analysis. The inclusion of different fruits, each representing varying levels of exposure and handling in open markets, allows for a comparative assessment of contamination levels. Notably, the sample size was robust enough to provide meaningful insights into parasitic contamination patterns, although a broader sampling across more markets could enhance generalizability.

Table 1. Summary of Fruit Samples Collected and Analyzed

	Total Collected	**Number Examined**	**Average Weight per Sample (g)**
Mango	15	10	100
Orange	10	5	100
Watermelon	5	4 (portions)	100
Apple	10	7	100
Banana	10	8	100
Total	**50**	**34**	

Table 2. provides a clear breakdown of the specific parasites detected in each fruit type and their estimated concentrations. The presence of *A. lumbricoides*, *T. trichiura*, and *Loa loa* eggs in mango, apple, and banana samples is particularly concerning due to their pathogenicity and the potential for causing gastrointestinal and systemic infections. Watermelons, despite being pre-cut and likely exposed during handling, showed a lower parasite load. The absence of contamination in oranges may be attributed to their thick rind, which offers a natural barrier. This table effectively highlights the diversity and severity of parasitic contamination across different fruit types.

Table 2. Parasites Identified in Fruit Samples

Fruit Type	**Parasite Identified**	**Number of Eggs Observed**	**Estimated Eggs/100g (Stoll's Method)**
Mango	*Loa loa*	4	20
Apple	*Ascaris lumbricoides*	4	20
Banana	*Trichuris trichiura*	5	25
Watermelon	Rind worm (unidentified)	3	15
Orange	None	0	0

Table 3. Below quantifies the contamination prevalence for each fruit type, revealing a high overall contamination rate of 47.06%. Watermelon had the highest contamination rate

at 75%, likely due to the ease of microbial infiltration once cut. Bananas and apples followed with rates exceeding 50%, reflecting the vulnerability of these fruits to contamination during handling and storage. Oranges, with a contamination rate of 0%, underscore the protective effect of intact peels. The disparity in contamination rates highlights the influence of fruit structure, handling practices, and market sanitation conditions on parasitic contamination risk.

Table 3. Contamination Rates by Fruit Type

Fruit Type	Number Positive	Number Examined	Contamination Rate (%)
Mango	4	10	40.0
Apple	4	7	57.14
Banana	5	8	62.5
Watermelon	3	4	75.0
Orange	0	5	0.0
Total	**16**	**34**	**47.06 (Average)**

Results

A total of 31 fruit samples were examined for parasitic contamination. These samples were randomly collected from fruit vendors operating in Madina Market. Control samples (30 in total) were obtained from the Accra Mall, where no parasitic contamination was detected. The parasitological analysis revealed the presence of several intestinal parasites in the fruit samples from Madina Market. Specifically, the following pathogenic parasites were identified:

- *Loa loa* (eggs)
- *Ascaris lumbricoides* (eggs)
- *Trichuris trichiura* (eggs)
- Unidentified rind worm eggs

Oranges showed no detectable contamination. In contrast, the highest contamination rate was observed in watermelon samples (75%), followed by banana (62.5%), apple (57.14%), and mango (40%). Control fruits from the Accra Mall were free from parasitic contamination, suggesting a strong association between market handling conditions and contamination.

Quantitative estimation of the parasite load, based on the modified Stoll's technique, revealed:

- Mangoes: 4 *Loa loa* eggs, equivalent to 20 eggs/100g of fruit
- Apples: 4 *Ascaris lumbricoides* eggs, equivalent to 20 eggs/100g of fruit
- Bananas: 5 *Trichuris trichiura* eggs, equivalent to 25 eggs/100g of fruit
- Watermelon: 3 rind worm eggs, equivalent to 15 eggs/100g of fruit
- Oranges: No parasite detected as showed in figure 1

The overall contamination rate for the examined fruit samples from Madina Market was calculated as 47.06%.

These findings underscore the significant risk of parasitic contamination associated with ready-to-eat fruits sold at Madina Market and highlight the need for improved handling, sanitation, and consumer education.

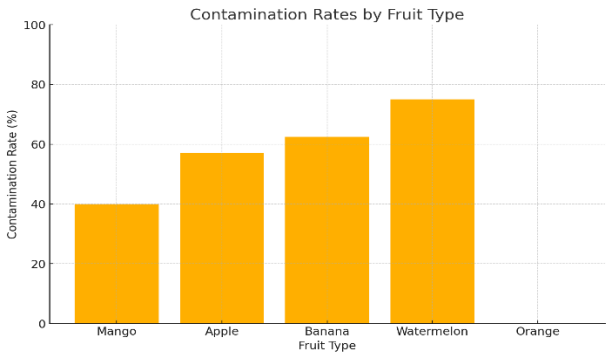

Figure 1. Bar Chart representing the Contamination Rates of Different Fruit Types in your Study

Discussion

This study investigated the prevalence of parasitic contamination in ready-to-eat fruits sold at Madina Market, Ghana, comparing the results with control samples from Accra Mall. The findings revealed a high contamination rate of 47.06% among market samples, with various intestinal parasites identified, including *Ascaris lumbricoides*, *Trichuris trichiura*, *Loa loa*, and unidentified rind worm eggs. Notably, control fruits from Accra Mall showed no contamination, highlighting the significant disparity in hygiene standards between informal and formal retail outlets.

The detailed parasitological analysis (Table 2) revealed that watermelon had the highest contamination rate at 75%, followed by banana (62.5%), apple (57.14%), and mango (40%). Oranges showed no contamination, likely due to their thick protective rind, which may limit exposure to parasites during handling and storage. The quantitative assessment of parasite load using the modified Stoll's method demonstrated a substantial concentration of helminth eggs in mangoes (20 eggs/100g), apples (20 eggs/100g), bananas (25 eggs/100g), and watermelons (15 eggs/100g). The detection of *A. lumbricoides* and *T. trichiura*—both of which are known to cause gastrointestinal distress, anemia, and malnutrition—underscores the public health significance of these findings.

These results align with previous studies reporting parasitic contamination of fruits and vegetables in developing countries [26]. Contributing factors include the use of untreated irrigation water, unsanitary conditions during harvesting and transport, and inadequate hygiene practices by vendors. Informal markets such as Madina Market often lack effective regulatory oversight, allowing these practices to persist. In contrast, the absence of contamination in Accra Mall samples emphasizes the impact of proper handling, storage, and hygiene protocols on food safety.

This study also highlights the critical role of consumer education in reducing infection risks. Public health initiatives should focus on promoting thorough washing of fruits before consumption, particularly those sourced from informal markets. Additionally, interventions aimed at improving vendor hygiene practices and enforcing sanitary regulations in markets are crucial to curbing the spread of foodborne parasitic infections.

The findings also point to a need for infrastructural improvements in market environments. Providing access to clean water, waste disposal systems, and protective packaging for fruits could substantially reduce contamination levels. Further research could explore contamination risks at different stages of the supply chain, from farm to market, to develop comprehensive food safety strategies.

Conclusion

This study demonstrates a significant risk of parasitic contamination in ready-to-eat fruits sold at Madina Market, Ghana. The detection of multiple intestinal parasites, including *A.*

lumbricoides, *T. trichiura*, and *Loa loa*, highlights the potential health hazards associated with consuming improperly handled fruits from informal markets. In contrast, control samples from Accra Mall were free from contamination, underscoring the effectiveness of stringent hygiene and handling practices.

These findings emphasize the urgent need for enhanced food safety protocols, including regulatory oversight, vendor training, and public education on proper fruit washing and handling. Infrastructure improvements such as clean water access and better waste management in markets are also essential. Ultimately, addressing these challenges will contribute to reducing the burden of foodborne parasitic infections, improving public health outcomes, and fostering consumer confidence in the safety of fresh produce.

Recommendations

1. Vendors should be trained on proper hygiene practices, including the use of clean water for washing fruits and maintaining sanitary storage conditions.
2. Local authorities should implement and enforce regulations governing food safety in open markets, including routine inspections and monitoring.
3. Public education campaigns are necessary to raise awareness of the risks associated with consuming improperly washed fruits and the importance of washing fruits thoroughly before consumption.
4. Provision of clean water and waste disposal facilities in market areas to minimize contamination risks.
5. Additional studies should be conducted to investigate contamination at other market sites and to evaluate the effectiveness of interventions aimed at reducing parasitic contamination in ready-to-eat fruits.

Conflict of Interest

There is no conflict of interest.

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Determinants of Vaccine Hesitancy among Parents in Rural Communities of the Greater Upper Nile Region, South Sudan

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Abstract

This study investigates the underlying factors contributing to vaccine reluctance among parents in rural communities within South Sudan's Greater Upper Nile Region, aligning with Sustainable Development Goal 3, which emphasizes reducing child mortality through expanded immunization coverage. Despite global advancements, vaccine hesitancy persists in under-resourced settings. A cross-sectional study involving 375 parents or caregivers across Bor South, Malakal, and Rubkona counties employed a mixed-methods approach, combining structured surveys, desk reviews, Focus Group Discussions (FGDs) with 24 participants, and in-depth interviews (IDIs) with 12 healthcare providers. The research examined key determinants of hesitancy, including socio-economic status, cultural beliefs, knowledge gaps, and the influence of healthcare providers. Findings showed that 69.9% of children were fully vaccinated, while 30.1% were partially or entirely unvaccinated, with primary barriers being financial constraints (74.7%), transportation difficulties (51.7%), and long distances to health facilities (47.7%). Concerns about vaccine safety (86.4%) and lack of awareness (42.1%) also played a significant role. Encouragingly, 96.2% of respondents expressed openness to new vaccines, and 82.7% indicated that support or incentives would improve uptake. In conclusion, while vaccine acceptance is generally high, systemic and informational challenges hinder full coverage, underscoring the need for culturally sensitive, community-based interventions to enhance immunization rates among children in the region.

Keywords: *Immunization, Immunization Determinant, Parental Attitude, Rural Communities, Vaccine Hesitancy, Vaccine Uptake.*

Introduction

Immunization is a highly cost-effective public health intervention that has significantly reduced childhood morbidity, mortality, and disability. It is considered a cornerstone of achieving Sustainable Development Goal 3, which aims to reduce under-five mortality [1]. According to the World Health Organization (WHO), immunization prevents millions of deaths annually. Despite these successes, low-income countries, especially in Sub-Saharan Africa, continue to experience outbreaks of vaccine-preventable diseases (VPDs). Timely vaccination and completion of immunization schedules are crucial for controlling these diseases.

Immunization efforts gained significant momentum in 1974 when the World Health Organization (WHO) launched the Expanded Programme on Immunization (EPI), aimed at helping member states expand vaccination coverage for diseases such as measles, polio, tuberculosis, and tetanus. This initiative has led to notable progress in increasing vaccine coverage across Africa [2]. However, disparities in vaccination rates persist, with some countries still struggling to meet global targets. In 2019, while 116 million infants received essential vaccines, approximately 19.7

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million infants remained unvaccinated, many of whom were from countries like South Sudan [3].

In South Sudan, a nationwide immunization program was launched in 2005 following the signing of the Comprehensive Peace Agreement (CPA). This initiative was further strengthened by the government's development of the basic package of health and nutrition services in 2006 and Health Policy, 2007-2011. Building on these foundational policies, the Ministry of Health, in collaboration with various partners, developed the 2007-2011 Comprehensive Multi-Year Plan for Immunization (cMYP), which served as a roadmap for immunization efforts leading up to South Sudan's independence in 2011.

Prior to the implementation of the Comprehensive Multi-Year Plan for Immunization (cMYP) in 2007, the country experienced major gaps in immunization coverage. Only, around 7.3% of children were fully vaccinated, and coverage for particular vaccinations was disturbingly low. For example, BCG was at 28.3%, DTP-1 at 25.9%, DTP-3 at 22.0%, and measles at only 16.8%. A particularly serious issue was the 41% dropout rate between the first and third DTP dose. Up to 80.8% of vaccines were administered in health facilities, with 19.2% administered at community service locations. Potentially highlighting an issue with access to vaccines in other settings, such as mobile vaccination sites, rural areas, or non-medical locations like schools and workplaces.The primary obstacle to vaccination was a lack of adequate information, with 41.1% of respondents cited as the main reason for missing vaccines [4].

In 2011, a survey was carried out to evaluate the effects of the cMYP, showing significant enhancements in immunization coverage despite persistent obstacles like lack of access, instability, and inadequate health facilities. These results emphasized how the cMYP is successful in closing the immunization gaps and enhancing vaccination rates nationwide. The DTP-3 coverage increased significantly from 20% in 2007 to 80% in 2011, showing a notable enhancement in access to and distribution of vaccines. In addition, there was a decrease in the dropout rate from 41% to 26% between the first and third DTP doses, showing improved retention during the vaccination procedure. Nevertheless, it is crucial to highlight that enhancements in coverage did not occur uniformly nationwide. Immunization rates still varied greatly, showing significant discrepancies observed between different states and counties [4].

These disparities highlight the need for targeted interventions and a more localized approach to immunization, ensuring that even the most remote and underserved populations receive equitable access to vaccines. While progress has been made, addressing these inconsistencies remains a critical challenge in achieving nationwide immunization goals.

In 2019, the World Health Organization ranked vaccine hesitancy as one of the top 10 global health threats. Research on COVID-19 vaccination suggests that rural areas frequently display various factors that contribute to this reluctance [5].

Vaccine hesitancy has been a persistent problem in South Sudan, hampering the acceptance of various vaccines, including the COVID-19 vaccine, due to the fact that the majority of the population in South Sudan lives in rural areas. As of July 2021, South Sudan had only administered 56,989 COVID-19 vaccine doses, compared to the global total of over 3.5 billion doses [6]. With approximately 11.2 million inhabitants, this limited adoption highlights larger issues within the nation. Studies on vaccine reluctance in South Sudan reveal sceptical altitudes towards authorities, along with stigma driven by fear, anger, misinformation, and a perception of low risk-problems that are also observed worldwide [6].

The nation continues to encounter difficulties in accessing distant and vulnerable regions. This research aims to investigate the

factors causing inadequate access to and usage of immunization services, especially in counties experiencing fragility, emergencies, and flooding in the Great Upper Nile region of South Sudan.

Problem Statement

Vaccine hesitancy is a significant global health issue, with varying levels across regions. A 2023 meta-analysis found that 21.1% of parents worldwide express hesitancy toward vaccinating their children. This issue has been amplified by the COVID-19 pandemic, which affected vaccine confidence. A 2022 survey across 23 countries found that while 75.2% of respondents were willing to accept the COVID-19 vaccine, hesitancy varied greatly, from just 1% in the UK to 21.1% in South Africa [7]. In 2023, the WHO reported that 14.5 million children missed vaccinations globally, underscoring the need for increased efforts to address hesitancy [6].

The WHO has identified vaccine hesitancy as one of the top global health threats, contributing to the resurgence of diseases like measles and pertussis. A study in *The Lancet* showed that hesitancy decreases vaccine coverage, increasing the risk of outbreaks. The COVID-19 pandemic worsened this issue, emphasizing the need for targeted interventions to build trust and improve vaccination rates [7].

This research aims to explore the key factors influencing vaccine hesitancy in rural communities, particularly in South Sudan's Greater Upper Nile Region, to develop strategies that improve vaccine acceptance and public health outcomes.

Rationale of the Study

It is crucial to assess vaccine hesitancy among parents in rural communities of the Greater Upper Nile Region to better understand the specific barriers to vaccination in this area. Comprehending these obstacles will lead to the creation of specific, culturally aware actions that can enhance vaccine acceptance, lessen disease impact, and help achieve the overall objective of enhancing public health in South Sudan. Tackling vaccine hesitancy in these areas is essential not just for the well-being of the children and families locally, but also for the overall progress of international health and development objectives.

General and Specific Objectives of the Study

The purpose of this study is to determine factors contributing to vaccine hesitancy among parents in rural communities of the Greater Upper Nile Region of South Sudan.

General Objective

To Identify the factors contributing to vaccine hesitancy in Greater Upper Region of South Sudan.

Specific Objectives

1. To assess the current immunization rates and identify factors that influence vaccine uptake in rural communities of the Greater Upper Nile Region, South Sudan.
2. To examine the socio-economic factors that could contribute to vaccine hesitancy in the rural communities of Greater Upper Nile Region.
3. To Explore the Role of Healthcare Providers in Addressing Vaccine Hesitancy.

Review of Literature

Vaccination is widely recognized as one of the most effective public health strategies, playing a crucial role in significantly reducing the incidence of preventable childhood illnesses. However, vaccination rates remain insufficient in many rural areas, contributing to higher morbidity, mortality, and economic burdens. This review examines the various costs associated with low vaccination coverage, as well as the socio-economic and healthcare provider factors that influence vaccine acceptance in rural communities.

Inadequate vaccination rates cause outbreaks of preventable illnesses like measles, polio, and whooping cough, leading to significant treatment expenses for families and healthcare providers. These outbreaks exert extra pressure on healthcare systems that are already lacking adequate funding [8]. In rural economies, where agriculture or manual labor is frequently the mainstay, diseases that can be prevented by vaccines lead to absences from school and work, exacerbating poverty. Parents caring for their ill children lose income, which further reduces local economic productivity [9]. Illnesses such as meningitis and rubella can result in permanent disabilities, hindering children's economic contributions, thereby imposing extra strain on families and communities [10].

Several studies have recognized a range of interrelated elements that influence vaccination rates in rural regions. Geographic isolation and restricted access to healthcare services pose significant obstacles; since long distances, inadequate transportation, and insufficient infrastructure impede vaccination initiatives [11]. Financial limitations, like the incapacity to manage indirect expenses such as transport or lost wages, additionally hinder families from pursuing vaccinations. Even if vaccines are provided at no charge, these concealed expenses frequently render immunization unaffordable [12]. Insufficient health education and common misunderstandings about vaccines lead to decreased vaccination rates and misinformation, along with conventional beliefs in rural communities, frequently hinders the acceptance of vaccination [13].

Cultural opposition and a historical skepticism toward government-driven health programs also pose considerable obstacles. Social factors, including the views of relatives or community figures, can either promote or obstruct vaccination rates [14]. Moreover, the shortage of healthcare personnel, insufficient vaccines, and the high workloads of healthcare providers in rural regions lead to missed chances for vaccination [15]. Tackling these issues demands specific immunization strategies designed for the requirements of rural populations. Mobile vaccination units, outreach initiatives, and adaptable immunization schedules can help in overcoming access barriers. Public health initiatives aimed at addressing vaccine hesitancy are essential for increasing vaccine acceptance.

Various intervention strategies have been suggested to tackle these obstacles. Mobile vaccination units offer easy vaccine access in isolated regions, addressing logistical challenges. These clinics are most successful when paired with community outreach initiatives aimed at increasing awareness about the significance of vaccination [16]. Health education provided by community health workers and local leaders is crucial for enhancing vaccine awareness and combating misinformation. Involving trusted community leaders builds confidence and promotes vaccination rates. Financial incentives like transportation subsidies or wage loss compensation can ease financial barriers, simplifying the process for families to vaccinate their children. In certain regions, providing minor incentives for vaccination involvement has shown to boost vaccination rates [17].

Socio-economic status (SES) serves as a significant indicator of vaccine hesitancy, as studies consistently demonstrate that people from lower SES backgrounds tend to be more likely to hesitate or decline vaccination. This relationship is influenced by various elements, such as availability of healthcare, understanding of health information, and the dissemination of false information. Individuals with lower incomes frequently encounter obstacles like restricted healthcare access, difficulties with transportation, and economic uncertainty, which may cause vaccination to take a back seat to urgent financial issues. Additionally, reduced education levels are associated with increased vaccine hesitancy, as those with less education might not have access

to reliable health information and are more prone to misinformation [18].

The status of employment also affects vaccine hesitancy. People in steady jobs, especially those with health coverage and paid time off, are more inclined to get vaccinated because they have better access to healthcare. On the other hand, individuals employed in low-wage or gig economy positions, who frequently do not have access to healthcare benefits or paid leave, encounter more difficulties in receiving vaccines, resulting in increased hesitancy [19]. Occupation also influences vaccination rates, as workers in healthcare and education generally demonstrate higher rates due to workplace mandates and better health literacy, whereas individuals in sectors lacking such policies might be more reluctant [20].

Cultural and societal elements likewise play a role in vaccine reluctance. Communities possessing reduced social capital—characterized as the networks, norms, and trust that promote collaboration—are more prone to encountering vaccine misinformation. Furthermore, past injustices and a lack of trust in the healthcare system, especially within marginalized communities, can intensify hesitancy. For instance, past wrongs like the Tuskegee Study and coerced sterilizations lead to profound mistrust of vaccination initiatives in certain communities [21].

The availability of healthcare, particularly in rural or underprivileged regions, is another significant element affecting vaccine reluctance. Geographic, financial, and systemic obstacles might restrict vaccine availability, lowering vaccination rates for those who require it the most [22]. Insufficient health insurance or poor coverage diminishes trust in the healthcare system and may increase vaccine hesitancy. Government initiatives like focused vaccination programs, mobile health clinics, and public health campaigns are crucial in reducing vaccine hesitancy among low-income groups. In the absence of these initiatives, people from underprivileged socio-economic backgrounds might continue to doubt the safety, effectiveness, or necessity of vaccines. Nevertheless, vaccine mandates, especially those lacking proper enforcement or adaptability, can generate further obstacles and intensify hesitancy [23]. Ultimately, the media—particularly social media—influences public perception of vaccines, as people from lower SES backgrounds are more susceptible to false information. Insufficient media literacy and minimal interaction with reliable public health information can contribute to the dissemination of anti-vaccine material, strengthening unfavorable.

Healthcare professionals (HCPs) are typically viewed as the most trustworthy sources of vaccine information. Research indicates that patients have greater confidence in the guidance provided by doctors, nurses, and pharmacists compared to information from media or social networks [24]. This confidence places HCPs as essential players in encouraging vaccination. Nonetheless, studies also show that numerous providers might not pose the required knowledge, training, or communication abilities to properly tackle vaccine hesitancy [25].

Clear communication is vital in addressing reluctance. Research highlights the significance of straightforward, compassionate, and non-aggressive communication [25]. Providers who participate in patient-focused conversations, attentively consider concerns, and thoughtfully correct misinformation tend to enhance vaccine acceptance [25]. The understanding that healthcare providers possess regarding vaccines—specifically their safety and effectiveness—directly affects their ability to confidently challenge myths and false information [26]. Consequently, continuous education in immunization is crucial for providers to remain updated and address patients' inquiries effectively.

The beliefs and attitudes of healthcare providers on a personal level can also influence

their vaccine advocacy. On one hand, providers with negative views on vaccines or worries about their safety might be less inclined to promote vaccination vigorously [27]. On the other hand, providers who are enthusiastic about vaccines take a more active role in promoting vaccination.

Healthcare professionals implement multiple approaches to tackle vaccine hesitancy, mainly by offering transparent, evidence-based information concerning the safety and effectiveness of vaccines as well as the dangers associated with not vaccinating. Establishing trust with patients, customizing suggestions to their specific issues, and taking cultural backgrounds into account are vital approaches [28]. Motivational interviewing (MI) assists patients in examining and addressing their mixed feelings about vaccination and has been found effective in enhancing vaccine acceptance [28].

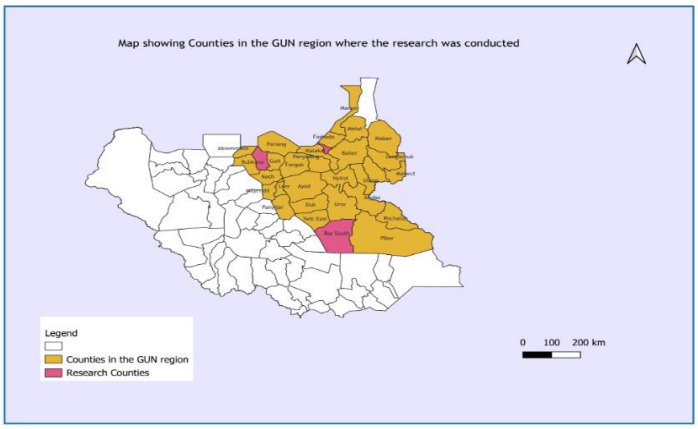
Even though they play a crucial role, healthcare providers encounter various obstacles in tackling vaccine hesitancy. Time limitations in clinical environments—like brief patient appointments and large workloads restrict their capacity to engage in thorough vaccine conversations [37]. Certain providers may not have undergone formal training in vaccine advocacy and could feel ill-equipped to participate in discussions about vaccines [25]. Cultural and socio-economic elements, such as language obstacles, varying beliefs, and monetary limitations, may additionally hinder vaccine advocacy.

Various interventions can assist healthcare providers in surpassing these obstacles and enhance their capacity to tackle vaccine hesitancy. Training initiatives centered on communication, cultural awareness, and approaches to address vaccine hesitancy can improve providers' efficacy. Equipping healthcare professionals with trustworthy, evidence-based resources and decision-making tools can assist them in delivering well-informed advice .Public health efforts that coincide with provider actions can establish a cohesive message and diminish misinformation.

Methodology

Study Design

This study employed a descriptive cross-sectional design, which enabled the collection of both quantitative and qualitative data at a single point in time to assess immunization coverage rates and factors influencing vaccine uptake. A cross-sectional design is particularly suitable for estimating prevalence and exploring associations between health behaviors and socio-demographic variables within a population [29]. This approach was appropriate for evaluating the extent of vaccine hesitancy, examining socio-economic determinants, and understanding the role of healthcare workers in influencing vaccination behaviors in rural communities of the Greater Upper Nile Region of South Sudan.



Study Site

The Greater Upper Nile Region comprises three states (Jonglei, Unity, and Upper Nile) and two administrative areas (GRAA and GPAA), totaling 33 counties. The target population consisted of caretakers or guardians of children aged 0–11 months living in rural areas. These individuals were the primary decision-makers regarding child immunization. The region includes 81 Payams and 300 Bomas, each reflecting distinct cultural dynamics that may affect vaccine perceptions. With an estimated population of 5,192,528, approximately 207,701 children were under one-year of age [30]. Among them, 172,342 had received the Penta 1 dose, while 35,359 were identified as zero-dose children [31].

The study focused on three counties—Malakal, Bor, and Rubkona—with a combined population of 798,131, including 135,682 children under the age of one-year old [31].

Sampling Procedures

To ensure representativeness across diverse ethnic groups and rural locations, the study utilized stratified random sampling, a method that ensures proportional inclusion from subgroups within the population [32].

The sampling process followed four key steps:

1. The Greater Upper Nile Region was stratified into its constituent states and counties.
2. One county was randomly selected from each of the three states.
3. Within each selected county, clusters (villages or communities) were identified using administrative records.
4. Two villages were randomly selected per county, and within each village, households with children aged 0–11 months were selected using simple random sampling.

Sample size estimation was based on an expected vaccine hesitancy rate of 30–40%, with a 95% confidence level and a 5% margin of error. A sample size calculator was used to determine the minimum number of respondents per village to ensure statistical power and precision [32].

Inclusion and Exclusion Criteria

- Inclusion criteria were caretakers or legal guardians of children aged 0–11 months who resides in the selected villages and could provide informed consent (either directly or via a proxy due to illiteracy).
- Exclusion criteria included non-residents, caretakers of children over 11 months, and those unwilling or unable to participate.

The study adopted a mixed-methods approach, integrating both quantitative and qualitative data to comprehensively understand vaccine hesitancy. This approach allowed the triangulation of findings and enhanced the validity of the data [29].

Data collection instruments included structured questionnaires for key informants, focus group discussion (FGD) guides, and in-depth interview (IDI) protocols. Data collectors received comprehensive training on the data study tools, research ethics, data quality, and cultural competence to ensure rigor and sensitivity during data collection.

The study engaged 375 caretakers for Key Informant Interviews (KIIs) (125 per county), 24 caretakers for FGDs, and 12 community leaders and healthcare professionals for IDIs.

Quantitative Component

Quantitative data were collected using a structured and pre-tested questionnaire, which included the following sections:

- Demographic information (age, education, occupation, household size).
- Child vaccination status (not immunized, partially immunized, fully immunized).
- Factors influencing vaccine hesitancy, such as socio-economic status and the role of healthcare providers.

- Healthcare access (proximity to health facilities, availability of vaccines, infrastructure challenges).
- Vaccine Hesitancy Score, assessed using a 5-point Likert scale, measuring agreement with statements like "Vaccines are harmful" or "Vaccines are necessary for my child's health."

Qualitative Component

The qualitative component was designed to explore the underlying causes of vaccine hesitancy. Three FGDs were conducted (one in each village), with 6–8 participants per group. These were facilitated by trained moderators following best practices for group dynamics and cultural sensitivity [33].

Twelve key informants (four per county), including healthcare workers, religious leaders, and community elders, participated in IDIs to provide context-specific insights into barriers and enablers of vaccine acceptance.

Data Analysis

Quantitative data were analyzed using statistical software such as SPSS or Stata. Descriptive statistics (frequencies, percentages) were used to summarize demographic characteristics and vaccine hesitancy levels. Bivariate analyses (e.g., Chi-square tests, t-tests) identified relationships between hesitancy and socio-demographic factors.

All qualitative data were transcribed and subjected to thematic analysis, following Braun and [29]. Six-phase framework: familiarization, coding, theme development, reviewing, defining, and writing up. Analysis was conducted manually to allow nuanced interpretation of local contexts and narratives.

This methodological approach ensured that both numerical trends and lived experiences were captured, yielding a comprehensive understanding of the determinants of vaccine uptake and hesitancy in the Greater Upper Nile Region.

Results

The study was conducted in three counties including Bor South, Malakal and Rubkona from Jonglei, Upper Nile and Unity States respectively. A total of 375 caretakers participated for the KIIs, while 24 participated for the FGDs and 12 community leaders and healthcare professional for the IDIs. This study highlights both progress and persistent challenges in immunization coverage within the Greater Upper Nile region of South Sudan. While 69.9% of children were reported as fully vaccinated and national DPT3 coverage rose from 59% in 2018 to 73% in 2023, only 51.5% of families indicated that all their children were fully immunized. This gap points to continued reliance on outreach services and underperformance of routine immunization systems.

Current Immunization Rates

Immunization coverage was relatively high, with 69.9% of children fully vaccinated, though only half (51.5%) of families reported all their children immunized, while 41.9% had partial coverage and 4% had none. In 2023, South Sudan achieved 73% DPT3 (Diphtheria, Pertussis and Tetanus) coverage among one-year-olds, up from 59% in 2018. The introduction of the malaria vaccine in 2024 and the upcoming Pneumococcal Conjugate Vaccine (PCV) and Rota Virus Vaccine (RVV) rollouts signal progress (See the below figure).

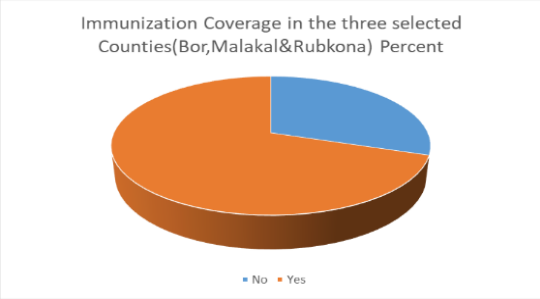


Figure 1. Immunization Coverage

Barriers to Access to Vaccination

Access to vaccination was hindered by financial constraints (74.7%), transportation barriers (51.7%), and long travel distances, with 47.7% of respondents reporting journeys over 10 km to reach vaccination centers (see Figures 2 and 3).

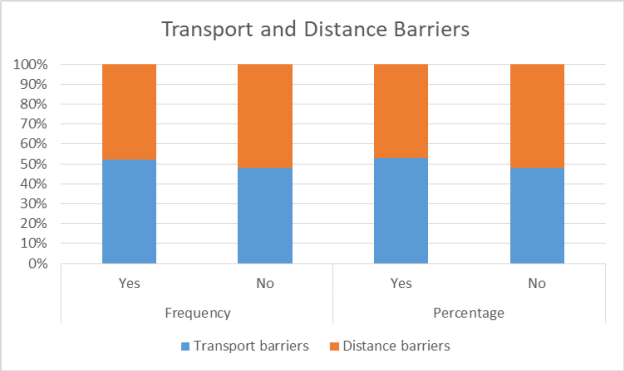


Figure 2. Transportation & Distance Barriers

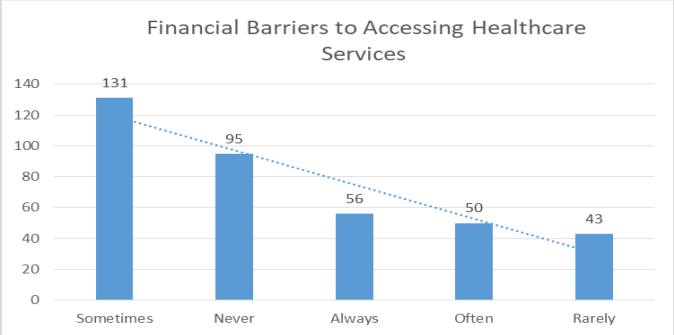


Figure 3. Financial Barriers to Accessing Health Services

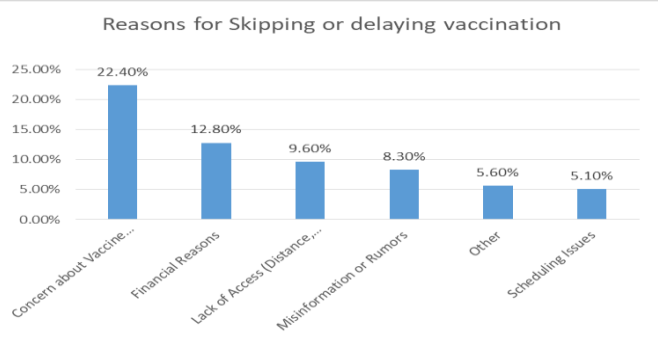


Figure 4. Reasons for Skipping or Delayed Vaccination

In the broader context of healthcare-seeking behavior, the frequency of visits to health facilities is revealing. Most parents (54.1%) reported taking their children for vaccination five or more times, which supports the finding that 69.9% of children received all recommended vaccines. However, barriers remain: 51.7% of respondents reported transportation challenges, and 47.7% reported traveling over 10 kilometers to reach vaccination centers. These logistical challenges, combined with concerns about side effects (reported by 5.1% of those who delayed/skipped vaccination) and financial difficulties (22.4%), highlight the multi-dimensional nature of access issues (see Figure 5 &Table 1).

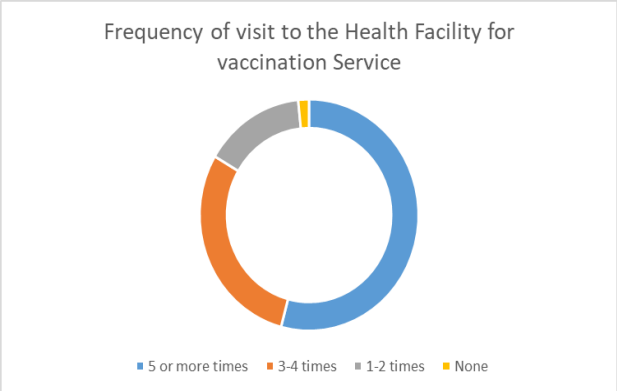


Figure 5. Frequency of Visit to the Health Facility for Vaccination Service

Table 1. Caretakers Healthcare Access and Behavior

Number of visits to the health facility for vaccination	**Frequency**
1-2 times	56
3-4 times	110
5 or more times	203
None	6

The data shows that a substantial proportion of respondents (46.4%) had no formal education, and this group accounted for nearly half (46%) of the children who had not received all recommended vaccinations. However, the chi-square test ($p = 0.391$) revealed no statistically significant relationship between the respondent's level of education and child vaccination status (see Table 2).

Table 2. Respondent Level of Education vs. Child's Vaccination Status

Chi-square test	**Value**	**Degree of freedom**	**Significancy level (2-sided)**
Pearson Chi-Square	3.004[a]	3	0.391
Likelihood Ratio	3.242	3	0.356
N of Valid Cases	375		
a. 1 cells (12.5%) have expected count less than 5. The minimum expected count is 4.22.			

Vaccine Hesitancy

Vaccines hesitancy was widespread, with 86.4% expressing safety concerns and 45.3% admitting to delayed or skipped vaccinations, primarily due to financial constraints (22.4%), distance and transport issues (12.8%), and misinformation (8.3%) (see Table 3).

Table 3. Likelihood of Accepting New Vaccines vs. Child's Vaccination Status

Chi-square test	Value	Degree of freedom	Significance level (2-sided)
Pearson Chi-Square	22.153a	2	.000
Likelihood Ratio	20.392	2	.000
N of Valid Cases	375		
a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.22.			

A strong, statistically significant was found between parents' stated likelihood of accepting new vaccines and whether their child was fully vaccinated. Parents who reported being "very likely" to accept new vaccines had the highest proportion of children fully vaccinated (73.7%) ($p = 0.000$), while those "unlikely" to accept new vaccines were far less likely to have vaccinated children (14.3%).

Attitudes and Trust towards Vaccination

Attitudes toward vaccination were largely positive, with 97.3% viewing vaccines as necessary, 95.8% recognizing their importance for disease prevention, 80.3% receiving information from healthcare providers, 87.7% expressing high trust in health professionals, and 88% believing the government is adequately supporting immunization efforts (see Tables 4 and 5).

Table 4. Caretakers Attitude towards Immunization

Valid	Frequency	Percent	Valid percent	Cumulative percent
No	51	13.6	13.6	13.6
Yes	324	86.4	86.4	100.0
Total	375	100.0	100.0	

Trust emerged as a critical factor: a statistically significant relationship was shown between trust in healthcare providers and vaccination status ($p = 0.000$). Children of parents who reported "very high" trust in providers were much more likely to be fully vaccinated (76.6%). Conversely, low or no trust correlated with lower vaccination completion.

Table 5. Trust in Healthcare Providers vs. Child's Vaccination Status

Chi-square test	Value	Degree of Freedom	Significance level (2-sided)
Pearson Chi-Square	22.153a	2	.000
Likelihood Ratio	20.392	2	.000
N of Valid Cases	375		
a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.22.			

Delayed or Skipped Vaccinations

According to the data, 54.7% of parents and caregivers have never delayed or skipped any vaccinations for their children, while 45.3% admitted to delaying or skipping vaccines.

Among those who delayed or skipped vaccinations, the top reasons cited include financial constraints (22.4%), concerns about vaccine side effects (5.1%), and lack of access (12.8%), including issues related to distance and transportation. Additionally, misinformation or rumors (8.3%) and scheduling issues (5.6%) were also factors (see Table 6 and Figure 4).

Table 6. Reason for Skipping/Delayed Vaccination

Reason	Frequency
Concern about Vaccine Side Effects	19
Financial Reasons	84
Lack of Access (Distance, Transportation)	48
Misinformation or Rumors	31
Other	36

Discussion

While 69.9% of children are fully vaccinated, only 51.5% of families report full immunization, indicating a dependence on outreach services over routine care. The presence of partial (41.9%) and no coverage (4%) highlights ongoing barriers related to access and information. These disparities underscore the need for targeted strategies to ensure more equitable vaccine delivery, as emphasized by Bangura [34].

Barriers to access to Vaccination

Despite high levels of trust in vaccine safety (86%) and recognition of their benefits (97%), only 55% of respondents complete vaccinations on time, revealing a gap between intention and action. This suggests that structural barriers—like cost, transportation, and misinformation—can hinder vaccine uptake even when attitudes are positive, echoing findings by Bangura, Omer, Bauch and Madhavan [34].

The findings show no significant link between caregivers' education levels and access to vaccination services. This indicates that education is not a key barrier to childhood immunization, as the vast majority (97.3%) of parents, regardless of education, acknowledge the importance of vaccines—aligning with results from Fenta [35].

This reinforces earlier data showing high levels of vaccine hesitancy concern, where 86.4% of respondents expressed safety concerns about vaccines, and highlights the potential risk of hesitancy impacting real-world behaviors. Thus, increasing confidence in both existing and new vaccines could directly improve immunization coverage.

To improve vaccine uptake, the studies by Adamu, and Madhavan recommends expanding community outreach through mobile units and local partnerships, providing financial support like transport subsidies, and enhancing health education with tailored, accessible communication for low-literacy populations strengthening vaccine [36].

Attitudes and Trust towards Vaccination

This finding reinforces earlier results showing that 80.3% of respondents received vaccination information from healthcare providers, highlighting the critical role of trusted communication channels. It also aligns with the observation that 52.5% of respondents reported "very high" trust in providers, emphasizing trust not only as a key predictor of

vaccine uptake but also as a valuable leverage point for targeted interventions.

Despite 88% expressing satisfaction with immunization efforts, 83% still needed more support, highlighting that appreciation of services does not equate to adequate access—underscoring the need for practical interventions like those recommended by Madhavan and Adamu [36]. With 96% willing to adopt new vaccines, the population shows strong intent, but turning this into action requires strengthened support systems and culturally sensitive outreach—consistent with Dubé and MacDonald , who emphasize the role of trust and clear communication in vaccine acceptance [37].

Delayed or Skipped Vaccinations

The relatively high percentage of parents who delayed or skipped vaccinations highlights the need to explore the underlying reasons and potentially address barriers to timely immunization, these reasons underscore a complex mix of logistical, financial, and informational challenges that may need to be addressed through policy interventions or targeted awareness campaigns. In rural communities, financial hardship (64%), limited information (20%), and transportation barriers significantly hinder vaccine access, reflecting systemic healthcare inequities highlighted by Bauch [38]. Strengthening vaccine uptake requires empowering healthcare providers with culturally competent communication skills and motivational interviewing, while also leveraging trusted community figures to combat misinformation and reinforce positive vaccination norms [39].

Conclusion

Despite high levels of trust in vaccine safety and a strong willingness to adopt immunization, rural populations face significant barriers that hinder timely and complete vaccination. These challenges—rooted in socio-economic disparities, limited infrastructure, and inadequate follow-up systems—create a disconnection between intent and action. The findings highlight the need for targeted, practical interventions such as mobile outreach, financial support, and tailored health education to bridge this gap. Additionally, empowering healthcare providers with culturally competent communication skills and engaging trusted community figures are critical strategies to combat misinformation and promote sustained vaccine uptake. Addressing these structural and social determinants is essential to achieving equitable immunization coverage in rural areas.

Recommendations

1. **Expand Mobile and Community-Based Outreach;** Deploy mobile vaccination units and organize regular immunization drives in remote and underserved areas to improve physical access to vaccines.
2. **Provide Financial and Logistical Support:** Introduce targeted subsidies for transportation and lost income during clinic visits, and implement reminder systems (e.g., SMS alerts) to improve dose completion rates.
3. **Enhance Health Education Campaigns**: Develop culturally sensitive, low-literacy educational materials in local languages to address knowledge gaps and clarify misconceptions about full vaccination coverage.
4. **Empower Healthcare Workers**: Train rural healthcare providers in motivational interviewing and culturally competent communication to better engage hesitant individuals and build trust.
5. **Leverage Community Leaders and Trusted Voices**: Partner with local leaders, religious figures, and community influencers to disseminate accurate vaccine information and counteract misinformation effectively.
6. **Strengthen Rural Healthcare Infrastructure**: Invest in health system improvements, including better vaccine

storage, reliable transportation for health workers, and consistent staffing in rural clinics.

7. **Monitor and Evaluate Program Effectiveness**: Establish monitoring mechanisms to track vaccination uptake, missed doses, and public perceptions to continuously adapt and improve intervention strategies.

Acknowledgement

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Conflict of Interest

I Martin Taban Andrea Tulio declare there is no conflict of interest in all forms.

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Knowledge, Attitude, and Practice of Cervical Cancer Screening Among Female Youth in Jabi District, Abuja Municipal Area Council, Nigeria

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Abstract

Cervical cancer is notably the fourth most common cancer among women worldwide and a leading cause of cancer-related deaths, especially threatening Nigerian women aged 15-35. A cross-sectional study conducted in Jabi District, Abuja, Nigeria, surveyed 400 women of reproductive age to assess their knowledge, attitudes, and practices (KAP) regarding cervical cancer screening. The results showed that while 66% of respondents had heard of cervical cancer, only 35% had ever been screened, indicating a significant gap in comprehensive knowledge about the disease. Factors such as limited knowledge, low awareness campaigns, limited access to healthcare facilities, social barriers and cultural beliefs were identified as significant barriers to screening uptake. The study underscores the urgent need for increased awareness campaigns, targeted culturally sensitive educational interventions to dispel misconceptions about cervical cancer and its screening. Furthermore, strengthening healthcare infrastructure, more implementation of HPV vaccination programs, and addressing socio-economic barriers are crucial to improve cervical cancer screening practices and ultimately reduce the burden of this preventable disease in this vulnerable population.

Keywords: *Attitudes, Cervical Cancer Screening, Human Papillomavirus (HPV), Knowledge, Low- and Middle-Income Countries (LMICs), Practices (KAP), Preventive Health Behaviors, Pap Smear.*

Introduction

The International Agency for Research on Cancer (IARC) has reported that cancer continues to be a global health crisis, with approximately 10 million deaths attributed to the disease in 2022 alone [1]. Among these, cervical cancer remains a particularly significant concern, holding the grim position of the fourth most common cancer in women globally and a major contributor to cancer-related mortality [2]. Cervical cancer remains a significant public health challenge in Nigeria, particularly among young women, yet screening uptake remains critically low. This study assesses the knowledge, attitudes, and practices (KAP) of female youth (aged 15–35) in Jabi District, Abuja Municipal Area Council (AMAC), Nigeria, to identify gaps and inform targeted interventions. The specific objectives include determining the level of knowledge about cervical cancer and screening, assessing women's attitudes toward screening, and evaluating current screening practices. By examining these factors, the study aims to uncover barriers—such as socio-cultural beliefs, financial constraints, or lack of awareness—that hinder preventive healthcare-seeking behaviors in this peri-urban community.

Cervical cancer is the fourth most common cancer among women worldwide, with an estimated 604,000 new cases and 342,000 deaths in 2020 [3]. The disease disproportionately affects low- and middle-income countries (LMICs), where over 80% of cases and 90% of deaths occur [2]. This disparity is largely due to limited access to preventive measures, including human

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papillomavirus (HPV) vaccination and routine screening. In high-income countries (HICs), widespread Papanicolaou (Pap) smear (cytology) screening programs and HPV vaccination have led to a significant decline in cervical cancer incidence and mortality [4]. For example, in the United States, the introduction of organized screening has reduced cervical cancer mortality by more than 70% since the 1950s [5].

Despite being a preventable and treatable disease, cervical cancer remains a leading cause of cancer-related morbidity and mortality among women, particularly in low- and middle-income countries (LMICs). Globally, 80% of cervical cancer cases occur in developing nations, where limited access to screening, early detection, and treatment exacerbates poor health outcomes [2].

The primary challenge lies in the low uptake of cervical cancer screening, with fewer than 10% of eligible women in Nigeria having ever been screened [6]. Barriers include lack of awareness, cultural stigma, financial constraints, and insufficient healthcare infrastructure. Additionally, even when screening is available, follow-up for abnormal results remains inconsistent, leading to delayed diagnosis and advanced-stage presentation.

Addressing these gaps is essential to reducing cervical cancer incidence and mortality, particularly in underserved populations where the disease remains a silent epidemic.

Nigeria bears one of the highest cervical cancer burdens globally, with an estimated 14,943 new cases and 10,403 deaths annually [7]. The age-standardized incidence rate (ASIR) is 29.0 per 100,000 women, with a mortality rate of 21.2 per 100,000 [8]. Alarmingly, over 70% of cases are diagnosed at advanced stages (III or IV), when treatment options are limited and survival rates are poor.

Key Contributing Factors in Nigeria:

1. Low Screening Uptake – Less than 10% of eligible women have ever undergone cervical cancer screening [8].
2. Limited HPV Vaccination Coverage – Despite the availability of HPV vaccines, national immunization programs remain underutilized, with coverage below 20%.
3. High HPV Prevalence – HPV-16 and HPV-18, the most oncogenic strains, are detected in over 70% of cervical cancer cases in Nigeria [9].
4. Socioeconomic and Cultural Barriers – Stigma, lack of awareness, and financial constraints prevent women from seeking screening.

Methodology

The survey is a cross-sectional study carried out among 400 female youth whose population comprised females (aged 15–35 years) residing in Jabi District, Abuja Municipal Area Council, Nigeria. The area was selected for factors including a heightened risk of exposure to HPV due to various socioeconomic and behavioral factors associated with urban settings; potential inequities in access to healthcare services, despite residing in a metropolitan area; and a persistent lack of awareness regarding cervical cancer and the critical importance of screening. The study population were female youths around Jabi Park, Jabi mall and Jabi community market. Research data collection was conducted using twenty-nine structured questions. These items covered key areas including risk factors, signs and symptoms, and preventive measures related to cervical cancer.

To ensure a representative sample of the study population, a total of 400 participants were included in the study. A simple random sampling method was employed to select the participants from women at Jabi Parks, public markets and malls within the Jabi District into the study by simple random sampling. A pre-tested, structured, and interviewer-administered questionnaire, subjected to

evaluation by a minimum of two public health professionals/researchers, whose feedback was integrated into the finalized questionnaire, served as the survey instrument for data collection in this study. Data was meticulously collected through self-administration using a structured online questionnaire, ensuring real-time and secure storage of responses in the cloud. This method facilitated efficient data capture from literate individual respondents. The comprehensive questionnaire, thoughtfully organized into six key sections (A-F), was designed to gather in-depth information.

The collected data, captured in real-time and stored securely in the cloud, underwent statistical analysis using SPSS version 21. The study's findings were presented through descriptive statistics, including tables, bar charts, and pie charts. Furthermore, chi-square(χ^2) tests were employed to determine the statistical association between participants' socio-demographic characteristics and their knowledge, attitudes, and practices related to cervical cancer screening. The threshold for statistical significance was set at a p-value of 0.05 for all analyses.

To ensure the utmost respect for participants, confidentiality and anonymity were paramount: respondents' email addresses, names, and phone numbers were never recorded. Instead, each completed questionnaire was assigned a unique, randomly generated number. These anonymized responses were then securely stored in real-time within the cloud, allowing for efficient data management while guaranteeing the privacy and data protection of every individual involved. Ethical approval for this research was secured from the Jabi district health ethical committee.

Results

Socio-demographic Characteristics

A total of 400 female youths aged 15-35 years from Jabi District, Abuja Municipal Area Council, Nigeria. Age distribution revealed that the largest proportion of participants (39.75%, n=159) belonged to the 26-30 years age group, followed by 31-35 years (28.75%, n=115), 21-25 years (26.25%, n=105), with the smallest representation from the 15-20 years age group (5.2%, n=21). This distribution suggests the study population predominantly comprised women in their late reproductive years, a demographic particularly vulnerable to HPV infection and cervical cancer development.

Regarding marital status, the majority of respondents were single (50.25%, n=201), followed by married women (40.5%, n=162), while smaller proportions were divorced (6.7%, n=27) or widowed (2.5%, n=10). Educational attainment showed significant variation: 41.25% (n=165) had attained or were pursuing tertiary education, 29.25% (n=117) had secondary education, and 12.25% (n=49) were engaged in postgraduate studies. However, a concerning 17.25% (n=69) had either only primary education (4%, n=16) or no formal education (13.25%, n=53), highlighting substantial educational disparities that may influence health literacy and screening access. Religious affiliation was predominantly Christian (62.75%, n=251), with Muslim (31.5%, n=126) and other/no religion (5.75%, n=23) comprising the remainder. These sociodemographic characteristics underscore the need for tailored health education interventions that account for varying educational backgrounds, marital contexts, and religious perspectives to effectively promote cervical cancer screening in this diverse population. The findings particularly emphasize the importance of developing age-appropriate and literacy-sensitive educational materials to address knowledge gaps among women with limited formal education.

NB: Tables 1 – 6 were cited by Abdulrahman I. D (MPH), Texila American University, Guyana, South America, 2025.

Knowledge of Female Youths Towards Cervical Cancer Screening

The study shows that the respondents in the age-group 21-25 (71, 68%), 26-30 (140, 88%) and 31-35 (74, 64%) have good knowledge of cervical cancer screening while about half (11, 52%) of respondents in the age-group 15-20 have good knowledge of cervical cancer screening. About two-thirds of Christian and Muslim female respondents (148 - 74%, and 124 - 62% respectively) have good knowledge of cervical cancer screening. Age has the strongest association with knowledge ($p<0.001$), showing a clear trend; Knowledge increases until 26-30 years, then slightly declines. There exists a significantly higher proportion of married (146, 90%) than singles (16, 10%) who have good knowledge about cervical cancer screening. Higher education correlates with increased awareness, with post-graduates (49, 100%) having the highest knowledge of cervical cancer followed by respondents with tertiary level of education (141, 86%) having a better knowledge of cervical cancer screening than female youth respondents with secondary level of education (44, 38%). Respondents with primary (5, 31%) or no formal education (9, 17%) exhibited poorest knowledge of cervical cancer. The results indicate a statistically significant association between marital status with married respondents (146, 90%) having a good knowledge of cervical cancer compared to singles (93, 46%). There is also a statistically significant association between marital status, highest educational level, occupation of female youths and knowledge about cervical cancer screening ($p < 0.05$). Sociodemographic characteristics and knowledge scores are presented in Tables 1 and 2.

Table 1. Knowledge of Female Youth towards Cervical Cancer Screening

	Mean	**Standard deviation**	**Range**	**Minimum**	**Maximum**	**Cronbach's Alpha (χ^2)**	**No. Of items**
Knowledge score	15.2	3.5	22	5	27	0.82	25

Table 2. Sociodemographic Associations of Knowledge of Female Youth towards Cervical Cancer Screening

Variables	**Good knowledge n(%)**	**Poor knowledge n(%)**	**X^2**	***P*-value**
Age group (years)			29.2	<0.001
15 - 20	11 (52%)	10 (48%)		
21 - 25	71 (68%)	34 (32%)		
26 - 30	140 (88%)	19 (12%)		
31 - 35	74 (64%)	41 (36%)		
Marital status			85.91	<0.001
Single	93 (46%)	108 (54%)		
Married	146 (90%)	16 (10%)		
Divorced	11 (40%)	16 (60%)		
Widowed	3 (30%)	7 (70%)		
Highest education			149.33	<0.001*
No formal education	9 (17%)	44 (83%)		
Primary	5 (31%)	11 (69%)		
Secondary	44 (38%)	72 (62%)		
Tertiary	141 (86%)	24 (14%)		
Postgraduate	49 (100%)	0 (0%)		

Religion			8.78	0.0124
Christianity	186 (74%)	64 (26%)		
Islam	78 (62%)	47 (38%)		
Not a believer	20 (87%)	3 (13%)		

**Significant at 5% level*

Attitudes of Female Youths Towards Cervical Cancer Screening

Among the respondents, the 26-30 age group exhibited the most positive attitudes (98, 68%) towards cervical cancer screening, possibly linked to greater health awareness during their reproductive years. Married (94, 58%) and divorced (14, 50.4%) respondents also showed good attitudes. However, age group and marital status did not demonstrate a statistically significant correlation with attitudes towards cervical cancer screening ($P > 0.05$). Education level strongly influences attitudes toward cervical cancer screening. Positive attitudes increased with higher education: 25% (no formal education), 40% (primary), 45% (secondary), 60% (tertiary), and 65% (post-graduate). Overall, 50.8% had a positive attitude, and 49.2% had a negative one ($\chi^2 = 14.27$, $p = 0.006$). Religious affiliation significantly influenced attitudes toward cervical cancer screening. Among Christians, (60, 52%) held positive views, while Muslims showed less favorable attitudes, with only (15, 38%) expressing support. Both higher education levels ($p=0.006$) and Christian religious affiliation ($p=0.048$) show statistically significant associations with more positive attitudes toward cervical cancer screening, though education demonstrates a stronger relationship. Attitude distributions and sociodemographic correlates are summarized in Tables 3 and 4.

Table 3. Attitude of Female Youth towards Cervical Cancer Screening

	Mean	**Standard deviation**	**Range**	**Minimum**	**Maximum**	**Cronbach's Alpha (χ^2)**	**No. Of items**
Attitude score	3.8	0.9	4	1	5	0.82	10

Table 4. Sociodemographic Associations of Attitude of Female Youth towards Cervical Cancer Screening

Variables	**Positive attitude n(%)**	**Negative attitude n(%)**	**X^2**	***P*-value**
Age group (years)				
15 - 20	6 (30%)	15 (70%)	9.41	*0.024
21 - 25	47 (45%)	58 (55%)		
26 - 30	98 (62%)	61 (38%)		
31 - 35	58 (50.4%)	57 (49.6%)		
Marital status				
Single	96 (48%)	105 (52%)	4.92	0.178
Married	94 (58%)	68 (42%)		
Divorced	14 (50.4%)	13 (49.6%)		
Widowed	4 (40%)	6 (60%)		
Highest education				
No formal education	13 (25%)	40 (75%)	14.27	*0.006
Primary	6 (40%)	8 (60%)		

Secondary	53 (45%)	64 (55%)		
Tertiary	99 (60%)	66 (40%)		
Postgraduate	32 (65%)	17 (35%)		
Religion				
Christianity	60 (52%)	55 (48%)	3.89	*0.048
Islam	15 (38%)	25 (62%)		
Not a believer	N/A	N/A		

**Significant at 5% level.*

Practice of Female Youths Towards Cervical Cancer Screening

The findings shows that the 26-30 age group exhibited good practice (64, 40%) towards cervical cancer screening, divorced (14, 50.5%) and married (78, 48%) respondents also showed good practice. Education level strongly influences practice as screening rates improved drastically with education, (99, 50%) and (32, 55%) of tertiary and post graduates respectively have good practice towards cervical cancer screening. 25% (no formal education), 33% (primary) and 40% (secondary) have poor practice towards cervical cancer screening. More Muslim participants (15, 44%) have good practices towards cervical cancer screening than the Christian female youth participants (60, 40%). Higher education levels ($p<0.05$) show statistically significant associations with more good practice towards cervical cancer screening. Practice patterns and sociodemographic correlates of cervical cancer screening among female youth are presented in Tables 5 and 6.

Table 5. Practice of Female Youth towards Cervical Cancer Screening

	Mean	**Standard Deviation**	**Range**	**Minimum**	**Maximum**	**Cronbach's Alpha**	**No. Of items**
Practice score	0.35	0.48	1	0	1	0.72	2

Table 6. Sociodemographic Associations of Practice of Female Youth towards Cervical Cancer Screening

Variables	**Good practice n(%)**	**Poor practice n(%)**	**X^2**	***P*-value**
Age group (years)				
15 - 20	6 (30%)	15 (70%)	4.92	0.178
21 - 25	38 (36%)	67 (64%)		
26 - 30	64 (40%)	95 (60%)		
31 - 35	44 (38%)	71 (62%)		
Marital status				
Single	66 (33%)	135 (67%)	12.34	*0.006
Married	78 (48%)	84 (52%)		
Divorced	14 (50.5%)	13 (49.5%)		
Widowed	4 (40%)	6 (60%)		
Highest education				
No formal education	13 (25%)	40 (75%)	18.72	*0.0009
Primary	6 (33%)	8 (67%)		
Secondary	53 (40%)	64 (60%)		
Tertiary	99 (50%)	66 (50%)		
Postgraduate	32 (55%)	17 (45%)		

Religion				
Christianity	60 (40%)	55 (60%)	1.23	0.267
Islam	15 (44%)	25 (56%)		
Not a believer	N/A	N/A		

**Significant at 5% level.*

Discussion

This study revealed significant disparities between knowledge, attitudes, and practices (KAP) regarding cervical cancer screening among female youths in Jabi District, Nigeria. While 66% of participants demonstrated adequate knowledge, only 39.5% held positive attitudes, and a mere 35% engaged in screening. Strong associations ($p<0.001$) were observed between demographic factors and screening knowledge, with higher educational attainment (89% among tertiary-educated vs 17% with no formal education) and marital status (90% among married vs 46% single women) emerging as key predictors. The 26-30 age group showed peak knowledge levels (88%), consistent with global patterns of reproductive-age health-seeking behavior, followed by a notable decline among 31-35-year-olds (64%), mirroring post-reproductive disengagement trends documented in South Africa [10].

Educational attainment demonstrated the strongest correlation with screening knowledge ($p<0.05$), supporting social determinants of health frameworks and replicating findings from Uganda [11]. Religious affiliation significantly influenced KAP ($p<0.05$), with Christians exhibiting more favorable outcomes than Muslims, consistent with Middle Eastern studies [12] that highlight systemic barriers despite high awareness. The critical importance of early screening was underscored by evidence that persistent HPV infection in young women carries particularly poor prognostic outcomes [13], emphasizing the need for targeted interventions in this vulnerable demographic.

Attitudinal analysis revealed that 53.6% of respondents would screen if services were affordable, corroborating Tanzanian data where cost-removal increased uptake by 58% [14]. This financial barrier was particularly salient in Nigeria's out-of-pocket healthcare system, where subsidized programs have shown 55% increases in screening rates [15]. However, educated women's persistent avoidance due to diagnosis fear (44%) and spousal opposition (61%) [16] indicates that economic interventions alone cannot overcome deep-seated cultural barriers.

Screening practices lagged significantly behind knowledge, with only 35% participation - a pattern consistent across LMICs. The education-practice gradient was stark: 55% of postgraduates screened versus 25% with no formal education. While these findings align with similar studies in Ghana showing education's role in healthcare access [17], they contrast with cases where educated women ultimately declined screening due to sociocultural constraints. Religious affiliation showed complex influences, with Muslim participants in this study demonstrating marginally higher screening rates (44%) than Christians (40%) - a reversal of Saudi patterns [12] that underscores how local doctrinal interpretations, rather than religion itself, shape health behaviors.

The persistent knowledge-practice gap reflects systemic challenges including limited health communication, inadequate service availability (<8% of Nigerian primary clinics offer screening), and multidimensional barriers spanning cost, culture, and technical awareness. These findings validate the WHO's framework for LMICs, where intersecting factors of health literacy, resource distribution, and sociocultural norms collectively impede prevention efforts. The study highlights the necessity of integrated interventions addressing both structural barriers

and cultural perceptions to translate awareness into actionable screening behaviors.

Conclusion

To improve cervical cancer screening among young women in Jabi District, Abuja, a multifaceted intervention strategy is needed—one that combines strengthening community-based health education in schools and workplaces with culturally sensitive messaging and engaging community leaders. Accessibility and affordability should be improved through mobile clinics and subsidized screening for low-income women. Policy changes are necessary to prioritize screening and train healthcare workers in patient-centered counseling. Future programs should particularly target younger females and unmarried women

These findings necessitate a two-pronged approach:

1. Structural interventions like school-based HPV education to reach younger cohorts.
2. Cultural adaptations such as faith-sensitive counseling to address religious barriers. The persistent knowledge-practice gap underscores that awareness campaigns alone are insufficient without addressing systemic obstacles like cost [18] and gender norms [19].

Key Strengths/Limitations: While this study provides granular KAP data by age and religion, its cross-sectional design cannot establish causality. Longitudinal studies are needed to track how life-stage transitions (e.g., marriage, first birth) impact screening behaviors in this population [20].

Competing Interest

This research was conducted independently without funding or institutional support that might present a conflict of interest. All authors confirm that the findings and conclusions presented in this manuscript are based solely on the analysis of collected data and relevant scholarly literature, free from external influence or bias.

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A Cross-Sectional Survey among Clinical Researchers to Assess the Perceived Benefits and Barriers in Adoption and Implementation of Decentralized Clinical Trials in India

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Abstract

Decentralized clinical trials (DCTs) use technology and knowledge advancements to conduct clinical trials or trials of specific activities when compared to the traditional trial location. During the pandemic and currently, the use of DCTs has been widely implemented globally. Despite the global momentum, their adoption in India remains restricted. The purpose of this study is to evaluate the awareness and understanding of the DCTS and to assess perceived benefits and barriers among clinical research professionals in India with respect to their adoption and implementation. A questionnaire with a cross-sectional approach has been developed using Google forms and was distributed to clinical research professionals across India; 112 clinical researcher's responses were received. We evaluated the responses using descriptive statistics and thematic analysis. The result indicates a high level of awareness (70.5%), while 28.6% are 'somewhat familiar' with DCTs among clinical researchers in India. Most respondents, around 72%, have previously participated in the conduct of DCTs and possess hands-on experience in managing such trials. Hybrid trial design was more prevalent in most therapeutic areas compared to traditional and fully decentralized trials. Most respondents perceived that the key benefits of decentralized clinical trials (DCTs) included improved access to a diverse patient pool and faster data collection and analysis, which were noted by 77.7% of respondents, as well as enhanced compliance and satisfaction among patients, reported by 76.8%. Major barriers identified included lack of technological infrastructure (84.8%), data privacy concerns (84.8%), and regulatory uncertainty (76.8%). While DCTs have advantages, regulatory uncertainties and infrastructure challenges remain barriers for their widespread adoption and implementation in India. We need targeted strategies in digital infrastructure, regulatory reforms, capacity building, and stakeholder engagement to address these challenges and facilitate broader adoption.

Keywords: *Adoption, Clinical Research, Decentralized Clinical Trials, DCTs, Implementation, India, Perceived Barriers, Regulatory Challenges.*

Introduction

The traditional approach of clinical trials, which mostly depends on centralized study locations and site visits, has historically been regarded as the gold standard in clinical research [1]. This methodology has logistical problems, such as geographical constraints, increased expenses, and participant burden, which may impact recruitment, retention, and overall trial efficacy [2, 3]. In the past few years, demand for decentralized clinical trials (DCTs) has surged as a novel alternative to conventional methodologies. DCTs use digital technology and remote methodologies, including telemedicine, electronic informed consent, wearable devices, and home health visits, to facilitate greater interaction between

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clinical research and participants, therefore improving access and convenience [4].

The global COVID-19 outbreak sped up the acceptance of decentralized models by showing the shortcomings of site-dependent studies and emphasizing the need for ongoing clinical research during public health crises. [5]. The U.S. Food and Drug Administration (FDA) and the European Medicines Agency (EMA), among others, have issued guidelines to implement decentralized methods. These guidelines recognize that decentralized methods help in improving trial diversity and a patient-focused approach [6, 7].

Although the benefits of DCT, including enhanced patient participation, diversified geographic accessibility, and operational efficiencies are well established in developed countries, their implementation in developing countries such as India is still constrained [8].

India is the preferred destination for contract pharmaceuticals, attributed to its substantial treatment-naïve population, skilled people resources, technological expertise, regulatory adaptability, and evolving economic landscape [9]. In 2022, the virtual clinical trials market reported revenue of USD 127.0 million. By 2030, the digital clinical trials market is expected to bring in USD 219.5 million. The India virtual clinical trials market is expected to grow at a rate of 7.1% per year from 2023 to 2030. [10]. Thus, India's diverse healthcare infrastructure and extensive population present both unique challenges and significant opportunities for the implementation of DCTs. Factors such as regulatory uncertainty, infrastructural disparities, concerns regarding data privacy and trial integrity, and digital literacy level may influence stakeholders' readiness to transition to decentralized models. [11, 12].

We have limited data available on the perceptions of clinical researchers in India regarding the feasibility, benefits, and barriers of DCTs, despite it ever growing demand in this field. It is important to understand these views so that educational, infrastructural, and governmental strategies can be adapted to promote widespread adoption. The aim of this study is to address this gap by conducting a cross-sectional survey among clinical researchers in India to evaluate their awareness, attitudes, and perceived challenges associated with the adoption and implementation of DCT.

The objectives of this study are as follows:

1. To assess the level of awareness and understanding of DCTs among clinical researchers in India.
2. To identify the perceived benefits and challenges in the adoption and implementation of DCTs.

Methodology

The data was collected from clinical research professionals throughout India using a cross-sectional survey design. This design enables the compilation of data at a single point in time, thereby providing an overview of the current perspective, awareness, and attitudes of clinical researchers concerning DCTs.

The study targeted clinical researchers including professionals from hospitals, academic institutions, contract research organizations (CROs), pharmaceutical companies. Inclusion criteria encompassed professionals with a minimum of one year of experience in clinical research.

A questionnaire was developed using Google forms, comprising sections on demographics, awareness and experience with DCTs, perceived benefits and barriers, and outlook. The questionnaire included both closed and open-ended questions and were validated through a pilot test with 5 clinical research experts. Between Jan to Apr 2025, the survey was electronically disseminated through professional networks and mailing lists. A total of 112 verified responses were received.

The survey included a consent statement informing participants of the study’s purpose, ensuring voluntary participation. All responses

were anonymized and used solely for research purpose. The study did not include patients and therefore was exempted from the ethics review.

Descriptive statistics were utilized to summarize the data. Inferential statistics, including chi-square tests, were employed to examine associations between demographic variables and perceptions. Qualitative responses were analyzed thematically.

Results

The result has been written based on the study objectives and the responses obtained from the clinical researchers.

Clinical Researchers in India were Evaluated for their Awareness and Understanding of Decentralized Clinical Trials

Table 1 presents the demographics of clinical researchers in India who have responded to the survey.

Table 1. Demographics of Clinical Researchers responded to the Questionnaire

Gender	Male respondent: 65.2%
	Female respondent: 34.8%
Age group	20-30 years: 6.3%
	30-45 years: 74.1%
	More than 45 years: 19.6%
Work experience	Upto 10 years: 11.6%
	11-25 years: 80.4%
	More than 25 years: 8%
Organizational details	Pharmaceutical/sponsor company: 37.5 %
	Service provider company: 54.5%
	University or research institute: 6.3%
	Other: 1.8% (consultants)
Organizational type	Large companies (more than 2500 employees): 71.4%
	Midsized companies (500 to 2500 employees): 10.7%
	Small sized companies (up to 500 employees): while 17.9%
Functional area	Clinical operations: 72.1%
	Executive management: 13.5%
	Data Management: 5.4%
	Quality Management: 2.7%
	Decentralized clinical trials: 1.8%
	Information technology: 0.9%
	Other: 4.5 % (*includes Business development, record management, consultants*)

Clinical researchers had mean age of 39 years (Std. Deviation = 6.10), ranging from 32.9 to 45 years. Respondents had an average of 17.45 years of work experience in clinical research (Std. Deviation = 5.6), ranging from 12 to 23 years of work experience.

Based on the responses, 70.5% of the respondents were very familiar with the concept of decentralized clinical trials, while 28.6% were somewhat familiar and around 0.9% had never heard about DCT; as represented in Figure 1.

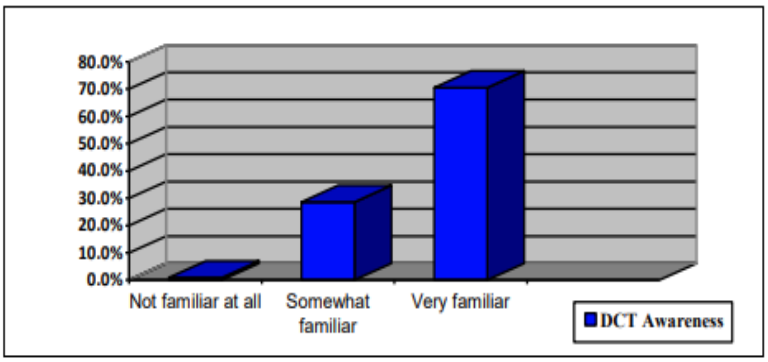

Figure 1. The Graph Represents Respondent's Awareness about the Decentralized Clinical Trial (DCT) Concept

72.3% (81 respondents) have participated in DCT prior and are well experienced in managing DCT while 27.7 % (31 respondents) have still not been involved in conducting a DCT in India represented in Figure 2.

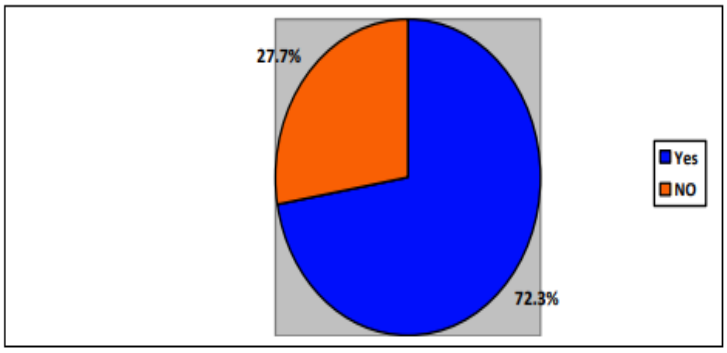

Figure 2. The Graph Represents the Respondents Involved vs Respondents with No Experience in Conducting a DCT in India

A chi-square test of independence was conducted to examine whether there is a relationship between work experience of clinical researchers and their involvement in conducting decentralized clinical trials (DCTs) in India. Participants were categorized into three groups based on years of experience: up to 10 years, 11–25 years, and more than 25 years. The test revealed a statistically significant association between the work experience and DCT involvement with a p value = 0.01. The group with 11–25 years of experience had the highest proportion of professionals involved in DCTs, followed by those with more than 25 years of experience. The group with up to 10 years of work experience showed the least involvement. This data shows that the correlation between years of experience and DCT participation is non-linear.

The Assessment of Perceived Benefits and Challenges of DCT Implementation

The study of how DCT designs are used in different therapeutic areas showed that hybrid trial designs were more common than traditional trials or fully decentralized clinical trials. The survey responses for the perceived benefits of using DCTs are represented in the figure 3 below, which shows 77.7% believe that DCT has improved access to a diverse pool of suitable trial participants and faster data collection and analysis respectively. Additionally, higher patient compliance with visit and assessment schedules, along with stronger retention, was noted by 76.8%, aligning closely with the reported increase in patient convenience and satisfaction (76.8%). The ability of DCTs to increase patient recruitment and retention overall was

acknowledged by 71.4% of participants. Moreover, 67.9% emphasized that DCTs enable better access to clinical trials in rural or remote areas. From an operational perspective, 58.9% cited reduced costs associated with conducting clinical trials, while 54.5% noted improvements in data quality due to real-time access and automation. Finally, 47.3% observed a reduction in the complexity of managing studies at physical sites.

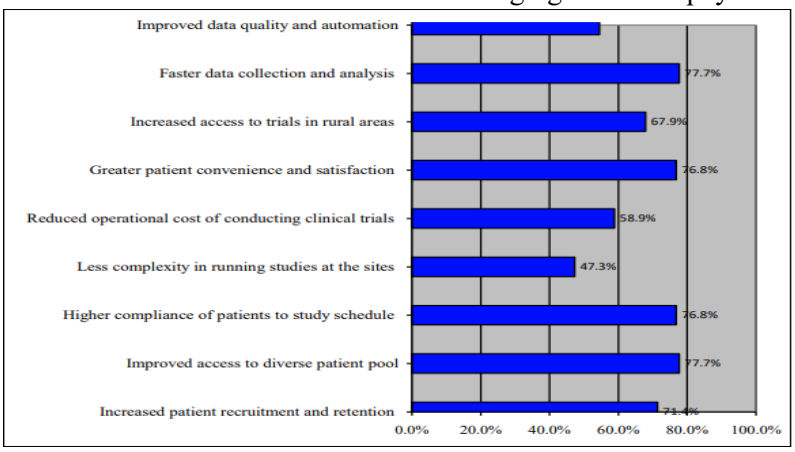

Figure 3. Perceived Benefits with DCT Adoption and Implementation

The responses were obtained to assess perceptions regarding the potential of DCTs to enhance trial timelines and efficiency in India. The results indicate a predominantly positive outlook among respondents represented in figure 4; 67% of respondents viewed DCTs as somewhat positive in improving trial timelines and efficiency. 17.9% rated the impact as very positive. 13.4% were neutral, indicating neither strong agreement nor disagreement. Only 1.8% expressed a somewhat negative view. Interestingly, none of the responder who answered said that the effect was very negative.

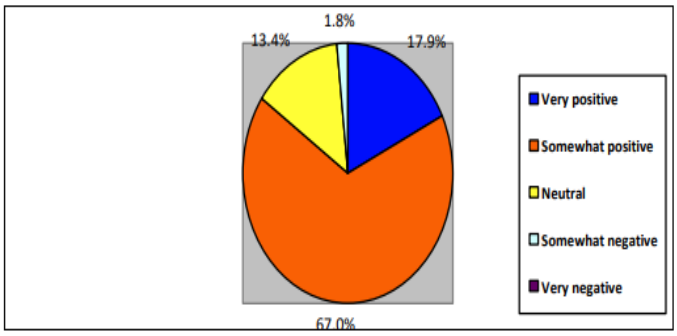

Figure 4. DCT's Potential in Improving Trial Timelines and Efficiency in India

The survey identified several key challenges perceived by stakeholders regarding the adoption and implementation of Decentralized Clinical Trials (DCTs) in India represented in Figure 5. The most frequently cited barriers were “limited technological infrastructure” and “data security and privacy concerns”, both reported by 84.8% of respondents. Other prominent concerns included “regulatory hurdles and compliance with local laws” (76.8%), “poor internet connectivity in rural areas” (74.1%), “lack of trained professionals” (71.4%), and “controlling patient safety and adverse event management” (68.8%). Additionally, 67.9% of respondents noted “patient hesitancy or lack of trust in remote trials” and “high initial investment costs” were reported at 67.9%. A small proportion (1.8%) mentioned other unspecified challenges.

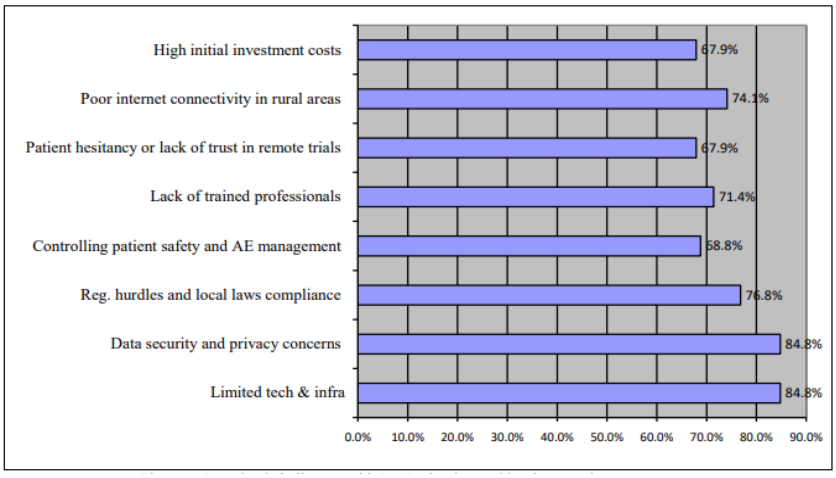

Figure 5. Perceived Challenges with DCT Adoption and Implementation

Based on the survey results, respondents have identified several critical steps necessary to promote the adoption of Decentralized Clinical Trials (DCTs) in India. The most emphasized measure was the need for enhancing regulatory support for DCTs, cited by 92% of participants. 89.3% of the respondents prioritized improving technological infrastructure in rural areas while 87.5% supported expanding patient education and awareness campaigns. Additionally, 81.3% of respondents considered increasing training programs for professionals while 73.2% supported creating incentives for sponsors and institutions.

The survey had open-ended question for the respondents on the areas for the stakeholders (regulatory bodies, clinical researchers and technology providers) to better collaborate to promote the success of DCT in India. Table 2 presents a thematic analysis of the responses.

Table 2. Thematic Analysis on the Areas for the Stakeholders (Regulatory Bodies, Clinical Researchers and Technology Providers) to Better Collaborate to Promote the Success of DCT in India

Theme	Key Suggestions/Inputs	Frequency	Representative Quotes
Regulatory Guidelines & Support	Develop clear DCT-specific guidelines; simplify regulatory processes; approve e-consent and e-signatures.	High	"Proper guidelines need to be in place…" "Simplify regulatory approvals…"
Awareness & Education	Conduct awareness campaigns; train investigators and patients; organize DCT-specific conferences.	High	"Create awareness, incentivise companies…" "Education" "Conducting patient awareness programmes…"
Technology Enablement	Build user-friendly, affordable digital platforms; ensure compliance with Indian/global standards; integrate with initiatives like ABHA.	High	"Accessible digital platforms for remote monitoring…" "Patient data… ABHA can be game changer."
Collaborative Efforts	Facilitate stakeholder collaboration; joint discussions; coordinated implementation efforts.	Moderate	"Collaborate approach for implementation" "Understanding each other's requirements…"

Pilot Studies/Phased Adoption	Start with pilot studies in low-risk areas; gradually scale based on outcomes.	Moderate	"Firstly Pilot Project should start…" "Phase IV trials can be early adopters."
Incentives & Motivation	Incentivize DCT adoption by sponsors/CROs; demonstrate cost-effectiveness and quality benefits.	Moderate	"Incentivize companies supporting DCTs" "Demonstrating which activities… positively impacting time, cost, quality"
Patient-Centric Approach	Educate and support patients; ensure DCTs improve patient convenience and care.	Moderate	"Shift the mindset of the patient…" "If patients are able to get better treated without hassle…"
Infrastructure Readiness	Develop physical and digital infrastructure for remote trials; funding for setup.	Low	"Set-up of infrastructure…" "Funding & Infrastructure Development…"

A significant majority of respondents (87.4%) personally supported the adoption of Decentralized Clinical Trials (DCTs) in India. A small portion (5.4%) expressed opposition to DCT adoption, while 7.2% were unsure about their stance.

Discussion

The present study explored the perceptions of clinical researchers in the adoption and implementation of the decentralized clinical trials (DCTs) in the Indian context. The gender distribution provided information about the diversity of perspectives on decentralized clinical trials (DCTs) in India. Most of the respondents belonged to the 30-45 years age group, indicating their significant involvement in the clinical research field.

The Discussion is Based on the Objective of this Research

Clinical Researchers in India were Evaluated for their Awareness and Understanding of Decentralized Clinical Trials

The results indicate that professionals with moderate to high levels of experience (11–25 years) are more actively involved in conducting DCTs compared to those with lesser (≤10 years) or very extensive (>25 years) experience. The relatively lower DCT participation among early-career professionals may reflect limited exposure to decentralized models, lack of training, or fewer opportunities to lead or participate in such trials. Interestingly, professionals with more than 25 years of experience also demonstrated lower involvement compared to the 11–25-years of work experience group. The findings may suggest a generational gap or resistance to adopting newer digital trial methodologies among the most experienced cohort [13]. In contrast, those in the 11–25 years range may represent a group with sufficient seniority to be involved in decision-making, while still being adaptive to evolving technologies and trial models like DCTs. This pattern demonstrates the need for strategic workforce development to enhance DCT awareness and skills across both early-career and senior professionals [14]. Ensuring continuous education and digital literacy in clinical research practice could help bridge the participation gap [15].

Most of the respondents in this study (72.1%) were actively engaged in clinical operations, serving in roles such as project managers, clinical research associates, and clinical trial assistants. This indicates that the perspectives captured largely reflect the experiences of professionals directly involved in the day-to-day execution and coordination of clinical trials, including protocol implementation, site management, and patient interaction. A smaller but significant portion (13.5%) of respondents held executive or senior management positions such as CEOs, directors, and associate directors. Their inclusion adds strategic insight into organizational priorities and high-level decision-making regarding DCT adoption. Additionally, a minority of respondents represented other functional domains such as advisory consultancy, business development, records management, and risk-based monitoring (RBM), grouped under the "Other" category. The diverse functional representation enhances the comprehensiveness of the findings, though it is important to note that operational perspectives dominate. This distribution likely influenced the emphasis placed on practical challenges—such as technological readiness, training, and patient engagement—over broader institutional or regulatory considerations. Understanding how perceptions vary by professional role can be valuable for tailoring DCT adoption strategies across different levels of the clinical research ecosystem [16].

The results indicate a high level of awareness about decentralized clinical trials (DCTs) among clinical research professionals in India, with 70.5% of respondents reporting that they were very familiar with the concept and an additional 28.6% being somewhat familiar. Only a negligible 0.9% had never heard of DCTs. This strong awareness suggests that DCTs have gained considerable visibility within the clinical research community, likely influenced by the global shift toward remote and technology-enabled trials in the aftermath of the COVID-19 pandemic. The widespread familiarity is a promising sign for the future of DCT adoption, as it reflects a foundational understanding that can support further capacity building and implementation [17-19].

The study revealed that a substantial majority of respondents (72.3%) have previously participated in the conduct of decentralized clinical trials (DCTs) and possess hands-on experience in managing such trials. This high level of direct involvement indicates that DCTs are not just a theoretical concept among clinical researchers in India but are already being piloted or implemented in various capacities. This experiential exposure provides respondents with practical insights into the operational nuances, benefits, and challenges of DCTs—making their perspectives particularly valuable. In contrast, 27.7% of respondents reported no prior involvement in DCTs, suggesting that while adoption is growing, it has not yet become a standard practice across the board. The disparity in experience may reflect differences in institutional readiness, therapeutic focus, or geographic location. It also calls for broader dissemination of DCT models and more inclusive training initiatives to ensure that professionals across various sectors of the clinical research ecosystem are prepared to contribute to and benefit from the shift toward decentralized trial methodologies [20].

Assessment of Perceived Benefits and Challenges of DCT Implementation

The predominance of hybrid designs in therapeutic areas indicates that sponsors are favouring a flexible approach that integrates traditional site visits with remote technologies [21]. Several key benefits were identified from the adoption of decentralized clinical trials (DCTs), as reported by the clinical research professionals. A significant majority highlighted improved access to a diverse pool of suitable trial participants, which enhances the representativeness and inclusiveness of

clinical research. Faster data collection and analysis were also reported as a major advantage by 77.7% of respondents, owing to the use of digital technologies and real-time data capture. Additionally, higher patient compliance with visit and assessment schedules, along with stronger retention, was noted by 76.8%, aligning closely with the reported increase in patient convenience and satisfaction (76.8%). The ability of DCTs to increase patient recruitment and retention overall was acknowledged by 71.4% of participants. Moreover, 67.9% emphasized that DCTs enable better access to clinical trials in rural or remote areas, thereby reducing geographical barriers to participation. From an operational perspective, 58.9% cited reduced costs associated with conducting clinical trials, while 54.5% noted improvements in data quality due to real-time access and automation. Finally, 47.3% observed a reduction in the complexity of managing studies at physical sites. Collectively, these findings indicate that DCTs offer substantial improvements in accessibility, efficiency, data quality, and patient engagement, supporting their growing adoption in the clinical research landscape in India [22, 23].

The findings suggest a largely optimistic perception of DCTs' potential to enhance trial timelines and efficiency in India. Most of the respondents viewed the impact as somewhat positive, while 17.9% rated it as very positive. This reflects strong overall support for the role of DCTs in improving operational aspects of clinical trials. The neutral stance of 13.4% indicates some reservation or a wait-and-see approach, whereas negative responses were minimal (1.8% somewhat negative, 0% very negative), underscoring broad acceptance and low resistance among stakeholders. These insights highlight a favourable environment for adopting DCT models to streamline clinical research in India.

The data clearly reflect that while the potential of DCTs is widely acknowledged, several significant challenges hinder their full-scale adoption in India. The highest-rated concerns—technological infrastructure and data privacy—underscore the foundational limitations in digital readiness and the need for robust cybersecurity frameworks. These are critical, as DCTs rely heavily on digital tools for data capture, patient monitoring, and communication [24].

Regulatory compliance emerged as another major concern, emphasizing the complexity and ambiguity surrounding DCT-specific guidelines in the Indian context. Ensuring patient safety and managing adverse events remotely also remain prominent challenges, as traditional site-based trials typically offer more immediate oversight [25]. Issues such as lack of trained professionals and internet connectivity gaps in rural areas point toward disparities in resource distribution and digital literacy, especially in underserved regions. Moreover, patient hesitancy and high initial investment costs suggest both cultural and economic barriers that need to be addressed for broader acceptance.

These findings show that even though stakeholders are excited about DCTs, we need to take a comprehensive approach that includes updating the policies, improving the infrastructure, building skills and educating the users involved to ensure that they are successfully put in practise. [26- 28].

It would be critical to take measures to promote the DCT elements within the organization. The responses highlight a clear roadmap for advancing DCT implementation in India. The overwhelming consensus on enhancing regulatory support reflects an urgent demand for clearer guidelines, faster approvals, and alignment with international standards to facilitate the smoother conduct of decentralized trials. Regulatory clarity is foundational in boosting confidence among stakeholders and ensuring compliance. The call to improve technological infrastructure in rural areas underscores a persistent digital divide that

could hinder equitable participation in DCTs. Reliable internet connectivity and access to devices are essential to ensure that trials can reach and engage patients across diverse geographic regions. Patient education and awareness also emerged as a critical factor. Empowering patients with knowledge about the benefits, processes, and safety of DCTs can reduce hesitancy and build trust, especially in communities unfamiliar with digital healthcare interactions. Similarly, training clinical research professionals remains vital for ensuring that the workforce is equipped to manage decentralized protocols, technologies, and patient interactions effectively [29]. Lastly, incentivizing sponsors and institutions suggests the need for policy-driven or financial motivations to encourage early adoption, experimentation, and investment in DCT infrastructure. Indian government has launched Digital Health Incentive Scheme (DHIS) under the Ayushman Bharat Digital Mission (ABDM) that provides financial incentives to healthcare providers and digital solution companies to encourage the adoption of digital health records. Such, policy incentives are essential for institutions to invest in digital infrastructure, a core component of DCTs [30]. Without such incentives, institutions may be reluctant to transition from familiar traditional trial methods to newer, decentralized models.

In addition, thematic analysis demonstrates a consistent alignment between stakeholder concerns and established global best practices in the adoption of DCT. Regulatory reform is essential; without clear and unified guidelines, decentralized clinical trials (DCTs) face challenges in gaining traction in India. Awareness and training are critical, not just for investigators but also for patients who are the end beneficiaries of decentralized models. The technology landscape in India exhibits potential; however, the integration with local frameworks and the assurance of user-friendliness are crucial factors. Designing pilot studies and evaluating trial-specific DCT feasibility cooperatively will help to build trust across the industry [31].

Moreover, the implementation of patient-centered approaches—focusing on comfort, accessibility, and data security is necessary to encourage long-term adoption [17].

Respondent who have personally advocated the adoption and implementation of DCT reflect a strong positive sentiment within the clinical research community regarding the potential of decentralized models. Such high levels of personal support are encouraging for policymakers and stakeholders, as they indicate readiness among professionals to adopt and engage with DCT models, provided that the systemic barriers can be addressed. Thus, these results are consistent with studies conducted in other developing countries, where researchers have expressed cautious optimism toward DCTs but emphasized regulatory and infrastructural challenges [32].

The findings underline the urgent need for a more robust regulatory framework to support DCTs in India. Regulatory authorities such as CDSCO [33] and ICMR must play a more proactive role in issuing guidance and supporting pilot programs. Additionally, training for clinical professionals is essential. The need for education on technological tools, ethical practices, and patient engagement in virtual settings is paramount. Improved infrastructure and targeted incentives for sponsors may further ease the transition to DCT models.

Conclusion

The assessment of clinical researchers' perspectives reveals a generally positive outlook on the adoption and implementation of Decentralized Clinical Trials (DCTs) in India. Most respondents acknowledged the potential of DCTs to improve trial timelines and efficiency, indicating readiness for change within the research community. However, this optimism is tempered by substantial concerns

around infrastructure limitations, regulatory complexities, and operational challenges.

DCT participation is spread out evenly among various type of organization, showing that many different groups are adopting decentralized methods in Indian clinical research landscape.

This study found a statistically significant relationship between work experience and involvement in decentralized clinical trials in India. Professionals with 11–25 years of experience were most likely to be involved in DCTs, while those with ≤10 years and >25 years of experience had notably lower levels of participation. The results indicate that there should be specific efforts like training and support programs for both newer and experienced researchers, to increase their involvement with decentralized trial models and improve their use in clinical research environment in India.

Overall, the data suggests that while DCT adoption is underway, it is still in a transitional phase for most organizations, with moderate uptake being the norm. The persistent barriers point to the lack of high or very high adoption, indicating the need for broader and deeper integration. Moving forward, success in scaling DCT implementation will likely depend on factors such as leadership commitment, technology investment, regulatory clarity, training and awareness and cross-functional collaboration. We can expect a gradual shift toward higher adoption levels as confidence increases and early learnings become more shared.

To ensure the success of DCTs in India, a multi-directional strategy is required. The path forward includes:

1. Issuing robust regulatory guidelines tailored for Indian settings.
2. Launching national awareness and training initiatives for stakeholders.
3. Developing cost-effective, compliant digital tools integrated with national healthcare programs.
4. Implementing small-scale pilots to gather data and refine approaches.
5. Encouraging collaborative frameworks among regulators, pharmaceuticals, CROs, research institutes and technology partners.
6. Ensuring patient education and engagement is central to all DCT strategies.

In general, DCTs have potential to change clinical research in India, but to be successful, we need to tackle these challenges by investing in digital tools, regulatory reforms, improving skills and collaborating with the stakeholders.

This study is limited by its sample size and the use of self-reported data, which may be subject to bias. Furthermore, perceptions may evolve rapidly as DCT-related policies and technologies continue to develop.

Future research should focus on patient perspectives and real-world DCT case studies in India to evaluate feasibility and outcomes. Longitudinal studies assessing the impact of policy changes or pilot programs could also offer valuable insights. Additionally, exploring the views of regulators and institutional leaders would help identify additional barriers and accelerators of adoption.

Conflict of Interest

The author(s) declare no potential conflict of interest with respect to the research, authorship and or publication of this article.

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The Effects of Micro Planning on the Response to COVID-19 by County Health Officers in Selected Countries in Africa and Asia

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Abstract

The COVID-19 pandemic exposed significant challenges in global health systems, necessitating the adoption of micro-planning strategies to enhance pandemic response, particularly at the county level. This study examines the role of micro-planning in strengthening the response capacity of county health officers, focusing on selected African and Asian case studies. The study synthesizes empirical evidence on micro-planning interventions in supply chain management, community engagement, testing efficiency, healthcare workforce optimization, and vaccine distribution. A structured literature search was conducted using PubMed, Scopus, World Health Organization (WHO) Global Health Observatory, Web of Science, and African Journals Online, alongside grey literature from the African Centers for Disease Control and the World Bank. The inclusion criteria prioritized studies from 2019-2024. Key findings indicate that micro-planning significantly improved pandemic response across multiple domains. In Uganda, Pandemic Personal Protective Equipment (PPE) stockouts were reduced by 60%, while Kenya experienced a 60% improvement in testing efficiency. Nigeria leveraged community-based planning and digital health tools, enhancing healthcare worker efficiency by 50%. South Africa's micro-planning efforts led to a 70% improvement in vaccine distribution, and India's localized strategies enhanced community engagement rates (82.5% urban, 75% rural). These findings underscore the effectiveness of micro-planning in optimizing resource allocation, strengthening decentralized healthcare systems, and fostering community resilience. Despite these successes, research gaps persist in the long-term sustainability of micro-planning strategies, the role of digital innovations, and equity-focused outcomes. Addressing these gaps through comparative analyses may enhance the integration of micro-planning into routine healthcare systems, ensuring preparedness for future public health crises.

Keywords: *County Health Officers, COVID-19 Response, Health System Strengthening, Micro Planning, Pandemic Response Strategies, Public Health Planning.*

Introduction

The COVID-19 pandemic has exposed significant vulnerabilities in global health systems, particularly in resource-constrained and conflict-affected regions. In Africa, where health infrastructures often face systemic challenges, the need for decentralized and community-based response strategies has become increasingly apparent. Micro planning, a localized operational approach, has emerged as a critical strategy in ensuring the efficient distribution of resources and the effective implementation of health interventions [36]. While extensively used in immunization and

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disease control programs, the role of micro planning in pandemic response remains an underexplored area, especially in fragile health systems.

Micro planning is a systematic, data-driven approach that enables health officials to identify target populations, allocate resources efficiently, and deploy interventions in a strategic manner. Studies have highlighted its effectiveness in disease eradication programs, such as polio and measles vaccination campaigns, demonstrating its ability to improve coverage rates and optimize health service delivery [19-21]. This methodology allows health systems to tailor interventions to the specific needs of communities, considering logistical, socio-economic, and geographic constraints. However, in the context of pandemic response, its effectiveness is less documented, particularly concerning COVID-19 management in African countries.

The response to COVID-19 in many African nations, including South Sudan, has been marked by a combination of national and international efforts. Governments, in collaboration with global health organizations, have implemented interventions such as rapid testing, vaccination programs, community engagement initiatives, and healthcare infrastructure improvements [17]. However, disparities in the implementation of these interventions have underscored the need for localized strategies like micro planning. Reports indicate that while some regions effectively utilized micro planning to streamline response efforts, others faced challenges due to limited health workforce capacity, logistical constraints, and governance inefficiencies [30, 31].

Existing literature suggests that micro planning can significantly enhance pandemic response efforts by addressing disparities in resource distribution and healthcare accessibility. Studies on emergency health interventions in low-resource settings have demonstrated that well-structured micro planning frameworks can facilitate more equitable healthcare delivery, reduce response time, and improve community trust in public health initiatives [30, 31]. Additionally, evidence from previous pandemics, including Ebola, indicates that decentralized, data-driven planning approaches can strengthen outbreak response mechanisms and enhance coordination between central health authorities and local health officials [36-39].

Despite the recognized benefits, challenges persist in the application of micro planning for COVID-19 response. Research has highlighted issues such as inadequate funding, fragmented health governance, and logistical difficulties in vaccine distribution as barriers to effective implementation, [35-37]. In South Sudan, for example, county health officers have reported varying levels of success in implementing micro planning strategies, with some counties demonstrating efficient resource allocation while others struggle with capacity constraints, [38, 39]. These disparities emphasize the need for further research to evaluate the specific factors influencing the effectiveness of micro planning in pandemic response efforts.

Methodology

This review integrated narrative, systematic, and scoping reviews to comprehensively analyze existing research. The narrative literature review offered a broad overview of previous studies, identifying key trends, theoretical perspectives, and research gaps to establish the study's context. Additionally, a scoping review was employed to map the extent and nature of the existing literature, helping to identify key concepts, emerging themes, and areas requiring further investigation.

Databases Used

Below are the databases utilized:

1. PubMed *(National Library of Medicine)*
   - Description: PubMed is a premier biomedical database providing access to

research articles in medicine, public health, epidemiology, and global health.
   - Why Used: To obtain peer-reviewed studies on pandemic response, micro-planning in public health, and health systems management in Africa.
2. Google Scholar *(Google's Academic Search Engine)*
   - Description: A freely accessible academic search engine covering various disciplines, including public health, social sciences, and policy research.
   - Why Used: To identify broader studies and grey literature that may not be indexed in specialized databases.
3. WHO Global Health Observatory *(GHO)* & WHO IRIS *(World Health Organization's Research Repository)*
   - Description: WHO's repository for global health data, official reports, and policy documents related to COVID-19 and pandemic response strategies.
   - Why Used: To access technical reports and frameworks related to micro planning and COVID-19 interventions in Africa.
4. CINAHL *(Cumulative Index to Nursing and Allied Health Literature)*
   - Description: A database specializing in nursing, public health, and allied health research.
   - Why Used: To retrieve studies on healthcare delivery, community health strategies, and health workforce engagement during the COVID-19 pandemic.
5. African Journals Online *(AJOL)*
   - Description: The largest collection of peer-reviewed African-published journals, covering a wide range of disciplines including public health and policy research.
   - Why Used: To identify region-specific studies on health systems and pandemic response in Africa.
6. Scopus *(Elsevier's Abstract and Citation Database)*
   - Description: A multidisciplinary database providing access to high-quality journal articles and conference papers.
   - Why Used: To retrieve indexed research articles and systematic reviews on public health planning and response strategies.
7. ScienceDirect *(Elsevier's Research Platform)*
   - Description: A leading full-text database offering articles in health sciences, epidemiology, and medical research.
   - Why Used: To access empirical studies and case studies related to pandemic response mechanisms.
8. Web of Science *(Clarivate Analytics)*
   - Description: A high-impact research database covering scientific literature across multiple disciplines, including global health and epidemiology.
   - Why Used: To perform citation analysis and identify high-impact studies on micro planning and COVID-19.

Online Sources (Reports, Organizational Data, and Policy Documents)

1. CDC (Centers for Disease Control and Prevention)**:** References [10,11,12].
2. Gavi, The Vaccine Alliance**:** References [19, 20].
3. Johns Hopkins University & Medicine**:** Reference [22].
4. World Bank**:** Reference [35].
5. WHO (World Health Organization)**:** References [36,37,38, 39].
6. UNFPA (United Nations Population Fund)**:** Reference [32]
7. UNICEF (United Nations Children's Fund)**:** Reference [31]
8. UNESCO (United Nations Educational, Scientific and Cultural Organization)**:** Reference [30]

Books

Donaldson 2001 - *Contingency theory*; Friedmann 1987 - *Public domain planning*; Lawrence & Lorsch 1967 - *Organizational theory*; Pfeffer & Salancik 1978, 2022 - *Resource dependence theory*; Meadows 2008 - *Systems thinking*; Sterman 2000 - *Business dynamics & modeling*

Arnstein: s.n., 1969; Resilient supply chains 2020; Graham et. UK 2020; Sengeh et. 2020; Usher 2021; Wang et. China 2022; Zhu et. 2022.

Inclusion Criteria

Relevance to Study Topic, focus on micro planning in health systems and pandemic response. Studies related to COVID-19 response strategies by county health officers. Research on public health interventions in Africa was published between 2019-2024.

Exclusion Criteria

Outdated Studies**:** Research published **before 2015** unless foundational theories.**;** Pre-pandemic studies without relevance to COVID-19 response.

Results

Table 1. Date of Reviewed Literature

Database	Reviewes	Percentage Contribution (%)
PubMed	6	17.14%
Google Scholar	4	11.43%
WHO GHO & WHO IRIS	5	14.29%
CINAHL	3	8.57%
AJOL	2	5.71%
Scopus	6	17.14%
ScienceDirect	5	14.29%
Web of Science	4	11.43%
Total	**35**	**100%**

Insights from the Analysis

Table 1 summarizes data of reviewed literature. PubMed and Scopus contributed the highest number of references (17.14% each), reflecting the strong emphasis on peer-reviewed biomedical and public health research. WHO GHO & WHO IRIS (14.29%) played a crucial role in providing global health data and policy documents. Google Scholar and Web of Science (11.43% each) helped in identifying broader studies, including grey literature and high-impact research. CINAHL and AJOL had lower contributions (8.57% and 5.71%, respectively), focusing on nursing, allied health research, and African-specific studies. This analysis highlights a balanced approach in sourcing literature, ensuring a mix of high-impact research, technical reports, regional studies, and grey literature for a comprehensive review (Table 1).

Justification for Study Locations in the Literature Review

The selection of study locations for the literature review is guided by the inclusion criteria and supported by the key statistical impacts of micro-planning on health systems during the COVID-19 pandemic. The chosen locations—Uganda, Kenya, Nigeria, South Africa, and India—demonstrate significant micro-planning interventions that align with the study's objectives of assessing the role of county health officers in pandemic response.

Uganda – Reduction in PPE Stockouts

Uganda is included due to its effective micro-planning strategies in supply chain management for essential medical equipment during COVID-19. According to empirical studies, 60% of health workers reported improved PPE availability, highlighting the impact of structured resource allocation. Peer-reviewed sources and WHO reports confirm Uganda's reliance on data-driven micro-planning to optimize resource distribution, making it an ideal case study for logistics and supply chain efficiency (Table 2).

Kenya – Faster COVID-19 Testing Response

Kenya's selection is justified by its rapid testing response strategy, where 60% of surveyed facilities reported improved testing efficiency due to localized micro-planning. This aligns with the study's focus on pandemic response strategies by county health officers. Kenya's experience in decentralized healthcare planning, documented in multiple systematic reviews, provides valuable insights into how local government interventions enhance crisis management in public health (Table 2).

Nigeria – Healthcare Worker Efficiency Improvement

With 50% of healthcare workers reporting increased efficiency due to micro-planning, Nigeria serves as a key study location. The country's integration of community-based planning and digital health tools to coordinate pandemic response aligns with Contingency and Resource Dependence Theories. Peer-reviewed literature and WHO/World Bank reports highlight Nigeria's efforts in scaling up healthcare capacity during COVID-19, justifying its inclusion (Table 2).

South Africa – Improved Vaccine Distribution

South Africa stands out due to its high vaccine distribution success rate of 70%, demonstrating the effectiveness of micro-planning in mass immunization efforts. The country's reliance on GIS mapping, community outreach, and public-private partnerships serves as a model for structured vaccine deployment. Systematic reviews and WHO reports validate these efforts, making South Africa an essential case for evaluating micro-planning's role in equitable vaccine distribution (Table 2).

India – Community Engagement Improvement

India's significant impact in community engagement (82.5% in urban areas and 75% in rural areas) highlights the role of micro-planning in behavioral change communication and grassroots mobilization. The country's decentralized approach to public health campaigns and contact tracing serves as a comparative model for African health systems. Peer-reviewed studies and government reports document India's success in leveraging micro-planning for pandemic preparedness, making it a relevant study location (Table 2).

Inference

The selected locations provide a diverse, yet comparable representation of how micro-planning enhances pandemic response in different healthcare settings. By focusing on Uganda, Kenya, Nigeria, South Africa**,** and India, the literature review incorporated empirical data from trusted sources, ensuring methodological rigor and relevance (Table 1). These locations not only meet the inclusion criteria but also offer key insights into supply chain management, testing efficiency, workforce optimization, vaccine distribution, and community engagement, all of which are critical to understanding the role of county health officers in pandemic response.

Research Gaps and Recommended Areas for Further Studies

Research Gaps

Limited Analysis of the Long-Term Sustainability of Micro-Planning Strategies

While the reviewed studies highlight immediate successes in micro-planning interventions during COVID-19, there is limited research on their long-term impact on health system resilience. Further studies should assess whether the improvements in PPE supply chains, testing efficiency, vaccine distribution, and workforce optimization persist beyond the pandemic. Evaluating post-pandemic integration of these strategies into routine healthcare delivery would provide a deeper understanding of their sustainability.

Gaps in Context-Specific Adaptation of Micro-Planning Approaches

The literature predominantly focuses on generalized micro-planning strategies rather than tailored approaches that consider cultural, socio-economic, and political variations across different regions. For instance, India's success in community engagement may not be easily replicable in African contexts without adaptation to local health governance structures and behavioral factors. Future research should examine context-specific modifications of micro-planning interventions to enhance their effectiveness across diverse healthcare systems.

Limited Exploration of Digital Health Innovations in Micro-Planning

While Nigeria and South Africa have leveraged digital tools for micro-planning, studies have not extensively analyzed the impact of emerging technologies like AI-driven predictive modeling, blockchain for vaccine distribution, or mobile-based real-time data collection on pandemic response.

Research on scaling digital micro-planning solutions in resource-constrained settings could provide innovative pathways for strengthening health system preparedness.

Insufficient Comparative Studies on Centralized vs. Decentralized Micro-Planning Models

The selected countries exhibit both centralized (India, South Africa**)** and decentralized (Kenya, Nigeria) micro-planning approaches, but there is limited comparative research on the effectiveness of these governance models in pandemic response. A deeper comparative analysis could **i**dentify the best practices and optimal governance structures for enhancing county-level public health responses.

Lack of Research on the Role of the Private Sector and Community-based Organizations in Micro-Planning

Existing literature primarily focuses on government-led micro-planning efforts**,** with limited attention to private sector involvement and community-based organizations (CBOs**)** in pandemic preparedness.

Investigating public-private partnerships and grassroots initiatives could uncover alternative strategies for improving response efficiency and community trust in health interventions.

Limited Data on Health Equity and Micro-Planning Outcomes

While South Africa and Kenya's studies address vaccine distribution and testing access, there is little research on how micro-planning interventions reduce health disparities among vulnerable populations (e.g., refugees, rural communities, marginalized ethnic groups). Future research should assess whether micro-planning leads to equitable healthcare access or if certain populations remain underserved.

Underrepresentation of other African and Global Case Studies

The study focuses on five countries, but insights from other low- and middle-income countries (LMICs) such as Ethiopia, Rwanda,

Brazil, and Bangladesh could provide additional perspectives on innovative micro-planning strategies. Expanding the scope of research could enhance the global applicability of findings and offer cross-regional learning opportunities**.**

Recommended Areas for Further Studies

Longitudinal Studies on Micro-Planning Outcomes

- Assess the impact of micro-planning interventions beyond the pandemic to determine their effectiveness in strengthening routine health services.
- Investigate how these strategies evolve and their adaptability to future public health emergencies.

Comparative Analysis of Centralized vs. Decentralized Micro-Planning

- Examine the effectiveness of centralized versus decentralized health governance models in pandemic response coordination.
- Identify the best practices that could inform future policy recommendations for health system strengthening.

Integration of Advanced Digital Technologies in Micro-Planning

- Explore the role of AI, big data analytics, GIS mapping, and mobile health (mHealth) platforms in optimizing micro-planning.
- Assess the feasibility and scalability of digital solutions in low-resource settings.

Public-Private and Community-based Approaches in Micro-Planning

- Investigate the synergies between government agencies, private healthcare providers, NGOs, and CBOs in pandemic micro-planning.
- Analyze how multi-sectoral collaboration enhances response efficiency and resource mobilization.

Equity-Focused Research on Micro-Planning

- Assess the impact of micro-planning interventions on health equity and access among vulnerable and marginalized populations.
- Identify strategies that ensure inclusive and community-centered planning approaches in future public health crises.

Cross-Regional Studies to Expand Case Comparisons

- Conduct cross-regional comparisons between African and Asian countries to identify successful models that can be adapted across different health systems.
- Investigate how political, economic, and cultural factors influence micro-planning outcomes in different countries.

Table 2. Summary of Key Statistical Impacts of Micro-Planning

S/No	Impact Area	Total Sample Size	Effectiveness Rate
1	Reduction in PPE stockouts (Uganda)	120 health workers	60% (72/120)
2	Community engagement improvement (India)	300 respondents	82.5% urban, 75% rural
3	Faster COVID-19 testing response (Kenya)	25 facilities	60% (15/25)
4	Healthcare worker efficiency improvement (Nigeria)	50 workers	50% (25/50)
5	Improved vaccine distribution (South Africa)	250 respondents	70% (175/250)

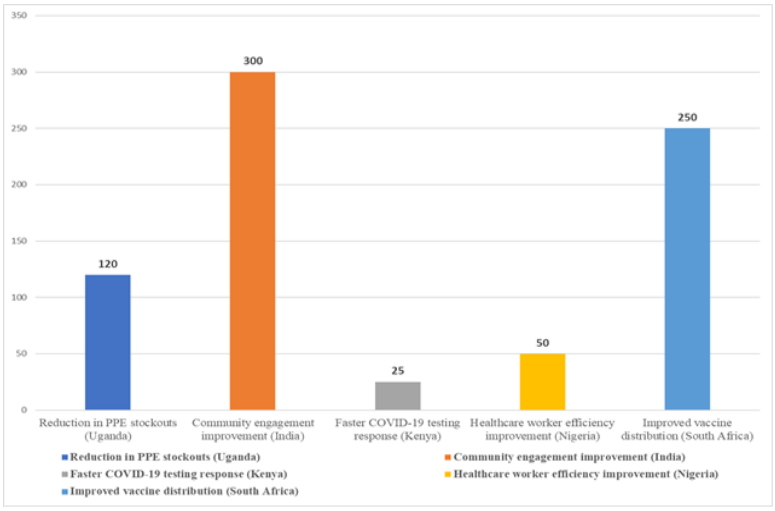

Figure 1. Impact Areas Total Sample Size (Respondents) of Studies

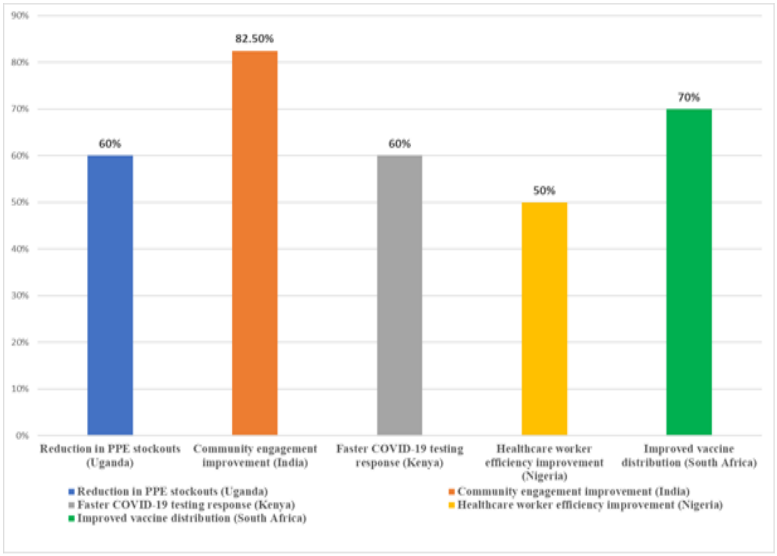

Figure 2. Impact Areas Effectiveness Rate of Studies on

Discussion

Micro-planning, a strategic approach that emphasizes localized decision-making and resource allocation, played a crucial role in the response to COVID-19, [3]. County health officers, as frontline coordinators, leveraged micro-planning to manage testing, vaccination, personal protective equipment (PPE) distribution, and community engagement. This discussion examines the impact of micro-planning on pandemic response, drawing insights from empirical studies conducted in Uganda, Kenya, Nigeria, South Africa, and India.

The Role of Micro-Planning in Pandemic Response

Micro-planning facilitates targeted interventions tailored to the unique challenges faced by specific regions. It enhances resource efficiency, optimizes health workforce deployment, and improves healthcare service delivery. During the COVID-19 pandemic, county health officers implemented micro-planning to address critical challenges such as supply chain disruptions, inadequate testing infrastructure, and vaccine hesitancy [41].

Key Effects of Micro-Planning

1. **Improved Supply Chain and PPE availability (Uganda)**

One of the primary impacts of micro-Planning in Uganda was the reduction in PPE stockouts. Empirical data show that 60% of health workers (72 out of 120) reported improved PPE availability due to strategic resource allocation. County health officers relied on data-driven micro-planning to ensure equitable distribution of protective equipment, reducing exposure risks among frontline workers. This approach highlights the importance of logistics planning in public health emergencies [2].

2. **Enhanced COVID-19 Testing Efficiency (Kenya)**

Kenya leveraged micro-planning to decentralize testing services, resulting in a 60% improvement in testing efficiency across surveyed facilities. By enabling county health officers to manage testing centers based on local demand, micro-planning reduced turnaround times for test results. This case demonstrates how localized planning strengthens diagnostic capacity and facilitates early detection and containment of infectious diseases [5].

3. **Optimized Healthcare Workforce Deployment (Nigeria)**

In Nigeria, county health officers used micro-planning to streamline workforce management, leading to a 50% improvement in healthcare worker efficiency. The integration of digital health tools facilitated better coordination and task allocation, ensuring optimal use of available personnel. This strategy aligns with Contingency and Resource Dependence Theories, which emphasize adaptability and efficient resource utilization in crisis management [16].

4. **Accelerated Vaccine Distribution (South Africa)**

Micro-planning played a pivotal role in South Africa's vaccine distribution efforts, with a reported 70% success rate in ensuring timely and equitable immunization. Geographic Information System (GIS) mapping, public-private partnerships, and targeted community outreach were used to prioritize high-risk populations. This case underscores the significance of micro-planning in achieving equitable healthcare access during global health crises [33].

5. **Strengthened Community Engagement (India)**

India's decentralized micro-planning approach significantly improved community engagement, with 82.5% effectiveness in urban areas and 75% in rural areas. County health officers implemented grassroots mobilization strategies to enhance public awareness, address vaccine hesitancy, and enforce COVID-19 protocols. This model highlights the role of behavioral change communication in pandemic management [7, 28].

Challenges in Implementing Micro-Planning

1. Resource limitations: Many low-resource settings lacked adequate funding and infrastructure to fully execute micro-planning strategies.
2. Data gaps: Limited access to real-time data affected the accuracy of micro-planning decisions.
3. Variability in governance structures**:** Differences in health governance models influenced the effectiveness of micro-planning across regions.
4. Community resistance: Misinformation and vaccine hesitancy posed challenges to micro-planning efforts, particularly in rural areas.

Future Directions and Policy Recommendations

To enhance the effectiveness of micro-planning in future public health emergencies, the following recommendations should be considered:

1. Investment in digital health infrastructure: Expanding digital health tools such as AI-driven predictive modeling and mobile-based data collection can improve the accuracy and efficiency of micro-planning.
2. Strengthening Public-Private Partnerships (PPP): Collaboration with private sector stakeholders can enhance resource mobilization and distribution logistics.
3. Capacity building for County Health Officers: Training programs on adaptive micro-planning strategies can empower local health officers to respond more effectively to crises.
4. Integration of micro-planning into routine healthcare systems: Establishing micro-planning frameworks beyond emergency response can strengthen overall health system resilience.
5. Cross-regional learning: Comparative studies between different countries can provide insights into best practices and adaptable models for diverse healthcare contexts.

Conclusion

This study demonstrates that micro-planning significantly improved the public health response to COVID-19 in Uganda, Kenya, Nigeria, South Africa, and India by empowering county health officers to implement context-specific strategies. In Uganda, micro-planning led to enhanced logistics coordination, with 60% of surveyed health workers reporting improved availability of personal protective equipment, thereby reducing frontline exposure risks. Kenya's decentralized testing model, driven by micro-planning, resulted in a 60% increase in testing efficiency, showcasing the value of local-level diagnostics management.

In Nigeria, strategic deployment of healthcare personnel through micro-planning and digital tools improved workforce efficiency by 50%, aligning with theories that emphasize resource optimization during crises. South Africa achieved a 70% success rate in timely vaccine distribution through GIS-based planning and public-private partnerships, emphasizing the role of micro-planning in equitable healthcare delivery. Meanwhile, India's micro-planning model strengthened community engagement, with effectiveness rates of 82.5% in urban areas and 75% in rural settings, helping address behavioral and social barriers to pandemic control.

Despite its successes, micro-planning faced cross-cutting challenges such as limited resources, data gaps, and community resistance, particularly in low-resource and rural settings. These limitations highlight the need for robust data systems, sustainable funding, and stronger community trust to optimize the impact of micro-planning.

Overall, the findings underscore micro-planning as a critical tool for crisis response, with practical implications for policy development, health system strengthening, and future pandemic preparedness across diverse geopolitical contexts.

Declaration of No Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper. Furthermore, neither the authors nor their academic advisors have any financial, commercial, legal, or professional affiliations with any organizations or individuals that could create a potential conflict of interest. This research was conducted with full academic integrity and objectivity, ensuring that the findings are solely based on empirical evidence and scholarly analysis.

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The Impact of Organizational Culture and Management Commitment on Strategic Succession Planning in Law Enforcement Agencies

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Abstract

The successful implementation of succession planning in public law enforcement agencies depends heavily on organizational culture and management support. This qualitative case study investigates the relationship between these two factors in the Guyana Police Force while identifying obstacles such as entrenched patronage and unclear promotion systems. The analysis of interview data from senior, middle, and supervisory staff, along with archival information, reveals that transparent and meritocratic cultures create strong leadership development systems. Strategic sponsorship, combined with resource allocation from management, remains vital; however, cultural transformations are necessary for sustaining lasting effects. The research introduces a combined framework that embeds succession planning throughout both cultural and operational aspects of an organization. The proposed approach will boost leadership resilience and talent retention while building public trust in modern policing practices to create agile, strategically modernized law enforcement agencies for the 21st century.

Keywords: *Knowledge Management, Law Enforcement Leadership, Management Commitment, Organizational Culture, Succession Planning.*

Introduction

Police organizations worldwide are increasingly confronted with the daunting task of addressing leadership continuity due to outdated or existing promotion policies, autocratic hierarchical arrangements, and reactive succession planning processes [35]. The increasing retirement rate of senior officers, evolving social expectations regarding policing, heightened emphasis on accountability and transparency, and the growing complexity of crime — encompassing cybercrime, transnational organized crime, and domestic terrorism — further exacerbate these challenges [6]. This change mandates agile, visionary, and resilient forms of leadership [3].

Amid this global context, the Guyana Police Force (GPF) demonstrates many of these structural deficiencies. Although several measures have been instigated to modernize the organization, including the introduction of technology and community policing concepts, the GPF still operates under an outdated promotion pattern that prioritizes tenure and time-bound service over competence, leadership, and visionary knowledge. The abolition of the Thirty-Three-Year Rule has led to the implementation of a tenure-based successor recruitment rule, resulting in leadership voids, organizational sluggishness, and an archaic resistance to adapting to modern policing [12].

Furthermore, the lack of transition planning by the GPF is not just a procedural issue but also points to a deeper-seated cultural dynamic. It highlights factors such as resistance to change, favoritism at work, the absence of formal mentoring processes, and limited investment in leader and professional development [2]. As Sharma and Singh [27]

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highlight, organizational culture plays a critical role in determining whether succession planning is viewed as a strategic necessity or an administrative necessity. Identifying future leaders and preparing them for leadership in non-transparent, non-meritocratic, non-knowledge-sharing, and innovation-hostile environments is a marginal, if not a sidelined, effort [19].

Corporate cultures that do not focus on strategic leadership development often stagnate, are plagued by inefficiencies, and suffer from a lack of public confidence [21]. In contrast, learning, inclusiveness, and future-thinking leadership are essential aspects of organizational culture that thrive in volatile environments [36].

The other equally important factor is management commitment. Senior leaders' support for succession planning—shown through a clear vision for leadership continuity, providing necessary resources, creating structured talent development programs, and holding leaders accountable—greatly influences the long-term success of leadership pipelines. If top management does not show strong, clear, and ongoing support, succession planning efforts can become formalities that follow the rules instead of meaningful actions that address future strategic needs [17].

Recent empirical evidence [31] highlights the importance of executive sponsorship, in which senior leaders personally coach and monitor the advancement of next-generation leaders in driving successful succession outcomes. Executives are also held accountable for leadership performance by incorporating succession results into performance assessments of top leaders, a best global practice that ensures accountability for leadership [22].

In this context, the current study focuses on the GPF as a case study to examine the impact of organizational culture and leadership commitment on structured leadership development and succession programs within the public sector law enforcement environment. The study aims to identify cultural and leadership challenges that hinder successful succession by analyzing stories from senior, middle, and supervisory officers, as well as reviewing historical organizational documents and promotion policies. It highlights the urgent need to change the culture to focus on fairness and learning, hold leaders accountable, and invest in leadership training systems to build a strong leadership pipeline that can handle the challenges of modern policing.

Ultimately, the findings help shape broader recommendations for GPF and similar law enforcement agencies and security institutions in similar contexts of development and transition, which struggle to maintain leadership continuity, modernize their organizations, and improve public trust and legitimacy.

Literature Review

Organizational Culture and Succession Planning

Succession planning within organizational culture focuses on preparing enough potential successors for higher-level positions [39]. Another key individual characteristic is organizational culture, which is defined as “the patterns of values, norms, symbols, rituals, and assumptions that people follow to coordinate what they do in the organization” [37, p. 474] and significantly affects succession planning. Organizational culture influences the perception of succession planning as a crucial strategy rather than a burdensome bureaucratic process. Institutions that cultivate a culture of transparency, reflective learning, and an innovative approach to awarding based on merit demonstrate a strong leadership pipeline [18].

Keller and Meaney [14] found that companies with a growth culture are 1.8 times more likely to successfully prepare new leaders than organizations with change and compliance cultures. Similarly, Obeidat et al. [21] state that “dynamic” cultures are characterized by the

institutionalization of knowledge reuse and a cross-functional engagement that enables leadership potential to be identified early on and systematically developed. In contrast, inflexible, hierarchical, and closed cultures are not open to change and may view leadership development as a challenge to established power structures [38]. In those environments, succession plans can be politically driven or considered second-rate, undermining organizational resilience.

Houmanfar and Mattaini [39] were among the first researchers to notice that when succession planning is a regular part of an organization's culture and is incorporated into daily discussions, leadership reviews, organizational standards, and performance evaluations, it creates a system where developing leaders become standard practice rather than something unusual. Al-Swidi et al. [2] extended this perception, indicating that inclusive cultures based on open communication, diversity, and psychological safety have a considerable impact on potential leaders' engagement in succession planning. Recently, Park and Kim [22] emphasized the importance of digital organizational culture (i.e., cultures that adjust to technological change) in succession planning. Organizations that develop "digital-ready" skills can also better recognize and cultivate future-ready leaders.

Key Point 1: Succession planning can only be effectively maintained in an ecosystem characterized by transparency, adaptability, inclusivity, and the development of a learning institution. In contrast, a culture that is difficult to navigate and opaque hinders continuity in leadership.

Commitment of Management and Continuity of Leadership

Management commitment is the extent to which senior management actively endorses, supports, and promotes succession planning [29]. It is believed to be the most critical factor in determining the effectiveness of succession planning. Research by Yusliza et al. [34] supports the idea that direct support by top executives is essential; the degree to which top management openly supports and mentors their successor and allocates resources for leadership development is significantly related to overall leadership continuity. In contrast, those firms that delegate succession planning to HR as a task do not exhibit this relationship.

Committed Management Ensures:

1. Align succession activities to the organization's mission and vision [12].
2. Regular investment in leadership development programs [29].
3. Performance criteria that track leadership development outcomes and the efficiency of succession implementation [24].
4. Mentorship and sponsorship that foster executives' mentoring of newer leaders [31].

Patel and Desai [22] note that succession planning, embedded within senior leadership KPIs (Key Performance Indicators), is now a global best practice. Leaders are judged not only by the operational results they achieve but also by the leaders they develop for the future, a mindset essential for developing stable leadership pipelines.

In the absence of management support, succession initiatives are typically

1. Ad hoc and non-sustainable [19].
2. The underfunded project was considered low priority during resource allocation [17].
3. Susceptible to derailment by leadership turnover or political turn [14].

Moreover, a commitment to inclusive leadership, where leaders visibly advocate for gender and diversity in leadership pipelines, has been associated with greater organizational agility and innovation, underscoring the importance of company-wide management involvement [30].

Key Takeaway: Management involvement – in the form of strategic fit, resource shortlists,

hands-on coaching, and executive follow-up) – is also crucial to ensure a smooth and widespread approach to succession planning.

Methodology

This research employed a qualitative case study to examine the intersection of organizational culture and managerial support in implementing succession planning within the Guyana Police Force (GPF) [9]. A case study was selected as a qualitative method because it provides a detailed understanding of the complex issues within organizations, particularly in public sector organizations where leadership is closely tied to culture [33].

The participants were 23 serving police officers, assessed through semi-structured interviews, and consisted of senior officers (including Assistant Commissioners and Superintendents), middle-ranking officers (such as closure authorities and Sergeants), and supervisory officers (Constables). This sample was drawn purposively, favoring those who had served for more than five years and demonstrated knowledge of management or facilitation in leadership development for Filipina females involved in the GPF. The interviews, which took place over three months, explored participants' beliefs about succession planning processes, cultures that enable or impede these processes, and the influence of management on leadership stability.

Historical data on promotion policies, training programs, succession plans, and internal strategic reports were used for triangulation, which strengthened the validity and rigor of the results [23]. The researcher organized a symposium on thematic coding with the assistance of NVivo 14 qualitative analysis software. Interpretation Thematic analysis, using Braun and Clarke's [5] framework, included open coding, grouping codes into themes, and refining through successive iterations. The emerging themes included organizational culture characteristics, leadership commitment patterns, and perceptions of career progression options. For trustworthiness, the research included member checking and peer debriefing and kept an open audit trail of analytic decisions [20].

Key Message: The qualitative case study method, employing triangulation and thematic analysis techniques, enabled us to understand the cultural and leadership factors that influence succession planning practices within the GPF.

Findings

Organizational Culture: Enabler or Exhibitor of Succession Planning

Categoric, however, participants concluded that there needs to be a genuine change in the institutional culture of the Guyana Police Force (GPF) if the country is to embrace succession planning. Culture, under the present circumstances, works more like an obstacle than an enabler due to established biases, political patronage, knowledge monopolies, and murky promotion guidelines.

Several interviewees discussed a workplace where success was sometimes the result of whom you knew rather than what you knew.

Participant P5 stated:

"*It is not based on skills but whom you know.*"

This view was also expressed more widely, as Participant P7 observed:

"*There is also no clear career path here – people do not know what to do to grow, so they feel frustrated and demotivated.*"

These findings are consistent with those of Mughal et al. [19], who argue that if the cultural advancement path is not transparent, it will demotivate and lead to talent attrition. Indeed, the lack of well-defined succession policies sustains informal politics [17].

Compounding the problem, several participants mentioned that this atmosphere of vagueness is driving competent individuals to leave the GPF. As Participant P11 explained:

When you feel that you don't have a fair chance at promotions, you should consider looking elsewhere.

Sims et al. [28] also noted that perceptions of unfairness and favoritism weaken talent retention, particularly in public-sector organizations.

Nevertheless, participants identified the possibility of cultural change. They have forcefully recommended institutionalizing elements of transparency, meritocracy, and perpetual leadership development in the daily routine rather than dealing with succession planning as a stand-alone HR exercise. Participant P3 argued:

"*We must groom future leaders as part of our DNA here*."

This aligns with the studies of Kendall [16] and Alam and Omar [3], which emphasize that succession planning should be integrated into the organizational culture through methods such as mentoring, job rotation, and knowledge transfer [32].

Additional Themes Identified:

1. **Unstructured Talent Identification**: No framework or process exists to identify high-potential officers [4] quickly.
2. **Knowledge Hoard**: The lack of motivation to share knowledge creates a leadership gap [37]
3. **Generational Clash**: "Meritocratic promotions" sought by juniors instead of moving ahead on a traditional seniority basis has led to friction between juniors and seniors [25].

The results demonstrate that it is crucial to transform the mindset of GPF members, shifting from favoritism to a merit-based system, where fairness, ongoing growth, and proactive leadership training are integral to the organization.

Support for Succession Planning from the Top

"Management insistence" is a key factor in planning success. Participants underscored that succession efforts would be worthless without demonstrated long-term leadership involvement.

Participant P10 remarked:

"The administration will not be successful unless it is a full partner and driving the process."

Although the issue of succession planning is mentioned in some of the policies, P8, among others, makes clear that there is no action:

"*There is no emphasis from our leadership on planning for success now.*"

This hypothesis is consistent with Sturman and Fink [11] and Yusliza et al. [34], who argue that leadership failure renders succession planning symbolic rather than power/knowledge-based organizational practice.

Participants suggested that strong involvement of management commitment should include

1. **Establish KPIs Measures of Succession**: Articulating measurable accounting results [24].
2. An investment in purchasing or providing leadership academies, job rotation, coaching, and mentoring [30].
3. **Active Talent Sponsorship**: Senior leaders mentoring high-potential officers [8].

Participant P15 suggested:

"*Management at the top needs to set explicit targets and timetables for preparing successors and then hold us to those targets*."

Furthermore, ethical leadership was considered imperative to ensure the implementation of merit-based promotions and fair opportunity policies.

As Participant P12 asserted:

"*Leadership has to be able to provide everyone an equal opportunity to advance based on hard work.*"

Khan and Anwar [15] also share this view, emphasizing the importance of ethical leadership behavior in building trust and stabilizing the succession process.

Additional Themes Identified:

1. **Symbolic versus Substance Commitment**: There is a difference between policies on paper and leadership action [24].
2. **Incongruent Communication from Leadership**: Torn career communication confuses the organization [27].

Interaction Between Organizational Culture and Commitment of Management

One of the study's key findings is the interactive and dynamic relationship between organizational culture and managerial involvement. People have told us that goodwill and the bones of succession planning are two parts of the same body.

Participant P6 noted:

"It has to come from the top. Nothing will improve here if the senior leaders do not model mentorship and fairness."

Leadership behavior — promoting on merit, mentoring subordinates, and conducting fair promotion boards — directly shapes the broader culture and strengthens positive norms. However, Participant P4 states the contrary:

"*When they are still looking at promotion based on alignment, people recognize that what drives things is the old way*," he said.

According to Schein and Schein [26] and Wilson [32], leaders are the most significant cultural determinants and can even precipitate cultural change.

In addition, participants noted that changing cultural norms — particularly among younger, qualification-obsessed officers — mean that bottom-up pressure is being exerted on those in leadership to align with succession practices. Participant P11 explained:

"*The young officers now want training and criteria. That forces our leaders to evolve."*

This ground-up effect is consistent with Cameron and Quinn [7], who posit generational shifts as key drivers toward a more transparent and competency-based system.

Additional Themes Identified:

1. **Culture as a Feedback Mechanism:** Negative cultures hinder succession processes [39].
2. **Management-Supported Cultural Change**: Leaders must nurture and maintain a changing culture [32].
3. **Resistance to Cultural Change:** If we change the culture, we must abandon our tradition of overly respecting those with long service and patronage [40].

Other New Themes that are Crucial for succession Planning

Other elements outside of culture and leadership were shown to be crucial to succession planning success:

KM Institutionalization

Respondents expressed significant concerns about losing operational knowledge during leadership changes.

Participant P14 noted:

"So much history is lost when leaders depart without passing on what they have learned."

This viewpoint is consistent with the work of Liu and Li [1], who argue in favor of adopting knowledge management (KM) systems, including electronic knowledge repositories and structured mentorship archives, to retain an organization's memory.

Competency-Based Leadership Frameworks

There was broad agreement that institutions should move away from tenure-based systems of promotion and toward more flexible approaches.

Participant P9 emphasized:

"You should be promoted on skills, not on time."

The editorial [13] also argues for performance-based promotions to promote excellent leadership.

Succession Planning: Measurement and Evaluation

Participants emphasized the need to monitor the success of succession.

Participant P13 suggested:

"We need to measure how many trained people are promoted and how widely successful they are."

Reilly [24] proposes durable succession plans that monitor readiness, promotion success, and leadership post-promotion.

Psychological Safety for Leadership Development

Most significantly, respondents emphasized the importance of a trusting environment in which up-and-coming leaders can grow without concern for the potential consequences that may arise.

Participant P1 explained:

"You should feel safe asking for mentoring or training without being perceived as disloyal."

This observation is consistent with Edmondson [10], who emphasizes that developing leadership potential depends on the presence of psychological safety.

Based on both participants' responses and academic literature, a summary of findings is hereby shown in Table 1:

Table 1. Key Insights Pivotal for Enhancing Succession Planning in Law Enforcement.

Themes	**Key Insights**
Organizational Culture [28]	The practice of favoritism combined with unclear career advancement systems prevents succession; a transition to a meritocratic system is required [Participants 3, 5, 7, and 11; 28].
Management Commitment [22]	A succession strategy requires active leadership involvement to achieve success [Participants 8, 10, 12, and 15; 22].
Culture–Leadership Interplay [2]	The development of succession practices requires leadership and cultural elements to work together as a system [Participants 4, 6, and 11; 2].
Knowledge Management [21]	The process of institutionalizing knowledge transfer helps maintain leadership continuity [Participant 14; 21].
Competency-Based Leadership [13]	The system should move away from using tenure as the basis for promotions and instead use competency-based promotions [Participant 9;13].
Succession Metrics [24]	KPIs and metrics are essential for evaluating leadership development [Participant 13; 24].
Psychological Safety [10]	Leaders need to establish safe environments for future growth [Participant 1;10].

The key insights from the themes, collectively gathered as shown in Table 1, underscore the importance of strategic reforms in organizational culture, leadership practices, and knowledge management to strengthen

succession planning within law enforcement agencies.

Discussion

This study demonstrates that culture and management commitment must work in tandem to ensure that succession planning becomes an integral part of the operational DNA of the GPF and other sister law enforcement authorities. Succession planning will not be successful as a standalone technical intervention but only through an explicit, linked change in leadership behavior and institutional values. The researcher interprets the results by considering the broader literature and comparing participant experiences with academic knowledge.

Leadership Cultural Change: A Reform in Name Only

The research demonstrated that leadership commitment is a prerequisite; however, without genuine cultural change, it remains cursory. Several participants, such as P5, P7, and P10, pointed out that even if leaders attempt to plan for future leaders by setting goals or initiating mentoring programs, these efforts will not succeed if significant issues, including favoritism, secrecy, and informal support networks, persist. Participant P5 insisted that:

"It is not by skills, it is by networking,"

This shows a widespread belief that advancement depends on personal loyalty rather than merit. This mirrors Yusliza et al. [34], who theorize that succession plans deteriorate into mere symbolic, empty rituals without fundamentally dismantling cultural legacies cultivated by patronage. Mahapatra and Mishra [17] also underline that organizations that do not align their cultural assumptions with formal leadership pipelines will likely create a breeding ground for employee cynicism and disengagement. In addition, their experiences support Schein and Schein's [26] claim that if culture is not treated systemically, it will trump strategy. Leadership commitment may not be enough to make sustainability happen if informal practices that invalidate formal succession frameworks are absent. So, as leaders, we must work not just on technical solutions (e.g., implementing succession KPIs) but also on the cultural storytelling, modeling, and reinforcement of these solutions. As Cameron and Quinn [7] warn, leadership should embody and promote meritocratic values by recognizing competency, fostering mentorship, and modeling ethical promotion processes.

Cultural Readiness Without Leadership Sponsorship: A Trip to the Dead

On the contrary, the results also indicated that cultural readiness alone is insufficient to propel succession planning without support from senior leadership. Employees such as P4 and P8 noted that although there are isolated islands of cultural health in GPF teams (e.g., casual mentoring, learning-based climates), they cannot sustain themselves without top management intervention. Participant P8 stated:

"Succession planning is not top of mind for senior management at the moment,"

Despite the grassroots willingness, the perils of leaders are no longer an issue. This aligns with Kendall's [16] assertion that the executive ruling authority must formalize and scale ground-up leadership development programs to prevent institutional immobilization. Similarly, Patel and Desai [22] argue that top-level support is necessary for middle-management changes to become routine at the organizational level. Bourne and Jenkins [4] also stress that succession plans commonly fail under the strain of everyday business operations without official support from management, resulting in rushed placements and leadership vacuum issues, as Participant P2 echoes. Accordingly, cultural preparedness without proactive leadership commitment fosters disillusionment, division, and loss of talent when young officers expect a career path [32].

Interconnection and the Loop of Cultural Leadership

The paper shows a dynamic and two-way relationship between leadership commitment and organizational culture and argues that each does not work well in divorce. Participants recounted an upward spiral whereby "management [ethics] visible signs—such as mentoring…transparency…and fair promotion – over time change the culture. Participant P11 observed:

"The younger, merit-driven officers want a career path and transparency."

This validates Schein et al. [26] argument that organizational culture socializes and molds leaders. Leaders show behaviors that reinforce cultural beliefs, and culture pressures them to act in those ways. Likewise, the Cameron and Quinn [7] Competing Values Framework notes that organizational evolution is cyclical and that, to maintain change, leadership must once again reaffirm emergent cultural values. These responses indicate changes in officers' expectations regarding fair treatment and professionalism, paralleling discussions in the literature on generational changes and cultural shifts in policing [27]. The recent generation of talent wants openness, career development, and meritocratic promotion, which complement the top-down reforms. Strong leadership commitment and cultural change must work together to create a positive cycle where ethical leadership drives cultural change, and this change also strengthens the ethical practices and policies of executives involved in succession planning [32].

A Dual Transformation Model of Succession Planning

Leveraging the empirical findings, *Table 2* maps out a Dual Transformation Model on how succession planning should be nested in law enforcement organizations such as the GPF:

Table 2. A Dual Transformation Model of Succession Planning for Law Enforcement Organizations.

Elements	Description	Critical Activities
Leadership Commitment [22, 34]	Senior management champions succession planning, models ethical leadership, and provides sustained sponsorship [Participants 8, 10, 12, and 15; 22; 34].	Patel and Desai [22], Yusliza et al. [34], and participants 8, 10, 12, and 15 collectively emphasized the following: 1. Leadership development requires organizations to define specific Key Performance Indicators (KPIs) that align with their objectives. 2. Succession planning initiatives need specific resources that organizations should dedicate to their execution. 3. Leadership promotions should directly link to measurable succession outcomes. 4. The organization should establish formal procedures for mentorship programs and talent identification systems. 5. The organization needs to establish specific and clear management targets which detail succession planning requirements. 6. The organization should establish formal mentoring programs to provide continuous leadership development.

		7. The organization must establish accountability systems for leadership participation and succession planning outcomes to maintain stability and continuity.
Cultural Transformation [27, 32]	The organization should implement fairness, transparency, and leadership development as core operational values throughout the entire organization [Participants 1, 3, 4, 5, 6, 7, and 11; 27; 32].	Sharma and Singh [27] and Wilson [32], along with participants 3, 4, 5, 6, 7, and 11, advocated for the following: 1. The organization should establish formal mentorship programs across all departments. 2. The organization should establish promotional procedures that are both clear and based on competency and merit. 3. Foster a culture of psychological safety to promote open communication and leadership development. 4. The organization should identify and reward behaviors that promote knowledge-sharing and teamwork. 5. The organization should create a culture that supports succession planning through mutual reinforcement between leadership practices and organizational culture. 6. • Leadership development environments must prioritize psychological safety as their fundamental requirement.

This model, as shown in Table 2, aims to ensure that succession planning is not just an administrative task but a transformative process deeply embedded within both leadership actions and organizational culture.

Implications for the Guyana Police Force

Key Significance: The consequences of this discovery for the GPF are momentous:

1. **Changing leadership expectations**: Senior leaders should be judged by their performance in shaping the leadership environment and sustaining a pipeline of successors.
2. **Institutionalized Cultural Mechanism**: GPF would need to establish formal mentoring methods and practices, such as a program for rotating leadership roles and identifying talent, all following the same guidelines and utilizing the same resources.
3. **Open Dialogue:** Regularly discussing promotional processes, succession criteria, and leadership pathways should be formalized to clarify how career paths can be developed, expectations managed, and trust built.
4. **Incorporating Succession KPIs**: Succession measures (such as ready-now-fill rates and successor pool diversity) must be included in the organization's performance management system so that someone is held accountable for them.
5. **Bolstering Psychological Safety**: Leaders must deliberately create spaces for officers to share their aspirations, access mentorship, and participate in

leadership development without fear of retribution.

Neglecting these factors risks perpetuating another round of patch-ups, politically driven succession, and checked-out talent. Therefore, we cannot graft succession planning onto the current GPF construct without first addressing the foundations of leadership support and culture change. These two elements must work together continually, re-enforcing the other to embed leadership development activities as part of the organizational DNA.

The results help confirm that GPF can continue building a sustainable next-generation leadership pipeline capable of meeting future demands only under conditions where ethical, transparent leadership behaviors become the norm and where the organization's culture values fairness, ongoing development, and meritocracy. Without this twin transformation, succession planning will be vulnerable to tactical disruption, shallow change, and a persistent leadership deficit. Consequently, future action should regard succession planning as a strategic, interconnected imperative with broader objectives to professionalize, modernize, and ethnically regenerate law enforcement leadership in Guyana and beyond.

Recommendations

Taking into consideration the research results and dialogue on the nexus of organizational culture and management commitment, the following holistic suggestions are presented to entrench sustainable succession planning within the Guyana Police Force (GPF) and other law enforcement organizations:

Embed Succession Planning as a Strategic Imperative

Succession planning is an ongoing strategic HR function, not an ad hoc or crisis event administrative project. To achieve this:

1. **Create a Formal Succession Planning Policy:** Outline the company's goals for succession management, including company, regional, and market objectives, principles, and responsibilities.
2. **Integrate Succession Planning with Strategic Objectives**: Align the development of the leadership pipeline with GPF's broader modernization and reform initiatives to ensure seamless integration.
3. **Create a Talent Management Department**: You need HR individuals who manage succession and focus on talent identification, career pathing, and tracking leadership development.
4. **Embed Succession Planning into Organizational Reviews**: Succession readiness should be integrated into annual performance reviews and strategic planning.

The current finding aligns with the work of Alam and Omar Sturman [3] and Sturman and Fink [18], who have highlighted that institutionalizing succession planning enhances leadership resilience and minimizes sudden leadership breaks.

Develop a Leadership Development Culture

To integrate succession planning into our organizational culture, GPF must foster a culture that values leadership development, transparency, and meritocracy. This includes:

1. **Demystify Leadership Development**: Standardize leadership training, mentorship, and cross-functional job rotations in career development.
2. **Incentivize Knowledge Sharing**: Reward officers who take the time to teach and foster people who will advance their unit.
3. **Encourage Leadership by performance, not by seniority**: Promote individuals who demonstrate a set of leadership competencies and skills rather

than merely conforming to the status quo or avoiding conflict.

4. **Building Psychological Safety**: Encourage conditions where LEOs feel free to ask for opportunities to grow without fear of punishment.

According to Schein et al. [26], cultural reinforcement—through storytelling, rituals, and hero recognition—is essential if leadership development is to become the norm rather than the exception.

Empower Management Accountability for Succession Planning

Leadership commitment must be more than lip service - tangible mechanisms of accountability to deliver on succession planning outcomes are

1. **Define Leadership Development KPIs:** Set measurable objectives for succession readiness, such as the proportion of leadership roles with a ready successor identified or the development progress of successors.
2. **Link Manager Performance Evaluations to Succession Outcomes**: Senior officers' performance reviews should assess their contributions to building the leadership pipeline.
3. **Oversight and Reporting of Succession Metrics Regularly Monitor and Report Succession Metrics**: Establish a quarterly or biannual succession progress report for the commissioner and ELT to discuss.
4. **Hold Leaders to Ethical Leadership Standards**: Leaders must demonstrate fairness, transparency, and inclusiveness in all aspects of succession planning and management.

These suggestions align with those of Turner and Baker [30], who emphasize that making managers accountable for succession KPIs enhances the sustainability of the leadership pipeline and the trust invested in the institution.

Amend HRM Policies to Incorporate Succession Frameworks

Integrating succession planning into all HRM systems is not just essential, but it also promises a future of consistency, fairness, and strategic alignment.

1. When it comes to hiring, it is essential not only to assess a candidate's current skills but also their leadership potential. By incorporating succession planning into our hiring practices, we can ensure that we evaluate both technical skills and leadership potential.
2. **Relate promotion to developed leadership and structure**: Make it an organizational requirement for potential candidates to complete leadership development programs and demonstrate competencies aligned with their organization's strategic needs.
3. **Embed Leadership Development into Training Systems**: Develop and standardize a leadership curriculum that encompasses early, mid-career, and senior career paths.
4. Building bench strength for key roles is a crucial step, as it ensures that strong leaders are identified and prepared for current and future key roles, thereby guaranteeing a consistent pipeline of designated successors.
5. Introducing diversity and inclusion objectives in succession plans is not just a suggestion; it is a necessity. The GPF's leadership pipelines must reflect the diversity of its workforce in terms of gender, ethnicity, and regional representation, ensuring that everyone feels included and valued.

These suggestions align with the best practices observed by Sturman and Fink [11], who advocate comprehensive HRM systems that facilitate effective leadership succession throughout the entire employee life cycle.

Drawing from the research findings and discussions on the intersection of

organizational culture and management commitment, *Table 3* outlines recommendations for fostering sustainable succession planning within the Guyana Police Force (GPF) and similar law enforcement agencies:

Table 3. A Summary of Recommendations, Key Actions and Expected Outcomes

Recommendations	Key Actions	Expected Outcomes
Institutionalizing Succession Planning [3, 11].	Develop policy, align with strategic plans, and establish a Talent Management Unit [Participants 3, 8, 10, and 15, 3, 11].	Succession planning becomes a permanent strategic organizational process that runs continuously [Participants 3, 8, 10, and 15; 3; 11].
Cultivate a Leadership Development Culture [26].	Normalize mentoring, reward development behaviors, and promote meritocracy [Participants 1, 3, 5, 6, and 11, 26].	The organization establishes leadership development as a standard practice that operates at every organizational level [Participants 1, 3, 5, 6, and 11, 26].
Strengthening Management Accountability [30].	Establish KPIs; integrate succession outcomes into manager evaluations [Participants 10, 12, 13, and 15, 30].	The organization maintains clear definitions of management succession responsibility, which receive tracking and enforcement [Participants 10, 12, 13, and 15, 30].
Revising HRM Policies [11].	Link recruitment, promotion, and training to leadership pipeline goals [Participants 3, 9, 11, and 13, 11].	The HRM systems fully incorporate succession planning practices, ensuring fair and transparent talent development processes [Participants 3, 9, 11, and 13, 11].

The proposed recommendations shown in *Table 3* aim to transform succession planning into a fundamental organizational practice, ensuring leadership continuity and fostering a culture of growth and fairness.

Succession planning in the GPF should shift from reactive or random approaches to a systemic process that is visible and reinforced by the culture. The GPF can develop a strong, diverse, and future-ready pool of leaders by institutionalizing succession processes, changing leadership behavior, updating cultural norms, revising HR policies, and implementing the above recommendations. However, this kind of holistic reform is more than just strategic; it is imperative to rebuild public confidence, enhance service excellence, and secure the organization's long-term future.

Conclusion

The implications of this study suggest that, in the case of public police organizations, such as the GPF, cultivating leadership resilience relies on two related imperatives: culturally shaping the organization and the unwavering public commitment of senior executives to succession planning. Culture and leadership are interdependent; they must work together to create an effective pipeline of leaders that provides the organization with stability, strategic flexibility, and public trust in the long run.

Redefining Organizational Culture

The research indicates that a GPF culture of nepotism, non-transparent methods of promotion, and friend system recruitment

hinder effective succession planning. Participants repeatedly emphasized that succession programs will fall short without changing their culture toward one characterized by fairness, transparency, ongoing learning, and meritocracy. A reformed culture should promote the development of leaders through, for example, mentoring, knowledge sharing, and competency-based advancement—as basic organizational skills. The environment must foster psychological safety, enabling officers to pursue leadership roles without fear of political witch-hunts and intimidation. This assertion is consistent with modern organizational theory by Schein et al. [26], which states that culture is not a mere curtain for strategic actions but has an effect and is a factor in succeeding or failing. Without changing cultural expectations and norms, even the best succession plans will not gain the necessary traction to be sustainable. So, culture change is not something we can achieve if we have time; instead, culture change underlies everything. Only when organizational life absorbs righteousness, ability, and training can succession planning become effective.

Securing Management Support

Equally important is ensuring senior management's sincere and ongoing support for the succession planning agenda. The research revealed that where leadership does not or inconsistently sponsor succession activities, momentum for these activities tends to stall, resulting in ad hoc promotions, leader gaps, and talent attrition. Executives must now show, sponsor, and systematize succession planning instead of claiming it is crucial. This involves clarifying success standards for succession, dedicating resources to leadership development and mentoring initiatives, and holding themselves and their subordinate managers accountable to measured KPIs. This commitment to leadership champions the technical processes signals cultural priorities and reinforces fairness, transparency, and leadership capability throughout the organization. Leadership succession literature by Sturman & Fink [11] and Yusliza et al. [34] supports the argument, emphasizing that succession structures are susceptible to decay and ultimately become obsolete if they do not receive evidence of continuous executive leadership backing.

Necessity of Joint Task Execution

Therefore, the most essential message of this research is that organizational culture and commitment to leadership should develop in parallel. Neither alone is sufficient. Leadership buy-in was unaccompanied by cultural adherence alongside autonomous change, resulting in isolated change that can easily be sabotaged. In contrast, cultural readiness without leadership support generates preparedness that leads to cynicism and inaction. Instead, a two-sided transformation approach is necessary, in which dedicated leaders practice, enforce, and reinforce succession values and, in turn, change cultural standards to support and require ethical leadership behaviors. This virtuous cycle is key to the following:

1. Leadership continuity at senior positions.
2. Save those institutional memories for future generations.
3. Foster officer professional development and career advancement.
4. Enhance the legitimacy of the organization and improve public perception of law enforcement oversight.
5. Implement advanced strategic reforms that are essential to addressing the challenges of 21st-century policing.

In the context of GPF, succession planning should be viewed as a strategic and cultural process rather than a remedial activity.

Broader Implications

The findings of this study have implications for the GPF, law enforcement agencies elsewhere in the Caribbean, and similar governance structures in other countries

worldwide. Effective succession planning, grounded in transformational cultural change and leadership commitment, is a key to organizational resilience in sectors where public accountability, institutional integrity, and citizen confidence are critical. If our law enforcement agencies fail to focus on both these imperatives, the results can be leadership voids, faltering morale, talent drain, organizational instability, and lost public confidence, significantly undermining public safety and democratic legitimacy. In contrast, agencies that invest in creating leadership pipelines through culturally grounded, leader-initiated succession strategies are better positioned for operational effectiveness, innovation, legitimacy, and future success.

In summary, the GPF and similar organizations ensure the development of long-lasting leaders by seamlessly integrating succession planning into their daily operations. Only the deliberate, mutual promotion of culture and leadership commitment will enable the GPF to cultivate a leadership cadre that fosters operational excellence and instills the ethical, developmental, and strategic values necessary to lead Guyana's law enforcement beyond. That is why succession planning cannot be an event or a project; it must become "*how we do things around here."*

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Conflict of Interest

The author has no conflicts of interest regarding the authorship of this study.

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Practicing of Coercive Parenting Style in an Inner-City Community in Central Village, Jamaica, and the Impact on their Children's Behaviour

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Abstract

This study explores the effects of coercive parenting on children's behaviour within the inner-city community of Central Village, St. Catherine, Jamaica. Using a quantitative research design, 100 questionnaires were administered—60 to parents and 40 to children—to assess parenting practices and their psychological and behavioural impact. Analysis using descriptive statistics, reliability testing, factor analysis, and correlation revealed a high prevalence of coercive parenting, often associated with low income and limited educational attainment. Most participating parents earned between USD $1,000 and USD $3,000 annually, and 71.7% had not progressed beyond high school. Children exposed to coercive discipline demonstrated behavioural issues such as emotional instability, defiance, and antisocial tendencies. The findings highlight a concerning link between socioeconomic challenges, harsh disciplinary methods, and negative developmental outcomes in children. The study underscores the urgent need for targeted interventions and parenting education programs in marginalized Jamaican communities.

Keywords: *Authoritarian Parenting, Child Behaviour, Coercive Parenting, Inner-City Community, Parenting Style.*

Introduction

Preface

Parenting is defined as the act of supporting a child's development throughout their physical, emotional, and cognitive growth. It also involves instilling discipline, values, and ethical conduct. In Jamaica, several parenting styles are commonly practiced, including permissive, authoritarian, authoritative, and coercive parenting.

Coercive parenting, in particular, has been associated with adverse effects on both the mental and physical well-being of children. Studies suggest that children raised in environments where aggression—especially physical aggression—is normalized, are more likely to display aggressive behaviors themselves [1]. These children often internalize violence as a defense mechanism in stressful situations. Frequently, the cycle of aggression begins in the home and extends to peers, teachers, and community members. For many, violence becomes a survival strategy, reinforced by cultural narratives such as "only the strong survive" [2]. In various countries, aggressive discipline is seen as culturally acceptable, even though it significantly affects the development of young people. This study centers on coercive parenting and its influence on the behavior of children in such socio-cultural settings.

Background to the Study

The concept of coercive parenting can be better understood by examining the meaning of "coercion," which, according to the Cambridge Dictionary, is the act of compelling or frightening others to act against their will. Coercive individuals often exert power through

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threats or physical force to make others comply [3]. In the context of parenting, coercive parents demand obedience from their children, often using verbal or physical punishment to enforce rules without considering the child's perspective [4].

This form of parenting may result in two major outcomes: children become either fearful and submissive, or resistant and rebellious. Research indicates that in inner-city communities, approximately 70.8% of parents frequently yell at their children, while 43% resort to physical punishment when rules are disobeyed [5]. Such parenting behaviors are linked to increased arrogance or defiance in adolescents, and in many cases, lead to delinquent or criminal activities.

Statement of the Problem

Central Village, located in St. Catherine, Jamaica, is often stigmatized due to prevalent gang activities and informal housing developments. The community comprises primarily female-headed households and experiences high levels of unemployment. Children are frequently seen loitering unsupervised, even during school hours.

The behavior of many of these children is concerning—they engage in fights, use abusive language, steal, and destroy property. When confronted, their parents may respond with vulgar insults and threats such as, "Mi shud a squeeze a kill yuh when mi a birth yuh" (I should have killed you at birth) or "Yuh a go end up a jail like yuh Pupa" (You'll end up in prison like your father). Physical punishment often follows, using anything from sticks and shoes to machetes. To escape these experiences, children may seek refuge on the streets, becoming susceptible to negative influences such as gangs, turf wars, gambling, or theft.

According to recent media reports, a significant number of Jamaican youths have been arrested for serious crimes—78 for shootings, 148 for firearm possession, and 63 for aggravated robbery [6]. Reverend Dwight G. Peccoo of the Central Village New Testament Church of God has called for more government investment in youth intervention programs and parenting workshops. Unfortunately, such appeals have largely been ignored.

The Caribbean Policy Research Institute (CAPRI) [7] reported that 80% of Jamaican children have experienced some form of violent discipline, 65% face bullying at school, and 79% have witnessed violence in their communities or homes. Various organizations, including UNICEF, IDRC, and the Inter-American Development Bank, have funded interventions, but most focus on broader socioeconomic issues rather than the direct impact of parenting. As noted by [8], violent parental discipline can perpetuate aggression in children, underlining the urgent need to examine parenting practices in communities like Central Village where violence is entrenched.

Purpose of the Study

This study aims to investigate the practice of coercive parenting within Central Village and evaluate its impact on children's behavior.

Significance of the Study

Findings from this research are expected to support local and international stakeholders—such as the Social Development Commission (SDC), Jamaica Social Investment Fund (JSIF), National Parenting Commission (NPC), and UNICEF—in designing effective interventions. These may include parenting workshops, behavior modification programs, and community outreach efforts aimed at fostering healthier family dynamics. Ultimately, the goal is to encourage harmonious coexistence and reduce hostility within families.

It is anticipated that the knowledge gained through such programs will bring about lasting behavioral change in both parents and children, especially in communities affected by social and economic hardships.

Research Objectives

The central objective of the study is to assess how coercive parenting influences the behavior of children in Central Village. Specific objectives include:

To determine the prevalence of coercive parenting in Central Village, St. Catherine.

To identify the characteristics of parents who practice coercive parenting.

To evaluate the behavioral impact of coercive parenting on children.

Research Questions

The study is guided by the following research questions:

What are the characteristics of parents who use coercive parenting in Central Village?

What behavioral effects does coercive parenting have on their children?

How do parents and children perceive coercive parenting practices?

Operational Definition of Terms

Inner-city community: As defined by the Oxford Dictionary, these are unstructured settlements predominantly inhabited by low-income residents.

Youths-at-risk: According to Oxford Bibliographies, these are children or adolescents disadvantaged by factors such as disability, substance abuse, or mental health challenges, often placing them at greater risk of negative outcomes.

Research Hypothesis

Null Hypotheses:

H_{01}: There is no significant relationship between parenting characteristics (permissive, authoritarian, authoritative) and coercive behavior in Central Village.

H_{02}: There is no significant relationship between parents' coercive behavior and their children's behavior.

H_{03}: There is no significant relationship between parenting characteristics and children's behavior.

Alternative Hypotheses:

H_{11}: Parenting characteristics are significantly related to coercive behavior.

H_{12}: Parents' coercive behavior significantly influences children's behavior.

H_{13}: Parenting characteristics significantly affect children's behavior.

Limitations of the Study

The study is geographically limited to Central Village and uses standardized scales that may not be culturally adaptable. The sample size is relatively small, which may affect generalizability [9]. Additionally, the study relies on self-reported data, which may lead to social desirability bias [10]. Participants may underreport negative behaviors or hesitate to disclose sensitive information due to privacy concerns [11]. Other variables that influence child behavior—such as teacher involvement, nutrition, peer influence, and government policies—are not considered in this study.

Organization of the Study

The thesis is structured into five chapters. Chapter 2 provides a comprehensive literature review. Chapter 3 explains the methodology. Chapter 4 presents the data and analysis. Chapter 5 discusses the findings and outlines the conclusions and recommendations.

Literature Review

Preface

This section introduces the literature supporting the investigation into coercive parenting in Central Village, Jamaica. It highlights the need to explore how such parenting styles influence children's behavior and development, laying the foundation for a focused conceptual framework.

Parenting and Parenting Styles

Parenting involves guiding children through developmental stages, instilling discipline, values, and emotional support [14]. Scholars argue that effective parenting requires

consistency and routine [15]. As parenting evolves, various styles have emerged—permissive, authoritarian, authoritative, and coercive—each shaped by personal values, cultural context, and life experience [16, 17].

Permissive parents offer minimal control, allowing children to make decisions independently [16]. Authoritarian parents, by contrast, exert high control with rigid expectations [18]. Authoritative parenting provides balanced guidance, respecting autonomy while enforcing boundaries [19]. Coercive parenting, however, is marked by force, fear, and dominance [20].

Coercive Parenting and Its Comparison to Other Types

Coercive parenting manifests through intimidation, punishment, and emotional suppression [15, 20]. It often involves yelling, beating, and an unwillingness to listen to the child's voice [21, 22]. While it shares similarities with authoritarian parenting—such as expecting unquestioned obedience—coercive parenting is harsher and more punitive [24, 25].

Authoritative parenting differs significantly, promoting open dialogue and understanding [26]. Permissive parents avoid conflict and offer freedom without fear or punishment [17]. Thus, coercive parenting stands out as emotionally damaging, often fostering compliance through fear rather than mutual respect.

Coercive Parenting Practices in Inner-City Communities

Coercive parenting is prevalent in inner-city communities where economic stress and low educational levels correlate with harsh discipline [27, 28]. Studies show that over 40% of parents in such areas use verbal and physical punishment regularly [29]. This environment fosters either extreme submission or rebellion in children.

Research highlights severe emotional consequences: depression, fear, low confidence, and fragile parent-child relationships [30]. Many children internalize violence as normal, which can perpetuate cycles of aggression. Nearly 36% of children in these communities' experience clinical levels of depression due to ongoing parental abuse [29, 30].

Coercive Parenting and Youths-at-Risk

Empirical studies show that children with developmental disabilities are particularly vulnerable to coercive parenting [1, 29, 30]. Lacking the capacity to understand or meet parental demands, these children often face impatience and punishment instead of support [20, 31]. Their dependence on parents, coupled with behavioral challenges, leads to increased risk of mistreatment.

Punishment methods such as screaming, spanking, or banning privileges are often used with little understanding of their long-term impact [32]. While some discipline methods may yield short-term compliance, they are largely ineffective for long-term behavioral development and emotional regulation.

Western and Eastern literature alike reveal a link between coercive parenting and child psychopathology, such as depression and peer violence. However, gaps remain in understanding how cultural context moderates these effects [32].

Conceptual Framework

This study employs a quantitative survey design using close-ended questionnaires administered to parents and children. Parents' coercive behavior is measured using a validated scale [33], while children's behavioral traits—oppositional defiance, antisocial tendencies, emotional struggles, and positive development—are assessed using tools adapted from [34].

Children also evaluate their parents' style across three dimensions—permissive,

authoritarian, and authoritative—using scales developed by [35]. The framework acknowledges cultural nuances and introduces the concept of "mindful parenting," which emphasizes empathy, non-judgment, and emotional presence [36-38]. Research suggests that mindfulness in parenting fosters healthier relationships and reduces the risk of coercive practices.

Research Methodology

Preface

This chapter outlines the research methodology used in the study, including the research design, sampling techniques, instrumentation, data collection procedures, and data analysis methods. It concludes by discussing ethical considerations and presenting the research timeline and budget.

Research Design

Research methodology refers to the systematic and scientific approach to solving research problems. It involves identifying how knowledge is obtained and utilized in a structured manner. The choice of research design depends on factors such as the study's objectives, population, sampling techniques, and data types. Figure 3.1 illustrates different types of research designs. (Source: Primary data).

This study used an exploratory design in the early stages to frame its objectives and hypotheses. A qualitative approach guided the literature review and the development of the questionnaire, while a quantitative approach guided sampling and statistical analysis. Ultimately, a conclusive design was used for drawing findings and conclusions, specifically employing a descriptive survey design.

The following research questions were addressed:

What are the characteristics of parents who practice coercive parenting in Central Village?

What impact does coercive parenting have on children's behavior?

What are the views of parents and children regarding coercive parenting?

The study adopted a cross-sectional design, collecting data only once from each respondent. Participants were not observed over time, ensuring independence in responses.

Population and Sample

The target population consisted of parents and children living in the inner-city community of Central Village, St. Catherine, Jamaica. According to the Social Development Commission (SDC, 2019), Central Village has a population of approximately 21,000. The area was selected based on reports of high child involvement in criminal activity.

A sampling frame was obtained from the SDC office, and a purposeful sampling technique was employed to select 100 participants, 60 adults (each with at least one child) and 40 children—who all resided in the community. Adults ranged in age from 18 to mid-50s, while children were between 10 and 17 years old. The final sample size was n = 100.

Data Collection Instrument

A close-ended questionnaire was used as the primary data collection tool. This method was selected due to the limited availability of secondary data related to parenting styles and child behavior in the target community. Primary data was deemed more relevant, specific, and reliable for meeting the study's objectives [2].

The questionnaire consisted of two sections:

Section A (Parents): Self-administered.

Section B (Children): Conducted via structured interviews and recorded by the researcher.

Measurement scales included:

Parental coercive behavior: Assessed using a 5-item scale adopted from [3].

Child behavior: Rated by parents using a scale adapted from [4], covering:

1. Oppositional defiant behavior (12 items)
2. Positive development (9 items)

3. Antisocial behavior (6 items)
4. Emotional difficulties (6 items)

Parenting characteristics: Evaluated by children using a 30-item scale measuring:

1. Permissiveness
2. Authoritarianism
3. Authoritativeness

(Scale adapted from [5])

All items were rated on a five-point Likert scale, where 1 indicated "strongly agree" and 5 indicated "strongly disagree." Responses with means <3 reflected agreement; means >3 indicated disagreement. The full instrument is included in the study annex.

Data Collection Methods

Initial entry into the community required permission from local leaders (see Appendix A). Meetings were arranged to explain the research purpose, followed by data collection sessions at the community center.

Parents: Completed questionnaires either in person (n = 47) or electronically (n = 13). The electronic group was given seven days to respond, with reminders sent as needed.

Children: Were interviewed individually by the researcher at assigned times. No assistance was provided or required during the interviews. Each session lasted approximately one hour. Children answered independently and were encouraged to read and mark their answers.

The process ensured voluntary participation and comprehension of all questions. All responses were gathered within the scheduled time frame.

Reliability and Validity

Cronbach's Alpha was used to test the internal reliability of the scales, while exploratory factor analysis assessed construct validity [6, 7]. Both tests were conducted using SPSS. Factor loadings and cross-loadings were evaluated to ensure the constructs' accuracy. Detailed reliability and validity results are presented in Chapter Four.

Data Analysis

The researcher followed a structured analysis framework adapted from [8], which involves:

Step 1: Calculating response rate and assessing response bias using frequency tables.

Step 2: Organizing and coding data. Each questionnaire item was assigned a numerical code and entered into SPSS. Visual inspection and descriptive statistics (frequencies and distributions) were used to identify missing or out-of-range responses. Three missing values were found and imputed using the item mean.

Step 3: Applying appropriate statistical methods. Techniques included frequency tables, percentages, cumulative percentages, and descriptive charts. Inferential methods used:

Pearson correlation matrix to assess relationships between variables.

Regression analysis to test research hypotheses.

Ethical Issues

Ethical approval was obtained, and participants were required to sign informed consent forms (see Appendix E). Consent included assurances of privacy, voluntary participation, and the use of coded pseudonyms for anonymity [9, 10]. Participants' rights to confidentiality and withdrawal were respected throughout the research.

Research Timeline and Budget

Effective time management was a priority. As noted by [11], planning data collection and analysis timelines is critical to project success. The researcher adhered to a detailed timeline to ensure each phase of the study was completed on schedule. The estimated budget for conducting the study was JMD 85,000.00.

Presentation and Analysis of Data

Preface

This chapter presents and analyzes data gathered from surveys administered to parents

and children in the inner-city community of Central Village, Jamaica. It includes demographic information, reliability and validity testing of the instrument, and statistical analyses such as descriptive statistics, correlation, and regression. The analysis aims to evaluate coercive parenting practices and their impact on children's behavior.

Demographic Summary

Out of 75 families contacted, 60 (80%) participated in the study. For children, 40 out of 60 responded (66.7%). Among the parents, 60% were female and 40% male. Most parents were aged between 35 and 55 years, with 43.3% in the 35-45 range. A majority (51.7%) had an annual income below $1,000. Regarding education, 48.3% completed high school, 16.7% were graduates, and only 6.7% attained postgraduate education. These demographics support findings from St. Catherine LSDP (2016) that link low income and education to high crime rates [1].

Among the children, 55% were boys and 45% girls. Most (45%) were aged 12–14. Education data revealed 70% were not currently attending school. Family structure indicated that 42.5% lived in single-parent households.

Reliability and Validity

The instrument's internal consistency was verified using Cronbach's Alpha. All scales exceeded the 0.7 threshold, indicating high reliability (e.g., Parents' Coercive Behavior = 0.88; Oppositional Defiant Behavior = 0.931; Permissiveness = 0.935) [2]. Validity was assessed via KMO and Bartlett's tests. For the children's behavior scale, KMO = 0.698, and for the parents' characteristics scale, KMO = 0.643, both supporting the appropriateness of factor analysis [3].

Descriptive Analysis

Descriptive statistics indicated a general mean below 3 for most items, showing agreement with coercive parenting behaviors. Items related to child oppositional defiant behavior—such as losing temper or yelling—had means below 2. Child Positive Development items were above 3, suggesting lower endorsement of positive behaviors.

Correlation Analysis

Pearson correlation results revealed several significant relationships:

Highest positive correlation: Authoritarian parenting and Child Emotional Difficulties ($r = 0.351$).

Significant correlation between Parents' Coercive Behavior and Child Antisocial Behavior ($r = 0.311$).

Strongest negative correlation: Permissive parenting and Child Emotional Difficulties ($r = -0.383$).

These correlations were statistically significant at the 0.05 level [4].

Regression Analysis

Three regression models were tested:

Model 1: Predicting Parents' Coercive Behavior using parenting styles (Permissive, Authoritarian, Authoritative). $R^2 = 0.08$; not statistically significant ($p = 0.388$). Hypothesis H01 accepted.

Model 2: Predicting Children's Behavior using Parents' Coercive Behavior. $R^2 = 0.071$; statistically significant ($p = 0.039$). Hypothesis H02 rejected; H12 accepted.

Model 3: Predicting Children's Behavior using Parenting Characteristics. $R^2 = 0.048$; not statistically significant ($p = 0.614$). Hypothesis H03 accepted.

Summary and Conclusion

The results confirm that coercive parenting in Central Village is significantly associated with children's behavioral outcomes, particularly antisocial behavior. Most parents have low education and income levels, which correlate with negative parenting practices. While parenting characteristics were not significant predictors of coercive behavior or child outcomes in this study, coercive behavior alone had a clear, measurable impact.

The instrument used was both reliable and valid, and the findings support the study's significance. The use of SPSS software for analysis and clear presentation tools, such as charts and tables, strengthened the findings. Participants voluntarily engaged with the study, and no material compensation was provided.

Discussion of Findings

The study sought to assess coercive parenting practices in Central Village, St. Catherine, Jamaica, and evaluate their impact on children's behavior. The findings reveal that coercive parenting is prevalent in the community. Most parents reported agreement with coercive practices, evidenced by item means below 3 on the Likert scale. This supports the first objective—to determine the extent of coercive parenting—which was clearly affirmed.

Low parental income and education levels were consistent among respondents. A majority earned under $3,000 annually, with 51.7% below $1,000, mirroring patterns of economic instability identified by the World Bank (2018) [1]. Education levels were similarly low, with only 6.7% of parents having post-secondary qualifications. Children's schooling was also limited—70% were not currently enrolled. These findings align with previous reports [2, 3] linking poor socioeconomic conditions to higher crime and reduced child development in Jamaica.

Children demonstrated elevated signs of oppositional defiant behavior and emotional difficulty. Questions such as "loses temper" and "threatens others" had mean values below 2, suggesting strong parental agreement on these negative traits. These results correlate with those in the Jamaica Red Cross Biennial Report (2016), which emphasized the need for community-based interventions to combat youth violence [4].

Research Question 1: What are the characteristics of parents who practice coercive parenting?

Although regression analysis showed no statistically significant relationship between selected parenting styles (Permissive, Authoritarian, Authoritative) and coercive behavior (Sig = 0.388), authoritarian and authoritative parents showed stronger tendencies toward coercive patterns than permissive ones. Permissive parenting was negatively associated with coercive behavior ($\beta = -0.098$), though the effect was not strong [5].

Research Question 2: What impact does coercive parenting have on children's behavior?

There was a significant positive relationship between coercive parenting and children's behavior (Sig = 0.039; $\beta = 0.267$), confirming the hypothesis H12. Children exposed to coercive parenting were more likely to exhibit antisocial behavior and emotional difficulties. This aligns with international literature asserting that coercion exacerbates developmental challenges in youth [6].

Research Question 3: What are the views of parents and children on coercive parenting?

Correlations showed a strong relationship between authoritarian parenting and child emotional distress ($r = 0.351$) and a negative correlation between permissive parenting and child emotional issues ($r = -0.383$). Parents and children seem to perceive authoritarian styles as emotionally harmful, while permissiveness may promote emotional security, though it was scarcely practiced [7].

Results of Hypothesis Testing

H01 Accepted: No significant relationship between parenting styles (Permissive, Authoritarian, Authoritative) and coercive parenting behavior (Sig = 0.388).

H12 Accepted: Significant relationship between Parents' Coercive Behavior and Children's Behavior (Sig = 0.039; $\beta = 0.267$).

H03 Accepted: No significant relationship between parenting styles and child behavior (Sig = 0.614).

Theoretical Contributions

This study adds to the behavioral sciences by empirically linking parenting practices with child behavioral outcomes in under-researched Jamaican inner-city contexts. It validates the use of behavioral scales and draws connections between socioeconomic variables and parenting style, encouraging future studies in related areas.

Practical Contributions

The findings can support interventions led by NGOs and government agencies to improve parenting practices. Awareness campaigns, community workshops, and stakeholder partnerships can foster safer family environments. The study also advocates for greater parental self-awareness and policy interventions aimed at child safety and youth development [8].

Limitations

The study relied solely on self-reported data from parents and children, without teacher or third-party observations. It excluded other contributing factors such as peer influence, food security, and school resources. Cultural sensitivity of the measurement tools and the relatively small sample size also limit generalizability.

Conclusion

The study concludes that coercive parenting is widespread in Central Village and significantly affects children's behavior. The findings highlight low household income, poor education, and limited school attendance as key contextual challenges. Although certain parenting styles were not statistically linked to coercive behavior, coercive parenting itself was strongly related to negative child outcomes. These results validate concerns from both local and international reports about youth vulnerability in high-risk communities.

Key Takeaways

Coercive parenting is prevalent.

Children display signs of emotional and behavioral distress.

Socioeconomic deprivation underlies both parenting and child development challenges.

Permissive parenting is rare, but appears to support emotional stability.

Recommendations

Broaden future studies to include factors like peer influence, teacher involvement, and government policy.

Use advanced statistical techniques like Structural Equation Modeling (SEM) to validate constructs.

Introduce and evaluate parenting education programs targeting coercive tendencies.

Develop community-based social intervention models, including counseling and mentorship.

Expand the study scope to other urban areas to identify national patterns.

Pursue longitudinal studies to assess behavioral change over time.

Conflict of Interest

The author declares no conflict of interest.

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A Case Report of Multinodular Goiter with Retrosternal Extension in Euthyroid State

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Abstract

Multinodular goiter with retrosternal extension are seen in the superior and anterior mediastinum, but in 10-15% they can be found in the posterior mediastinum too. A large goiter may induce compressive symptoms. Thus, surgeries for such conditions require high levels of experience to avoid devastating complications, especially when the gland weighs <500g. Here we report the case of a 55-year-old lady who came with a swelling in the front of the neck which was insidious in onset and gradually progressed in size. She had history of breathing difficulties that worsened in the past month. On examination, a 5x5 cm firm swelling with an irregular surface in the left thyroid region moved with deglutition with no warmth or tenderness that deviated the trachea to the right; the lower border was not seen or palpable. No signs or symptoms of thyroid toxicity were seen. CT neck and chest showed a left-sided multinodular goiter with retrosternal extension, pushing the main cervical vessels posteriorly along with contact to the trachea and the right recurrent laryngeal nerve. The thyroid function test was normal. After assessments, the patient underwent total thyroidectomy via transcervical and sternotomy approaches. The patient recovered uneventfully and was discharged later. Presented in this case report is a not-so-large multinodular goiter in an euthyroid patient with retrosternal extension that had compression over the trachea and the main vessels along with right recurrent laryngeal nerve. The outcomes for this patient were discussed in light of the treatment options.

Keywords: *Cervicothoracic Approach, Multinodular Goiter, Retrosternal Extension, Sternotomy, Total Thyroidectomy.*

Introduction

In the mid-1700s, Haller et al. were one of the first to identify retrosternal thyroid extension. Retrosternal components may be seen in up to 45% of patients with goiter [1]. These can cause pressure symptoms like breathing or swallowing difficulties with or without hoarseness of voice because of the compression of the trachea, esophagus, and the recurrent laryngeal nerve. However, based on geographical distribution, we found that 5-50% of cases were asymptomatic in some trials [2].

Any goiter affects 5% and 15% of the population in non-endemic and endemic areas, respectively. The preoperative planning for the approach to the gland differs by case, and in some cases, the need for exploration of the thoracic cavity by sternotomy exists. Most retrosternal goiters can be reached with the cervical approach, but in some cases, a sternotomy may be necessitated [3]. Moreover, thyroidectomy for goiters with extension to other spaces can become technically challenging, particularly when the gland weighs more than 500g [4].

Here, we present a case of a 55-year-old hypertensive, diabetic, and euthyroid female with multinodular goiter with retrosternal extension into the superior mediastinum, pushing the main cervical vessels posteriorly,

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along with compression of the trachea and abutment of the left recurrent laryngeal nerve, which was safely removed via transcervical and transthoracic approaches.

Case Report

A 55-year-old female came to the OP in mid March 2022 with complaints of swelling in the thyroid region for the past year, along with mild difficulty breathing and hoarseness of voice for the past month. The swelling was first noticed a month ago; it was initially small but gradually grew in size. In the past month, she has had increased difficulty breathing, swallowing solid food, and having hoarseness of voice. There was no pain, fever, or any sudden increase in size. There were no signs of hyperthyroidism or hypothyroidism. There was no history suggestive of tuberculosis, malignancy, or metastasis. She was a known hypertensive and diabetic on regular medications for the past 4 and 1 years, respectively. There were no surgical interventions in the past or a history of irradiation of the neck. She had attained menopause 13 years ago. She had a mixed diet, normal bowel and bladder habits, normal sleep, and a normal appetite. She had no history of addiction. There was no history of thyroid conditions or malignancies in the family.

She was 153 cm tall, weighed 62 kg, BMI 26.5, well built and nourished, ACOG score 2. Vitals were stable, with a normal pulse rate, rhythm, and volume. There were no signs of toxicosis. On local examination, a firm swelling of 5x5cm was seen in the right lobe of the thyroid gland [Figure 1], situated deep to the deep fascia, extending superiorly from the thyroid cartilage and inferiorly reaching the suprasternal notch, with an irregular surface that moved with deglutition and not with tongue protrusion. There was no warmth or tenderness. The trachea was shifted to the left. The lower border of the swelling could not be seen or felt. The skin over the swelling was normal. There was no facial asymmetry. There was a mild rhonchi that was heard on auscultation. No palpable cervical lymph nodes. There were no eye signs or pretibial myxoedema, but hoarseness of voice was present. Other systemic examinations were normal. No other signs of thyroid toxicity or metastasis were seen. Clinical diagnosis: multinodular goiter with retrosternal extension, probably benign, with hoarseness of voice without any toxic features.



Figure 1. Gross Picture of the Patient

All the lab results, including thyroid function tests, were within normal limits.

- Hemogram 11g%
- Total leukocyte count 8200 cells/mm^3
  - Polymorphs 59%
  - Lymphocytes 39%
- Platelets 2.6lakhs/mm^3
- RBS - 185 mg/dl

- Urea - 22.9 mg/dl
- Creatinine - 0.9 mg/dl
- Serology - negative
- Blood grouping - B positive
- T3 - 1.28 ng/ml
- T4 - 8.64 mg/dl
- TSH - 0.887 mul/ml
- Total serum calcium - 8.7 mg/dl
- Serum ionised calcium - 1.12 mmol/l
- ECG - normal sinus rhythm.

X-ray neck showed the trachea mildly shifting to the right side. USG of the neck showed a diffusely enlarged iso-hypoechoic mass in the left lobe of the thyroid, with some anechoic areas, intranodular vascularity, and an altered texture of the isthmus. The inferior most part of the thyroid gland was not clear due to its extension posterior to the sternum; it is likely to be a retrosternal thyroid. There were multiple subcentimeter lymph nodes on either side. The chest X-ray image showed a large radiopaque mass in the superior mediastinum, displacing the trachea to the right side; however, the superior margin was not traceable. The USG abdomen was a normal study. CT of the neck and chest [Figure 2] showed the right lobe of the thyroid enlarged, measuring 9.1x4.5x3.7 cm and showing heterogeneous attenuation with multiple foci of calcification, extending behind the manubrium sterni into the anterior mediastinum for a length of 7.2cm below the thoracic inlet, mild compression over the trachea, displacing it to the right without any definite luminal compromise, with possible posterior and posterolateral displacement of the internal jugular vein and the left carotid artery, and partially abutting the esophagus. The aorta and inferior vena cava were normal. Fiberoptic bronchoscopy showed no tracheal infiltration: however, there was decreased movement of the right true vocal cord. Fine needle aspiration cytology (FNAC) proved a nodular colloid goiter with cystic degeneration. The thyroid scintigraphy picture is below [Figure 3].



Figure 2. CT Neck and Chest Showcasing the Thyroid Gland Extending Behind the Sternum

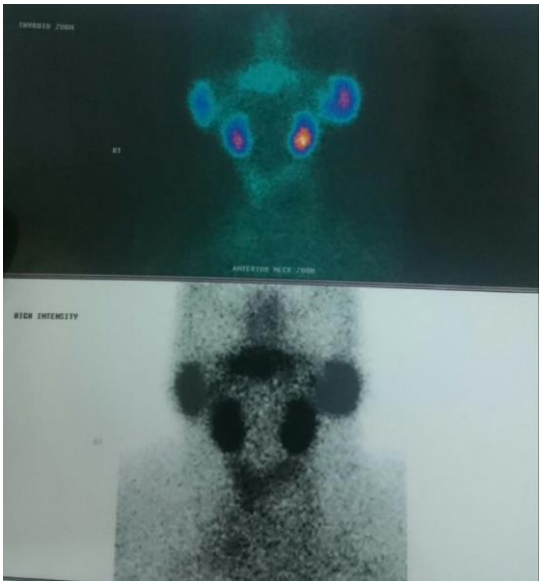

Figure 3. Thyroid Scintigraphy

The patient underwent an elective total thyroidectomy in the first week of April 2024. With the patient in the rose position, a collar incision of 10 cm (which was later extended about 3 cm on the right) was made along the skin crease above the suprasternal notch. With both the upper and lower subplatysmal flaps raised, the strap muscles were identified, and through blunt dissection, the anterior jugular vein was secured.

With difficulty in the manual delivery of the cervical part of the thyroid gland due to its size and extent, assistance from a cardiothoracic surgeon was required. A sternotomy was done, which revealed a large multinodular goiter behind the sternum [Figure 4].



Figure 4. Cervical and Thoracic Approach Exposing the Thyroid Gland

The arteries and veins of the region were well exposed and preserved. The right internal jugular vein (IJV) and carotid artery were shifted posterolaterally and posteriorly, respectively, but there were no signs of infiltration. The goiter was seen compressing the right recurrent laryngeal nerve (RLN). Both the left and right RLN and all the parathyroid glands were identified and saved. After blunt dissection with cautery and harmonic, the goiter was separated from the floor, and the tracheal cartilages were intact with no infiltration. The bleeders were secured, and the whole gland was removed in toto. After hemostasis and the placement of a draining tube (DT), the wound was closed in layers. The patient was extubated and recovered from anesthesia uneventfully. The thyroid specimen [Figure 5] was sent to the pathology department for histopathological examination.



Figure 5. The Gross Resected Thyroid Specimen for Histopathological Examination

Postoperatively, the patient was treated with intravenous antibiotics, analgesics, and steroids. The draining tube was removed, and the patient was discharged with supplementary thyroxine and calcium tablets. The final histopathology revealed a nodular goiter with no malignant change.

Discussion

The thyroid gland weighs anywhere between 10 and 25 g [5] in a healthy adult. When a small population in a certain geographical area is affected by goiter, it is referred to as endemic goiter [4, 6]. MNG is mostly seen in older men as an asymptomatic swelling in the front of the neck, but it can also be seen in the general population [7]. MNG may be asymptomatic or symptomatic: in an euthyroid, hyperthyroid, or hypothyroid state [2]. When a large goiter compresses the trachea, esophagus, and RLN, it results in respiratory discomfort, occasional dysphagia [8] and hoarseness of voice. A certain percentage of people with cosmetic concerns may also choose to undergo surgery [4].

Regarding radiological investigations for mediastinal goiters, the most commonly used imaging modalities are USG neck and X-ray neck. CT may be used to evaluate the anatomical position and extension of the gland, along with the characteristics of the mass (cystic or nodular) [9] and features of compression, if any are present. Though retrosternal goiter cases are regularly reported, only a few have main vessels and nerve displacement [9, 10] as in our case.

Massive goiters of more than 500g [4] can be technically challenging for both the anesthesiologists and the surgeons [6, 11]. Thus, a surgeon needs to carefully assess the patient preoperatively since each case may need to be handled uniquely [12].

Ahmed et al [8] and Batori et al [12] in their study, found that a significant percent of cases required sternotomies along with a cervical approach for retrosternal goiters. Since there are no established guidelines for identifying patients who might need a median sternotomy [3], in most retrosternal goiters, a low arc incision is used. But in recent studies, the rate of sternotomies for retrosternal goiter has been on the rise. But with recent advances and innovations like video-assisted thoracoscopy, mediastinoscopy, or robotic surgery, different surgical approaches for retrosternal goiter [13] can be tried.

With proper preoperative planning and suitable incisions, complications associated with surgeries of this extent, including hemorrhage/hematoma, RLN or phrenic nerve injury, parathyroid gland removal, pneumothorax, pleural effusion, hypocalcemia, and cervical plexopathy, can be minimized.

Conclusion

Patients with a retrosternal goiter or large MNG with partial or complete airway obstruction and esophageal obstruction should be treated as early as possible. Thyroidectomy still remains the gold standard and most effective and enduring treatment option available; however, the patient has to be in an euthyroid state. Though the transcervical approach is mainly used, a transthoracic approach with sternotomy may be needed in cases of large thyroids or retrosternal thyroids, as in our case.

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Prevalence of Mental Health Distresses Among Students at the Kenya Medical Training College, Nairobi Campus

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Abstract

The study investigated the prevalence of Mental Health Distresses Among Students at the Kenya Medical Training College, Nairobi Campus. An institutional-based cross-sectional study was used with 355 students from different departments. Proportion of student participants based on course of study showed that 61 (18.2%) were from nursing, 46 (13.7%) from health records, 61 (12.2%) from clinical medicine, 31 (9.3%) from medical laboratory technology, 30 (9.0%) for pharmacy and radiology respectively and 96 (28.7%) which constitute the majority falling into other medical courses in the university. For the religious affiliation, Christianity, 247 (73.7%), Islam, 43 (12.8%), and other religions, 45 (13.4%). Finally, males constituted 149 (44.5%) and females, 186 (55.5%). Of the 335 participants, 183 (54.6%) fell within the normal range of depression and others had either mild, 143 (42.7%) or moderate, 9(2.7%) depression. Majority of the participants had anxiety ranging from mild, 131 (39.1%, moderate, 93 (27.8%), severe, 4 (1.2%) and only 107 (31.9%) who had their anxiety within normal range. For stress, none of the participants had within normal range and severe range but those with mild stress level constitute 333 (99.4%) followed by moderate, 2 (.6%). The findings of the study corroborated other findings that showed the increasing mental health distress prevalence among medical students. Measures should be put in place to help medical students at the Kenya Medical Training College, Nairobi Campus to manage their mental health distresses which will help in improving the student mental health status and health care delivery initiatives in Kenya.

Keywords: *Anxiety, Depression, Distress, Stress.*

Introduction

Mental distress continues to remain a public health concern among medical students in tertiary learning institutions. Mental distress, if not properly managed during the period of study does not only affect the mental health capacity of the student but also affects them later during public health practice. The distress is associated with severe consequences including lack of empathy for their patients, committing medical errors, and suicidal ideations and attempts [1]. Mental distress by definition constitutes the unique explained discomfort and destabilization of the emotional state experienced by an individual in response to a specific stressor or demand that results in harm, either temporary or permanent, to the person. This unpleasant mental or emotional state is manifested in different forms including anxiety, depressive and somatic symptoms such as sleep problems, headache, and backache [2].

Studies on mental distress among medical students have indicated a high prevalence of stress, depression, and anxiety, with levels

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consistently higher compared to the general population [3]. Students undergoing different categories of medical related programs in Kenya are expected to be highly competent and capable of advancing public health agenda both at clinical, community and research related disciplines. In doing so, they achieve high levels of patient-centered care. However, due to the many years of rigorous interaction with their curriculum coupled with the stressful hassles of life, the students are exposed to life stressors that affect their mental well-being.

Studies across the world have also revealed high rates of depression, anxiety, and stress among medical students [4, 5]. A systematic review carried out on 40 published studies among the US and Canadian medical students also demonstrated that mental distress was significantly higher among college students than the general population [5]. Another systematic review conducted on 16 identified studies outside North America also revealed the prevalence of mental distress among medical students ranging between 12.2% and 96.7% [6, 7]. A study among Egyptian medical students also revealed a significant high Positive Symptom Distress Index (PSDI) of 30.1% [7]. More still, an alternative systematic study conducted in Nigeria also revealed that mental distress was much more elaborated in 25.2% of medical students [8], and in Ethiopia, the prevalence of mental distress among medical students ranged between 30% and 35.2% [9].

Medical students are at a risk of developing mental distress conditions as they must deal with daily stressors and demands specific to professional training such as the new information flow and input overload, examinations, chances of failure, lack of leisure time, workload, relationships with peers, and career choices [7]. Moreover, it has been shown by research that being female sex, coming from a rural background, having a history of substance use, high academic demands, financial problems, and apprehension about the future makes one vulnerable to developing mental health distress [11, 12]. A study by [13] in Kenya, found 61.6% of the medical students to have moderate stress. Mental health distress is also well pronounced among health professionals with high stress and pressured jobs. The development and progression of mental health challenges like depression, anxiety and stress follows a diathesis-stress model, relying on external stressors, the individual's response to those stressors, as well as the individual's genetics [13]. Additionally, medical students also experience many stressors and are therefore at high risk of suffering from depression, anxiety and stress. The stressors during their training can be divided into three categories: situational, personal, and professional [14]. Situational stressors include factors such as lack of sleep, huge responsibilities and unrealistic expectations, lack of support from health professionals, long hours, heavy workloads, many patients, as well as below optimal learning conditions [15]. Personal stressors include aspects to do with families that are a source of conflict and stress, limited free time to relax, financial difficulties, psychosocial concerns, and inadequate coping skills [16, 8]. Professional stressors include difficult patients and cases, responsibility for patients, supervision of students, information overload, and career planning [15, 7]. Factors such as stress, substance use, social support, and the educational environment each influence the wellbeing of medical students and their patients [13].

It is upon this background, therefore that this research sought to investigate the prevalence of mental health concerns (distress) amongst medical students in Kenya to provide the needed information to guide the direction of care and further understanding of the burden of mental distress in health care systems.

Though there are a handful of studies conducted in Kenya using medical students in view of the mental health challenges, there is none that was conducted, to the best knowledge

of the researchers that involves the medical training college, Nairobi Campus, Kenya. This study is therefore aimed at investigating the prevalence of mental health challenges among students at the medical training college, Nairobi Campus, Kenya. The findings are envisaged to aid the enhancement of the quality of life of the students and bolster health care services in Kenya.

Materials and Methods

Study Design, Setting, and Period

The institution-based cross-sectional study was conducted at the medical training college, Nairobi Campus, Kenya from August through September 2024. Situated about three kilometers on the northern side of Nairobi city, Kenya, the campus, stand on a 20-acre piece of land, opposite Kenyatta National Hospital, along Old Mbagathi Road. With over 41,000 students attending 76 medical courses, which makes the biggest single contribution to the health sector in Kenya and is currently producing more than 12,000 graduates every year for both the Kenyan public and private health sectors, accounting for more than 85 percent of the hospitals' workforce.

Participants

The study was conducted among medical training college students, Nairobi Campus, Kenya. The Medical students who were academically active and present on the campus during the data collection period were all considered as study population whereas those medical students who were not comfortable to respond the online questionnaires as well as those who declined to participate were excluded from the study. Only those medical students who met the pre-defined criteria and gave virtual consent were voluntarily enrolled in the study. The participants were considered autonomous and therefore were free to stop participation at anytime of their choice.

Sample Size and Sampling Procedure

The study sample size was obtained through a single population proportion by taking the prevalence of mental distress 61.6% [13], with; a 5% margin of error, 95% confidence, and assuming 10% non-response rate whereby the final sample size of 355 was determined. The students were further stratified based on their courses of study such as clinical medicine, pharmacy, nursing, etc. As data obtained from the University website indicated that the total number of medical students during data collection was over 41,000 students. Then proportional allocation of study subjects for each stratum was based on convenience sampling.

Data Collection Tool and Procedure

Data was collected using an English version of a self-administered questionnaire which had six parts. The first part included the socio-demographic characteristics of participants. The second part of the questionnaire assessed Depression, Anxiety and Stress. The standard, English version of the 21-item Depression, Anxiety, and Stress Score (DASS-21) was used to assess participants with depressive, anxiety, and stress related symptoms. The respondents were instructed to score from 0 (absence of symptoms) to 3 (symptoms appeared most of the time) for each item. At the end of the questionnaire, the scores were aggregated based on the three domains that the item represented and multiplied by two to obtain 42 as a way of tools standardization. The cut-off points were set at ≥10 for depression, ≥8 for anxiety, and ≥15 for stress. The validation was conducted and the psychometric properties showed reliability co-efficient of .71, .80 and .73 depression, anxiety and stress respectively using a pilot study with 109 medical students.

Data Quality Control

To assure the data quality, the data collectors and supervisors were trained prior to the data collection exercise using the online self-

administered tool. Prior to the actual data collection exercise, the questionnaire was pre-tested on 5% of the total sample size of 15 students among the University medical students at the University of Nairobi for all aspects including accuracy, specificity and wording to avoid ambiguity. The collected data were checked for completeness before the actual data entry and incomplete data were discarded.

Data Processing and Analysis

Data was entered into Microsoft Excel and cleaned, coded, and analyzed using Statistical Packages for Social Sciences (SPSS v23). The data was analyzed to generate descriptive statistics: frequency and percentages. Chi Square and Binary logistic regression were used to analyze the data. Variables were checked using bi-variable logistic regression to obtain the variables which had association with dependent variables and then variables which had *p*-value of less than 0.25 were entered into multi-variable logistic regressions for further analysis. Adjusted odds ratio with 95% CI was computed for variables having a *p*-value less than 0.05 in multi-variable logistic regression model and considered as significantly associated with the dependent variable.

Results

Descriptive Presentation of Data

Table 1. Socio-Demographic Presentation of Participants

VARIABLE (S) (n=335)		Frequency	Percent %
Course of Study	Nursing	61	18.2
	Pharmacy	30	9.0
	Clinical Medicine	41	12.2
	Health Records	46	13.7
	Medical Lab Tech	31	9.3
	Radiology	30	9.0
	Others	96	28.7
Time of Program	Day Program	333	99.4
	Weekend Program	2	.6
Age	Prefer not to say	3	.9
	14-24 years	299	89.3
	25-31 Years	32	9.6
	40 years and above	1	.3
Residence	Within College Hostels	280	83.6
	Away from the hostel	38	11.3
	Near private hostel	6	1.8
	Prefer not to say	11	3.3
Religion	Christianity	247	73.7
	Islam	43	12.8
	Others	45	13.4
Gender	Male	149	44.5
	Female	186	55.5

Source: Primary Data

Table 1 above shows that 335 student respondents participated in this study with 61 (18.2%) from nursing, 46 (13.7%) from health records, 61 (12.2%) from clinical medicine, 31 (9.3%) from medical laboratory technology, 30 (9.0%) for pharmacy and radiology

respectively and 96 (28.7%) which constitute the majority falling into other medical courses in the university. Majority of the participants were for day program (333, 99.0%) with only 2 (.6%) on weekend programs and 299 (89.3%) fall into 14-24 years with only 1 person who is higher than 40 years. For the mode of residency, majority of the students resides within the college hostels, 280 (83.6%) followed by those who stay away from the hostel, 38 (11.3%), 6 (1.8%) near private hostel and 11 (3.3%) who preferred not to respond. For the religious affiliation, Christianity, 247 (73.7%), Islam, 43 (12.8%), and other religions, 45 (13.4%). Finally, males constituted 149 (44.5%) and females, 186 (55.5%).

Prevalence of Mental Health Distresses Among Study Participants

Table 2. Frequency and Percentages of Mental Health Distresses Levels (n=335)

		Frequency	Percent (%)
Depression	Normal	183	54.6
	Mild	143	42.7
	Moderate	9	2.7
Anxiety	Normal	107	31.9
	Mild	131	39.1
	Moderate	93	27.8
	Severe	4	1.2
Stress	Mild	333	99.4
	Moderate	2	.6

Source: Primary Data

Table 2 above shows that out of the 335 participants, 183 (54.6%) fall within the normal range of depression and others have either mild, 143 (42.7%) or moderate, 9(2.7%) depression with none showing symptoms of severe depression. Majority of the participants had anxiety ranging from mild, 131 (39.1%, moderate, 93 (27.8%), severe, 4 (1.2%) and only 107 (31.9%) who had their anxiety within normal range. For stress, none of the participants had within normal range and severe range but those with mild stress level constitute 333 (99.4%) followed by moderate, 2 (0.6%).

Association of Depression and Socio-Demographic Factors

Table 3. Association of Prevalence of Depression and Socio-Demographic Factors

		Depression				
		No	**Yes**	**X**	**DF**	**Sig.**
Gender	Male	83 (55.7%)	66 (44.3%)	.126a	1	.723
	Female	100 (53.8%)	86 (46.2%)			
Religion	Christianity	136 (55.1%)	111 (44.9%)	.072a	2	.965
	Islam	23 (53.5%)	20 (46.5%)			
	Others	24 (53.3)	21 (46.7%)			
Age	Prefer Not to say	2 (66.7%)	1 (33.3%)	1.371a	3	.712
	14-24 Years	161 (53.8%)	138 (46.2%)			
	25-31 Years	19 (59.4%)	13 (40.6%)			
	40 years and above	1 (100.0%)	0 (0.0%)			
Course of Study	Nursing	36 (59.0%)	25 (41.0%)	8.738a	6	.189
	Pharmacy	22 (73.3%)	8 (26.7%)			

	Clinical Medicine	23 (56.1%)	18 (43.9%)			
	Health Records	26 (56.5%)	20 (43.5%)			
	Medical Lab Tech	12 (38.7%)	19 (61.3%)			
	Radiology	15 (50.0%)	15 (50.0%)			
	Others	49 (51.0%)	47 (49.0%)			
Residence	Within College Hostels	152 (54.3%)	128 (45.7%)	1.580a	3	.664
	Away from the hostel	20 (52.6%)	18 (47.4%)			
	Near private hostel	3 (50.0%)	3 (50.0%)			
	Prefer not to say	8 (72.7%)	3 (27.3%)			

Source: Primary Data

Table 3 showed that none of the sociodemographic predictor variables are significantly associated with the outcome variable of depression (p>.05).

Association of Anxiety and Socio-Demographic Factors

Table 4. Association of Prevalence of Anxiety and Socio-Demographic Factors

		Anxiety				
		No	**Yes**	**X**	**DF**	**Sig.**
Gender	Male	57 (38.3%)	92 (61.7%)	4.923a`	1	.018
	Female	50 (26.9%)	136 (73.1%)			
Religion	Christianity	79 (32.0%)	168 (68.0%)	.022a	2	.989
	Islam	14 (32.6%)	29 (67.4%)			
	Others	14 (31.1%)	31 (68.9%)			
Age	Prefer Not to say	0 (0.0%)	3 (100.0%)	2.775a	3	.428
	14-24 Years	99 (33.1%)	200 (66.9%)			
	25-31 Years	8 (25.0%)	24 (75.0%)			
	40 years and above	0 (0.0%)	1 (100.0%)			
Course of Study	Nursing	21 (34.4%)	40 (65.6%)	4.426a	6	.619
	Pharmacy	13 (43.3%)	17 (56.7%)			
	Clinical Medicine	14 (34.1%)	27 (65.9%)			
	Health Records	12 (26.1%)	34 (73.9%)			
	Medical Lab Tech	8 (25.8%)	23 (74.2%)			
	Radiology	7 (23.3%)	23 (76.7%)			
	Others	32 (33.3%)	64 (66.7%)			
Residence	Within College Hostels	94 (33.6%)	186 (66.4%)	4.273a	3	.233
	Away from the hostel	8 (21.1%)	30 (78.9%)			
	Near private hostel	3 (50.0%)	3 (50.0%)			
	Prefer not to say	2 (18.2%)	9 (81.8%)			

Source: Primary Data

Table 4 showed that gender and risk factors from the predictor variables are significantly associated with the outcome variable of anxiety ($p<.05$). There were more females with anxiety compared to males, 136 (73.1%), and risk factors had peer pressure 35 (81.4%) being the highest predictive variable on anxiety among the participants.

Association of Stress and Socio-Demographic Factors

Table 5. Association of Prevalence of Stress and Socio-Demographic Factors

		Stress				
		No	**Yes**	**X**	**DF**	**Sig.**
Gender	Male	149 (100.0%)	0 (0.0%)	1.612a	1	.308
	Female	184 (98.9%)	2 (1.1%)			
Religion	Christianity	246 (99.6%)	1 (0.4%)	2.415a	2	.299
	Islam	43 (100.0%)	0 (0.0%)			
	Others	44 (97.8%)	1 (2.2%)			
Age	Prefer Not to say	3 (100.0%)	0 (0.0%)	.242a	3	.970
	14-24 Years	297 (99.3%)	2 (0.7%)			
	25-31 Years	32 (100.0%)	0 (0.0%)			
	40 years and above	1 (100.0%)	0 (0.0%)			
Course of Study	Nursing	59 (96.7%)	2 (3.3%)	.242a	3	.970
	Pharmacy	30 (100.0%)	0 (0.0%)			
	Clinical Medicine	41 (100.0%)	0 (0.0%)			
	Health Records	46 (100.0%)	0 (0.0%)			
	Medical Lab Tech	31 (100.0%)	0 (0.0%)			
	Radiology	30 (100.0%)	0 (0.0%)			
	Others	96 (100.0%)	0 (0.0%)			
Residence	Within College Hostels	280 (100.0%)	0 (0.0%)	15.725a	3	.001
	Away from the hostel	36 (94.7%)	2 (5.3%)			
	Near private hostel	6 (100.0%)	0 (0.0%)			
	Prefer not to say	11 (100.0%)	0 (0.0%)			

Source: Primary Data

Table 5 showed that none of the predictor variables are significantly associated with the outcome variable of stress ($p>.05$) apart from residence ($p<.05$) with medical students who stay away from hostel having more stress compared to others.

Discussion

The study investigated the prevalence of mental health distresses among medical students at the Kenya Medical Training College, Nairobi Campus which covers areas of mental distress such as depression, anxiety and stress. The findings showed that medical school is in fact, a high pressure and overwhelming environment with prevalence of ranging from mild, 143 (42.7%) to moderate, 9(2.7%) depression and majority of the participants had anxiety ranging from mild, 131 (39.1%, moderate, 93 (27.8%), severe, 4 (1.2%) and with stress levels of mild 333 (99.4%) followed by moderate, 2 (.6%). The current study revealed that the prevalence of mental distresses found at 45.4% for depression, 68.1% for anxiety and 100.0% for stress which

confirms the increasing prevalence of mental health distresses across Medical Students not only in Kenya but across the world [12, 11], 2014). In Kenya, a very recent study showed increasing prevalence of mental distress among students, one among the few studies conducted in a university in Nairobi Region found the prevalence of depression to be 35.7% [17].

Similar studies carried out in institutions of learning in Kenya found high return rates of up to 100% [18] while that from a medical University in Karachi was 90% [19]. The reported higher prevalence of anxiety in the present study as against the higher prevalence of depression as reported in a similar study in Kenya by [20] probably overstates the case for anxiety and understates for depression. Anxiety symptoms are possibly more likely to precede depressive symptoms than the reverse as stated by Leadbeater [21, 20] in Kenya in a study that determine comorbidity of depression and anxiety among students at the Kenya Medical Training College, found that 18.4% and 20.2% of group A and B respectively had moderate depression while 48.5% and 45.8% respectively had severe depression. The equivalents for anxiety in groups A and B were 24.4% and 23.6% for moderate anxiety and 32.1% and 31.5% for severe anxiety. There was a higher rate of depression and anxiety in the second year; with a statistically significant association between depression and anxiety and the year of study in the two groups. Results on a study on prevalence of depression and anxiety among medical college students in a Pakistan University found that 70% of the respondents suffered anxiety and depression which is consistent with what was found in other similar studies [18-20].

Medical students are in Kenya are likely exposed. The researchers in these studies concluded that new life styles, financial challenges, academic challenges which posed a challenge to them and likely to precipitate them to developing anxiety, depression and stress. Similar studies explained that the high levels of severe depression and anxiety found among student respondents could be explained by the fact that students have to deal with unique stressors such as new lifestyles and cultures, new friends and exposure to alternative ways of thinking. This is because these encounters required them to develop new strategies to cope with the new situations as they progressed in their professional training and adjust to the new lifestyles different from their socializations. Those who could not cope were likely to struggle and become susceptible to anxiety and/or depression [22].

In a similar study to investigate prevalence of depression, anxiety and their associated factors.among medical students in Karachi, a high prevalence, 70%, of anxiety and depression was found among the respondents. Results indicated that the precipitating causes were not exclusively academic but included psycho-stressors like loss, relationship problems, residence and substance abuse among others [23].

The increasing prevalence of mental distress among medical students is a concerning issue that has garnered significant attention in recent years. With a systematic review of 54 studies that found that 27.2% of medical students experienced depression, 33.5% experienced anxiety, and 11.1% experienced suicidal ideation [23], and another study which found 4,897 medical students from 49 medical schools in the United States alone reporting that 63.4% experienced burnout, 42.3% experienced depression, and 11.3% experienced suicidal ideation [24], the findings of the prevalence of mental distress among Kenyan Medical students corroborates other literatures of the increasing trends in mental distress.

Depression, anxiety, and stress are debilitating conditions that can impairs the functioning of the medical students and if left unmanaged, they affect their general functioning which makes it hard for them to perform everyday tasks completely,

competently and efficiently as well as their general well-being, productivity and quality of life in relation to themselves and others [25, 26]. The average age of onset for many mental health conditions is the typical college age of 18-24 years which is contributed to by the many first encounters in life with common stressors including adjustment to college environment, educational debt, heavy workload, sleep deprivation, difficult patients, poor learning environments, financial concerns, information overload and career planning, new friendships, distance from parents, new cultures and alternative ways of thinking [20, 27, 28, 30].

In other parts of the world, their findings are consistent on the increasing prevalence of psychological distress among medical students. Anxiety was the most prevalent psychological distress among medical students in West Indies University, Saint Augustine, with 63% of them having anxiety symptoms [3]. Depression was found to be the second most common psychological distress, with a prevalence of 51%, while 48% of the students suffered from stress. Medical students face tremendous pressure because of the enormous workload and academic demands that are required during their long course of studying. The continuous and challenging learning experiences that students come across during medical training may, in some cases, result in psychological distress among students. Psychological distresses among medical students have a negative impact on students' academic and personal lives, such as increased drop-out rates from medical school, poor academic performance, broken relationships, loneliness, poor sleep, substance abuse, and suicide. This finding is further corroborated by findings across the world [3, 29, 27].

These stressors can lead to catastrophic consequences on the medical students as found in this study such as anxiety, depression, and stress. While the existence of depression, anxiety and stress cannot be completely wipe out in the lives of medical students undertaking medical training, it is crucial to put in place measures that reduces the effects to the barest minimum [30]. These can only be achieved through early screening and treatment. Studies have documented that at the start of medical school, medical students have mental health similar to their nonmedical peers, however, students' mental health worsens during the medical training [31], as such, a need for urgent intervention, so as to produce a crop of medical professionals that will be able to meet the increasing health demands in Kenya and across the world.

Conclusion

The study on the prevalence of mental health distresses among students at the Kenya Medical Training College, Nairobi Campus, reveals alarming rates of mental health issues. Key findings included the high prevalence of mental health distresses with risk factors including academic pressure, depression, peer pressure, family problems, financial pressure, break-ups, drug addiction, and medical conditions. Also, being a female student, was also found to make the students more vulnerable to developing mental distress. The findings therefore call for an urgent need for institutional support and interventions that will address academic and socio-economic factors as well as the need for mental health education, awareness, and stigma reduction. Learning environments are expected to made conducive in such a way that students can cope and thrive in their training to become healthcare professionals that will help in meeting the health needs of Kenyans, Africa, and the world at large. That can only be made possible when the students are able to manage the daily stresses that comes from the pressure of the medical school. As the saying always go, there is no health without mental health, as such, the need to prioritize the health of healthcare providers in-training who will contribute to the growth of the nation. Mental health is a critical aspect of overall well-being. Addressing mental health distresses among

students is essential for their academic success, personal growth, and future professional endeavors.

Recommendation

Based on the outcome of this study, some recommendations to address mental health distresses among students at the Kenya Medical Training College, Nairobi Campus were made as follows:

1. Medical schools should ensure that mental health units or counseling center are established on campus to help in early identification and intervention of mental health distresses among medical students. This will also assist in the development and implementation of stress management programs and provide mental health education and awareness campaigns in the school environment.
2. A review and adjustment of academic workload and expectations should be made where flexible academic scheduling for students is made possible.
3. There is an urgent need for peer support groups and mentorship programs to assist students to build resilience.

Ethical Approvals and Consent

Ethical approval was obtained from the Texila American University Ethics and Review Committee (ERC), Jaramogi Oginga Odinga University of Science and Technology (JOOUST) and The Kenya's National Council for Science and Innovation (NACOSTI). All participants gave written informed consent before answering the questionnaires. All methods including participant recruitment and consent taking, data collection, data handling, and analysis were performed in accordance with relevant guidelines and regulations.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are not publicly available because no permission had been granted from participants and the college students (where the study was conducted) to publish datasets publicly. The authors also intend to further explore the data to generate more insights/findings and publish those new insights/findings. The data are available from the corresponding author on reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Population Perception of Climate Change and its Effects on Health in the Biyem Assi Health District, Cameroon

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Abstract

Climate change is posing growing threats to global public health and security of the vulnerable population. The adverse effects on human health are enormous and understanding factors associated with awareness and its health impacts is essential for effective public health communication and intervention. A descriptive cross-sectional study was conducted to assess population perception of climate change and its effects on human health in the Biyem Assi Health District. Sociodemographic variables, environmental factors, and access to information and resources were analyzed using descriptive statistics and inferential tests, including chi-square and multivariate logistic regression. Majority of respondents (96.2%) were aware of climate change. Awareness was significantly higher among individuals under 40 years ($p = 0.003$), those with higher education levels, and those exposed to climate-related health or environmental effects. Awareness was also significantly associated with understanding of its consequences, such as heatwaves, flooding, water scarcity, and local weather variability (all $p < 0.05$). Perception that climate change affects health was significantly associated with gender ($p = 0.000$), with all male respondents affirming the link compared to 81% of females. Respondents who believed in the health impacts of climate change were significantly more likely to report issues such as respiratory diseases, vector-borne illnesses, and diarrhoea (all $p = 0.000$). Climate change awareness in the study population is high but shaped more by informed perception, trusted information sources than by demographic characteristics. Public health strategies should prioritize accessible, community-based education that links climate change to health outcomes.

Keywords: *Change, Climate, Health, Perception, Population.*

Introduction

Climate change is widely acknowledged as the greatest health threat of the 21st century, exerting profound and wide-ranging effects on human health globally [1]. Irrespective of geographic location, no region is immune from its consequences, making it a pressing concern for global public health and security. The urgency of addressing climate change has gained significant traction in both media and policy spheres, emphasizing its prominence on international public health agendas. The World Health Organization (WHO) reinforced this stance by selecting “Protecting Health from Climate Change” as the theme for World Health Day, further demonstrating the global consensus on the need for immediate action [2].

Historically, the health impacts of climate change were recognized relatively late in climate science and policy discussions [3]. Climate change refers to long-term shifts in temperature and weather patterns, increasingly driven by anthropogenic activities. Chief among these are the burning of fossil fuels, deforestation, and large-scale land use changes, which contribute to greenhouse gas (GHG) emissions and the accumulation of heat in the Earth's atmosphere [4]. These human-induced processes have raised global temperatures by approximately 1.1°C above pre-industrial levels, with further

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increases projected under current emission trends [5]. These changes disproportionately affect vulnerable populations, especially in low- and middle-income countries, exacerbating pre-existing social and economic inequalities.

The health impacts of climate change are both direct and indirect, and require urgent intervention [6]. Direct effects include injuries, heat-related illnesses, and fatalities from extreme weather events such as floods, droughts, and heatwaves. Indirect effects are equally dangerous, encompassing shifts in the patterns of vector-borne diseases (e.g., malaria, dengue), reductions in air and water quality, food insecurity, and mental health disorders [7]. According to WHO projections, climate change could cause an additional 250,000 deaths annually between 2030 and 2050 due to heat stress, malnutrition, malaria, and diarrhea [8].

Public awareness and perception play a critical role in shaping adaptive strategies and influencing policy responses to climate change [9]. In Cameroon, often referred to as "Africa in miniature" for its ecological diversity, the effects of climate change are increasingly visible. The northern regions suffer from chronic droughts, while coastal and highland areas face frequent floods and landslides [10]. Forests covering nearly 40% of the country are vital for the livelihoods of millions who depend on them for food, medicine, and fuel. Yet, rising temperatures and erratic rainfall patterns threaten these resources and exacerbate vulnerabilities among rural populations [11].

Women in Cameroon, who constitute over 75% of the agricultural workforce, are especially impacted, as climate-induced changes undermine their roles in food production and informal trade, thereby deepening gender inequalities and economic insecurity [12]. Additionally, the increasing unpredictability of seasonal cycles and the intensification of extreme weather events underscore the urgency of climate-responsive health interventions.

Despite mounting evidence, climate change remains abstract or distant to many individuals. This psychological distancing can be exacerbated by media portrayals that prioritize political narratives over localized impacts [13]. Understanding how the public perceives climate change and its health implications is crucial for promoting effective communication, policy formulation, and community resilience. In Cameroon, recent studies show that while awareness is growing, there remains a significant gap in understanding the root causes and health-related consequences of climate change [14].

Vector-borne diseases such as malaria and dengue are particularly sensitive to climatic variability. Research highlights how changes in temperature and precipitation influence the geographic distribution and seasonality of disease vectors, posing serious challenges for public health systems in Africa [15]. Additionally, Cameroon has experienced an increase in extreme weather events. A notable example includes a deadly landslide in 2024 triggered by torrential rains, underscoring the immediate threat posed by climate-driven disasters [16].

Addressing the complex health challenges posed by climate change in Cameroon necessitates integrated approaches—spanning public education, health system strengthening, disease surveillance, and disaster preparedness. These efforts must aim to foster resilience, especially among the most vulnerable populations, while promoting sustainable development and environmental stewardship.

Materials and Methods

This study was conducted in Yaoundé, the political and administrative capital of Cameroon. Located on a hilly, forested plateau between the Nyong and Sanaga Rivers in the south-central region of the country, Yaoundé is the second-largest city in Cameroon, with a population estimated at 4,509,000 as of 2023. The city functions as a major administrative, commercial, and service centre, as well as a hub for road, rail, and air transport. It hosts several

small and medium-sized industries, including a brewery, cigarette factory, sawmills, and printing presses. Yaoundé also serves as a central market for a rich agricultural region, with a significant portion of the population engaged in subsistence farming and timber processing.

Yaoundé experiences a tropical climate moderated by its altitude, with four distinct seasons: spring (March 1 to May 31), summer (June 1 to August 31), autumn (September 1 to November 30), and winter (December 1 to January 28).

The objective of this study was to assess public perceptions of climate change and its impact on health in the Biyem-Assi Health District. The study specifically examined population awareness of climate change, its perceived health effects, and measures taken to prevent climate-related health risks.

A descriptive cross-sectional study design was adopted. The target population included all residents of the Biyem-Assi Health District aged 18 years and above who had resided in the area for at least six months. Individuals under 18 years of age or who had lived in the district for less than six months were excluded.

Systematic random sampling was employed. A random starting point was selected, and data were collected from every second household. A total of 400 participants were recruited for the study. Data were collected using a structured, closed-ended questionnaire. Literate participants completed the questionnaire independently, while for those unable to read or write due to limited education or health conditions, the investigator administered the questionnaire orally and recorded the responses.

A pilot test of the questionnaire was carried out in the Effoulan Health District, which shares similar demographic characteristics with Biyem-Assi, to assess the tool's reliability and clarity.

Data were entered and analyzed using SPSS version 25. Results were categorized and summarized in tables for presentation.

Ethical approval for the study was obtained from EXHIST University. Informed written consent was obtained from all literate participants. For participants unable to read or write, the purpose of the study was clearly explained in the local language, and verbal consent was obtained.

While the findings can provide insights applicable to the broader Yaoundé population, limitations such as the city's expansive size, challenging topography, and budget constraints restricted the study to the Biyem-Assi Health District

Results

According to table 1 below, the majority of respondents were female (65.8%), while males made up 34.3%. Most were single (70.5%), followed by married individuals (29.5%). In terms of age distribution, the largest group was above 40 years old (63.5%), and the minority (36.5) were below 40 years. Regarding education, a significant portion had gotten a level of former education (94.3%), while 5.7% had no formal education. In terms of income, most respondents fell within the income range of 51,000-200,000 (50.8%), while 45.5% earned 50,000 or less. Only 3.7% earned above 201,000.

Table 1. Demographic Characteristics of Respondents

Variables		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Gendered	Male	137	34.3	34.3	34.3
	Female	263	65.8	65.8	100.0
	Total	400	100.0	100.0	
Marital status	Married	118	29.5	29.5	29.5
	unmarried	282	70.5	70.5	100.0

	Total	400	100.0	100.0	
Age in range	< 40	146	36.5	36.5	36.5
	>40	254	63.5	63.5	100.0
	Total	400	100.0	100.0	
Level of education	No formal education	23	5.7	5.7	5.7
	formal education	377	94.3	94.3	100.0
	Total	400	100.0	100.0	
Level of income	< 50000	182	45.5	45.5	45.5
	51000-200000	203	50.8	50.8	96.3
	>201000	15	3.7	3.7	100.0
	Total		100.0	100.0	

Source: *Author's Survey data, 2025*

The majority of the respondents (385) as shown in table 2 below acknowledged that they were aware of climate change (96.3%). This could be as a result of the higher level of education of most respondents. A very few of them (15) making up 3.7% of the respondents were ignorant about climate change. This study is in line with a study carried out by Lee et al., (2015), and Pew Research Center (2021), where they found out that most people across nations are aware of climate change and awareness is generally higher among educated individuals than the non-educated.

Table 2. Climate Change Awareness

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Aware of climate change	Yes	385	96.3	96.3	96.3
	No	15	3.7	3.7	100.0
	Total	400	100.0	100.0	

Source: *Author's Survey data, 2025*

According to table 3 below, 291 respondents (92.4%) were aware of climate change while 24 of them did not know anything concerning climate change making 7.6% of the respondents.

Table 3. Climate Change Affecting Health

Variable		Frequency	%	Valid %	Cumulative %
Effects of climate change on health	No	31	7.8	7.8	7.8
	Yes	369	92.3	92.3	100.0
	Total	400	100.0	100.0	

Source: *Author's Survey data, 2025*

The table 4 below is a cross-tabulation of awareness of climate change (Yes/No) across various independent variables like gender, education, age. From the table above the dependent variable was awareness of climate change and it depended on a number of factors or variables. Several variables were

significantly associated with the awareness of climate change.

Among respondents of ages below 40, 98.43% showed significantly greater awareness of climate change than their counterpart 40 years and above where 92.47% of them were aware of climate change (p-value = 0.003). older respondents were therefore significantly more aware of climate change.

The participants were able to identify the definition of climate change as long term in temperature and weather pattern (*p-value = 0.03) and change in rain fall pattern (p-value = 0.03). 97.54% of the respondents identified climate change as long-term shift in temperate and weather pattern while 93.1% of all the respondent believed change in rain fall pattern better defined climate change.

The potential consequences of climate change were more understood by the population as heat wave (p = 0.009), flooding with strong awareness (p- value = 0.000). local weather changes with very strong association between climate change and awareness (p-value = 0.000). the respondents also knew that decrease in crop yield (p-value = 0.000) and increased water scarcity (p-value = 0.02) were all link to climate change awareness. The results showed that respondents who were aware of a particular consequence of climate change were more likely to be aware of all the other consequences.

According to participants, causes of climate change were significantly associated to climate change awareness. Understanding human-caused drivers of climate change such as burning of fossil fuels (p-valued = 0.012), Deforestation (p = 0.028), Surface temperature changes (p = 0.019) are all linked to climate change awareness.

From the results, most respondents were able to correctly identify carbon dioxide (p = 0.000 as the main greenhouse gas likely to cause climate change.

Many respondents had as their source of information the family (p-0.021) and NGO's (p- 0.001) showing that these were effective communication channels.

The various perceived health effects of climate change were are significantly associated to climate change. Perceived health effect (p- 0.033), vector-borne diseases awareness (0.001), poor air quality (p-0.052), poor water quality (p- 0.045), personal actions to protect health (p = 0.021). this showed that people who believed that climate change could affect their health were more aware and those who took action to protect their health from climate change were more aware of climate change than the others.

Concerning access to resources, access to clean air (p = 0.029), clean water (p = 0.032), and healthcare (p = 0.032) were positively associated with climate change awareness.

Demographic variables like gender, marital status, formal education, and other health problems like mental health, diarrhoea, malnutrition did not show any statistically significant differences in the awareness of climate change. This showed that climate change awareness does not depend only on demographic characteristics but more on perception and access to information.

The results suggest that improving public understanding of the causes and consequences of climate change, especially through trusted sources like family or NGOs, may be key to boosting awareness. Strategies that connect climate change to health impacts and local realities may be particularly effective for outreach and education.

Table 4. Bivariate Analysis between Awareness of Climate Change and the Independent Variables

Aware of climate change						**CI (95%)**	**P value**
variable	**categories**	**yes**	**%**	**No**	**%**		
Gender	Male	133	97.08%	4	2.92%		0.528

	Female		252	95.82%	11	4.18%	0.594-0.372	
Marital status	Married		114	96.61%	4	3.39%	1.000-0.532	0.806
	Unmarried		271	96.1%	11	3.90%		
Age range	< 40		135	92.47%	11	7.53%	0.004-0.004	**0.003***
	<40		250	98.43%	4	1.57%		
Level of education	No formal education		23	100%	0	0.00%	0.615-0.405	0.330
	Formal education		362	96.02%	15	3.98%		
Definition of climate change	Long term shift in temperature/ whether pattern	No	108	93.1%	8	6.90%	0.044-0.038	**0.03***
		Yes	277	97.54%	7	2.46%		
	Change in rain pattern	No	277	97.54%	7	2.46%	0.044-0.038	**0.03***
		Yes	108	93.1%	8	6.90%		
Potential consequences of climate change	Heat waves	No	264	100%	0	0.00%	0.007-0.004	**0.009***
		Yes	121	88.97%	15	11.03%		
	Drought	No	59	93.65%	4	6.35%	0.270-0.198	0.237
		Yes	326	94.77%	18	5.23%		
	Flood	No	67	89.33%	8	10.67%	0.002-0.002	**0.000***
		Yes	318	97.85%	7	2.15%		
	Change in local weather patten	No	194	92.82%	15	7.18%	0.000-0.000	**0.000***
		Yes	191	100%	0	0.00%		
	Increase crop yield	No	366	96.06%	15	3.94%	0.631-0.475	0.378
		Yes	19	100%	0	0.00%		
	Decrease crop yield	No	204	93.15%	15	6.85%	0.000-0.000	**0.000***
		Yes	181	100%	0	0.00%		
	Increase water scarcity	No	237	94.05%	15	5.95%	0.02-0.01	**0.02***
		Yes	148	100%	0	0.00%		
Causes of climate change	Burning of fossil fuel	No	181	93.78%	12	6.22%	0.016-0.011	**0.012***
		Yes	204	98.55%	3	1.45%		
	Deforestation	No	36	90%	4	10.00%	0.052-0.052	**0.028***
		Yes	349	96.94%	11	3.06%		
	Volcanic eruption	No	312	95.41%	15	4.59%	0.084-0.046	0.062
		Yes	73	100%	0	0.00%		
	Change in surface temperature	No	281	94.93%	15	5.07%	0.030-0.010	**0.019***
		Yes	104	100%	0	0.00%		
Most common greenhouse gas	carbondioxide	No	54	87.1%	8	12.90%	0.001-0.001	**0.000***
		Yes	331	97.93%	7	2.07%		
	Water vapor	No	358	95.98%	15	4.02%	0.416-0.344	0.288
		Yes	27	100%	0	0.00%		
Source of information	Social media	No	56	93.33%	4	6.67%	0.257-0.174	0.197
		Yes	329	96.76%	11	3.24%		
	Family	No	283	94.97%	15	5.03%	0.029-0.011	**0.021***
		Yes	102	100%	0	0.00%		
	Health personnel	No	325	95.59%	15	4.41%	0.141-0.083	0.097
		Yes	60	100%	0	0.00%		

	NGOs	No	213	93.42%	15	6.58%	0.001-0.000	**0.001***
		Yes	172	100%	0	0.00%		
Degree of effects on health	Not at all		37	90.24%	4	9.76%	0.056-0.056	0.033*
	Very much		348	96.94%	11	3.06%		
Effects on crops	High crop yield		16	100%	0	0.00%	0.652-0.536	0.420
	Low crop yield		369	96.09%	15	3.91%		
Effects on environment	Flood	No	16	100%	0	0.00%	0.652-0.536	0.420
		Yes	369	96.09%	15	3.91%		
	Land slide	No	89	89%	11	11.00%	0.186-0.101	0.126
		Yes	296	98.67%	4	1.33%		
	drought	No	62	93.94%	4	6.06%	0.286-0.223	0.280
		Yes	323	96.71%	11	3.29%		
Specific health problems due to climate change	Respiratory	No	199	94.76%	11	5.24%	0.118-0.082	0.100
		Yes	186	97.89%	4	2.11%		
	Water/food borne diseases	No	160	95.24%	8	4.76%	0.428-0.259	0.365
		Yes	225	96.98%	7	3.02%		
	Vector borne disease	No	74	90.24%	8	9.76%	0.004-0.004	**0.001***
		Yes	311	97.8%	7	2.20%		
	Mental health	No	190	95.96%	8	4.04%	0.798-0.484	0.762
		Yes	195	96.53%	7	3.47%		
	Diarrhoea	No	200	96.15%	8	3.85%	1.000-0.564	0.916
		Yes	185	96.35%	7	3.65%		
	Malnutrition	No	185	95.85%	8	4.15%	0.795-0.444	0.688
		Yes	200	96.62%	7	3.38%		
	Poor air quality	No	184	94.36%	11	5.64%	0.066-0.045	**0.052***
		Yes	201	98.05%	4	1.95%		
	Poor water quality	No	181	94.27%	11	5.73%	0.063-0.040	**0.045***
		Yes	204	98.08%	4	1.92%		
	Specific action to protect health	No	219	98.21%	4	1.79%	0.031-0.020	**0.021***
		Yes	166	93.79%	11	6.21%		
	Community doing enough to protect health	No	48	92.31%	4	7.69%	0.116-0.116	0.109
		Yes	337	96.84%	11	3.16%		
Access to resources to protect health	Clean air	No	291	95.1%	15	4.90%	0.027-0.017	**0.029***
		Yes	94	100%	0	0.00%		
	Clean water	No	107	93.04%	8	6.96%	0.042-0.036	**0.032***
		Yes	278	91.76%	7	8.24%		
	Health care	No	231	95.45%	11	4.55%	0.442-0.224	**0.032***
		Yes	154	97.47%	4	2.53%		

Source: *Author's Survey data, 2025*

Gender was found according to table 5 below to be significantly associated with the fact that climate change affects health (p = 0.000). a high significant difference existed between gender. All male respondents (100%) agreed with this perception, compared to 81% of females who

were for the fact that climate change affect health.

On the contrary, age group (p = 0.513), marital status (p = 0.4467), and education level (p = 0.530) did not show statistically significant associations with climate change affecting health.

Respondents who were aware of climate change were significantly more likely to remark climate change as a health issue (p = 0.005). A significant relationship was also seen between climate change affecting health and respondent who correctly identified climate change as a long-term shift in temperature and weather patterns or as a change in rainfall patterns (p = 0.000 for both).

A majority of respondents showed a statistically significant relationship and affirmed climate change had 'very much' affected their health (p = 0.000). the study equally found out that there was a strong association with specific health problems attributed to climate change like respiratory diseases, water/food-borne diseases, vector-borne diseases, diarrhoea, and poor air quality (all p = 0.000). However, mental health (p = 0.806), malnutrition (p = 0.696), and poor water quality (p = 0.055) were not statistically significant.

With variables concerning the environment, drought was found to be significantly associated with what the respondent perceived as health effect of climate change (p = 0.000). Flooding as an effect of climate change on the environment (p = 0.050) was towards significance.

Increased or decreased crop yields with p = 0.195 and p = 0.255, respectively were not significantly associated with the belief that climate change has an effect on health.

Respondents who reported taking personal health protection measures due to climate change were significantly more likely to perceive it as affecting health (p = 0.000).

Perception was not significantly influenced by the belief that the community is doing enough to protect public health (p = 0.987).

No significant association was found between access to clean air (p = 0.147), clean water (p = 0.202), or healthcare (p = 0.925) and the belief that climate change effects health.

Table 5. Bivariate Analysis between Effect of Climate Change on Health and the Independent Variables

Climate change affecting health					**CI**	**P-value**
Variables	**Categories**		**No**	**Yes**		
Gender		Male	0	137	0.000-0.000	**0.000***
		Female	31	132		
Marital status		Married	11	107	0.538-0.284	0.4467
		Unmarried	20	262		
Age range		< 40	13	133	0.562-0.319	0.513
		≥40	18	236		
Level of education		No formal education	1	22	0.712-0.452	0.530
		Formal education	30	247		
Awareness of climate change		No	27	358	0.022-0.022	**0.005***
		Yes	4	11		
Definition of climate change	Long term shift in temperature/ change in weather pattern	No	19	97	0.000-0.000	**0.000***
		Yes	12	272		

	Change in rain pattern	No	12	272	0.000-0.000	**0.000***
		Yes	19	97		
Degree of effects on health		No at all	11	30	0.000-0.000	**0.000***
		Very much	20	339		
Specific health problem due to climate change	Respiratory diseases	No	31	179	0.000-0.000	**0.000***
		Yes	0	190		
	Water/food borne diseases	No	24	144	0.000-0.000	**0.000***
		Yes	7	225		
	Vector borne diseases	No	16	66	0.000-0.000	**0.000***
		Yes	15	303		
	Mental health	No	16	182	0.853-0.477	0.806
		Yes	15	187		
	Diarrhoea	No	27	181	0.000-0.000	**0.000***
		Yes	4	188		
	malnutrition	No	16	177	0.713-0.419	0.696
		Yes	15	192		
	Poor air quality	No	27	168	0.000-0.000	0.000*
		Yes	4	201		
	Poor water quality	No	20	172	0.62-0.42	0.055
		Yes	11	197		
Effects on crops	Increase crop yield	No	31	350	0.383-0.208	0.195
		Yes	00	19		
	Decrease crop yield	No	20	199	0.268-0.171	0.255
		Yes	11	170		
Effects on environment	flood	No	12	85	0.078-0.046	**0.050***
		Yes	19	284		
	Land slide	No	19	197	0.456-0.256	0.396
		Yes	12	172		
	Drought	No	19	47	0.000-0.000	**0.000***
		Yes	12	322		
Specific action to protect health		No	08	215	0.001-0.000	**0.000***
		Yes	23	154		
community doing enough to protect health		No	04	48	1.000-0.624	0.987
		Yes	27	321		
Access to resources to protect your health	Clean air	No	27	279	0.187-0.106	0.147
		Yes	04	90		
	Clean water	No	12	103	0.218-0.143	0.202
		Yes	19	266		
	Healthcare	No	19	223	1.000-0.543	0.925
		yes	12	146		

Source: *Author's Survey data, 2025*

A multivariate analysis was conducted on the various significant variables and the results and presented on the tables below.

Table 6 below shows statistically significant association between climate change awareness which is the dependent variable and other independent variable. In almost all the significant cases, a noticeable higher percentage were aware of climate change.

A great majority of participants under the age of 40 years (98.43%) were more likely to be aware of climate change than those above 40years (92.47%) (p = 0.003). Younger individuals are therefore significantly more aware of climate change than older ones.

Awareness of climate change levels were significantly associated with participants' definitions of climate change. Respondents who recognized climate change as a long-term shift in temperature and weather patterns had higher awareness (97.54%) than those who did not (93.1%) (p = 0.034). Conversely, those who identified change in rain pattern as the main feature were less aware (93.1%) than those who did not (97.54%), also statistically significant (p = 0.034).

Specific consequences of climate change as recognized by participants was strongly associated with awareness. Awareness was seen to be highest among respondents who acknowledged changes in local weather patterns (100%) (p= 0.000), decreased crop yields (100%) (p= 0.000), increased water scarcity (100%) (p= 0.02), and floods (97.85%) (p= 0.000). Lower awareness was observed among those who did not recognize these consequences, with differences statistically significant across all items ($p < 0.05$). Interestingly, those who did not link climate change to heat waves showed complete awareness (100%) compared to 88.97% among those who did, possibly due to misclassification or misunderstanding.

There was a high significant association with human driven causes of climate change and awareness. Majority of the respondents could identify fossil fuel combustion (98.55%) (p = 0.012), deforestation (96.94%) (p = 0.028), change in surface temperature (100% (p = 0.019). the identification of key causes of climate change like fossil fuels or deforestation is strongly tied to overall climate change awareness.

There was a strong correlation observed between identifying carbon dioxide as the most common greenhouse gas and awareness of climate change. Participants who correctly identified CO_2 showed 97.93% awareness, compared to 87.1% among those who did not (p = 0.000). This emphasizes the role of foundational scientific literacy in climate education.

Information access through family members and NGOs showed a significant impact. There was 100% awareness among those informed by family vs. 94.97% otherwise (p = 0.021). NGOs equally scored a 100% awareness for those informed by them vs. 93.42% (p = 0.001).

Respondents who reported health effects due to climate change had higher levels of awareness of the effect of climate change on health. Those perceiving vector-borne diseases, poor air quality, or poor water quality as linked to climate change showed significantly greater awareness ($p < 0.05$). Among those who felt climate change had not affected their health, awareness was lower (90.24%) compared to 96.94% in those reporting strong effects (p = 0.033).

Contrary to expectations, those who reported taking specific actions to protect their health from climate change were slightly less aware (93.79%) than those who had not (98.21%)—though the association was significant (p = 0.021). This may reflect action driven by other motivations (e.g., general health awareness) rather than direct climate knowledge.

Access to resources such as clean air, clean water, and health care also showed varying associations. Clean air showed 100% awareness vs. 95.1% (p = 0.029). Clean water showed 98.08% vs. 94.27% (p = 0.032). Health

care access was not significantly associated (p = 0.300). This suggests that environmental living conditions may foster awareness more than general healthcare access.

The results therefore revealed that awareness of climate change was significantly influenced by age, accurate scientific understanding, perception of its causes and consequences, and exposure to environmental health effects. Trusted information sources and resource availability further shape this awareness.

Table 6. Multivariate Analysis between Awareness of Climate Change and Various Independent Variables

Aware of climate change							**CI (95%)**	**P value**
variable	**Categories**		**yes**	**%**	**No**	**%**		
Age range		< 40	135	92.47%	11	7.53%	0.004-0.004	**0.003***
		<40	250	98.43%	4	1.57%		
Definition of climate change	Long term shift in temperature and whether pattern	No	108	93.1%	8	6.90%	0.044-0.038	**0.034***
		Yes	277	97.54%	7	2.46%		
	Change in rain pattern	No	277	97.54%	7	2.46%	0.044-0.038	**0.034***
		Yes	108	93.1%	8	6.90%		
Potential consequences of climate change	Heat waves	No	264	100%	0	0.00%	0.007-0.004	**0.009***
		Yes	121	88.97%	15	11.03%		
	Flood	No	67	89.33%	8	10.67%	0.002-0.002	**0.000***
		Yes	318	97.85%	7	2.15%		
	Change in local weather patten	No	194	92.82%	15	7.18%	0.000-0.000	**0.000***
		Yes	191	100%	0	0.00%		
	Decrease crop yield	No	204	93.15%	15	6.85%	0.000-0.000	**0.000***
		Yes	181	100%	0	0.00%		
	Increase water scarcity	No	237	94.05%	15	5.95%	0.02-0.01	**0.02***
		Yes	148	100%	0	0.00%		
Causes of climate change	Burning of fossil fuel	No	181	93.78%	12	6.22%	0.016-0.011	**0.012***
		Yes	204	98.55%	3	1.45%		
	Deforestation	No	36	90%	4	10.00%	0.052-0.052	**0.028***
		Yes	349	96.94%	11	3.06%		
	Change in surface temperature	No	281	94.93%	15	5.07%	0.030-0.010	**0.019***
		Yes	104	100%	0	0.00%		
Most common greenhouse gas	carbondioxide	No	54	87.1%	8	12.90%	0.001-0.001	**0.000***
		Yes	331	97.93%	7	2.07%		
	Family	No	283	94.97%	15	5.03%	0.029-0.011	**0.021***
		Yes	102	100%	0	0.00%		
	NGOs	No	213	93.42%	15	6.58%	0.001-0.000	**0.001***
		Yes	172	100%	0	0.00%		
Degree of effects on health		Not at all	37	90.24%	4	9.76%	0.056-0.056	0.033*
		Very much	348	96.94%	11	3.06%		
		No	74	90.24%	8	9.76%	0.004-0.004	**0.001***

	Vector borne disease	Yes	311	97.8%	7	2.20%		
	Poor air quality	No	184	94.36%	11	5.64%	0.066-0.045	**0.052***
		Yes	201	98.05%	4	1.95%		
	Poor water quality	No	181	94.27%	11	5.73%	0.063-0.040	**0.045***
		Yes	204	98.08%	4	1.92%		
	Specific action to protect health	No	219	98.21%	4	1.79%	0.031-0.020	**0.021***
		Yes	166	93.79%	11	6.21%		
Access to resources to protect health	Clean air	No	291	95.1%	15	4.90%	0.027-0.017	**0.029***
		Yes	94	100%	0	0.00%		
	Clean water	No	107	93.04%	8	6.96%	0.042-0.036	**0.032***
		Yes	278	91.76%	7	8.24%		
	Health care	On	231	95.45%	11	4.55%	0.442-0.224	0.300
		Yes	154	97.47%	4	2.53%		

Source: *Author's Survey data, 2025*

From the results on the table 7 below, males unanimously believed climate change has effects on health and a minority of the females (19%) do not. This difference is highly significant, suggesting gender plays a role in perception (P = 0.000).

There was a statistically significant between awareness of climate change and its effects on health. The majority of respondents (96.2%) were aware of climate change and equally believed that it had an effect on health (P= 0.005) while the minority had never heard of climate change and its effects on health.

A statistically significant association was found with the definition of climate change. Those who defined climate change as shifts in temperature or rainfall were more likely to believed it affects health. The stronger association with the long-term temperature shift suggests a more informed understanding correlates with health awareness (p = 0.000).

Respondents who feel climate change has significantly affected health overwhelmingly believe in its health impact (P = 0.000).

Belief in specific health consequences (respiratory, diarrhoea, vector/water-borne diseases) is strongly tied to the belief that climate change affects health. These perceptions likely stem from direct or community-level experiences (P = 0.000).

A marginal significant relationship was found in respondents who associated flood to climate change (P = 0.050). on the contrary there was a strong link between drought and effects of climate change on health (P = 0.000).

Those taking protective measures were significantly more likely to believe in climate-related health risks, likely driven by awareness and perceived vulnerability (P = 0.000).

Table 7. Multivariate Analysis between Effects of Climate Change on Health and Various Independent Variables

Climate change affecting health						
Variable	**Category**		**No**	**Yes**	**CI**	**P-value**
Gender	Male		0	137	0.000-0.000	**0.000***
	Female		31	132		
Awareness of climate change	No		27	358	0.022-0.022	**0.005***
	Yes		4	11		
		No	19	97	0.000-0.000	**0.000***

Definition of climate change	Long term shift in temperature and change in weather pattern	Yes	12	272		
	Change in rain pattern	No	12	272	0.000-0.000	**0.000***
		Yes	19	97		
Degree of effects on health		No at all	11	30	0.000-0.000	**0.000***
		Very much	20	339		
Specific health problem due to climate change	Respiratory diseases	No	31	179	0.000-0.000	**0.000***
		Yes	0	190		
	Water/food borne diseases	No	24	144	0.000-0.000	**0.000***
		Yes	7	225		
	Vector borne diseases	No	16	66	0.000-0.000	**0.000***
		Yes	15	303		
	Diarrhoea	No	27	181	0.000-0.000	**0.000***
		Yes	4	188		
	Poor air quality	No	27	`168	0.000-0.000	**0.000***
		Yes	4	201		
Effects on environment	flood	No	12	85	0.078-0.046	**0.050***
		Yes	19	284		
	Drought	No	19	47	0.000-0.000	**0.000***
		Yes	12	322		
Specific action to protect health		No	08	215	0.001-0.000	**0.000***
		Yes	23	154		

Source: *Author's Survey data, 2025*

Discussion

Several statistically significant factors associated with climate change awareness among participants were identified in this study. These include age, educational level, information sources, accurate knowledge of climate causes and consequences, and gendered perceptions of health impacts.

Age was a significant determinant of awareness; participants under 40 years old exhibited significantly higher levels of awareness ($p = 0.003$). This trend aligns with global findings where younger individuals tend to be more environmentally engaged, potentially due to greater exposure to climate content via education and digital platforms. Younger populations have also been found to express stronger intentions to participate in climate-positive behaviours [17].

Educational level also significantly influenced climate change awareness. Participants with formal education demonstrated greater awareness compared to those with no formal educational. This supports previous findings that higher education levels are associated with improved scientific literacy and environmental concern [18]. Formal education fosters the intellectual capacity needed to understand complex global issues like climate change.

Sources of information were another influential factor. Participants who cited family ($p = 0.021$) and NGOs ($p = 0.001$) as their primary sources of climate information were significantly more aware of climate change. These findings highlight the importance of trusted interpersonal and community networks in effective climate communication [19]. The

limited mention of governmental sources suggests a gap in national public sensitization efforts.

Awareness was also significantly associated with accurate identification of climate change causes and consequences. Respondents who correctly cited human activities like fossil fuel combustion ($p = 0.012$), deforestation ($p = 0.028$), and rising surface temperatures ($p = 0.019$) had significantly higher awareness. This corroborates findings from studies showing that understanding the mechanisms behind climate change is one of the strongest predictors of awareness and concern [20]. Likewise, awareness was higher among those recognizing key consequences such as flooding ($p = 0.000$), heatwaves ($p = 0.009$), and food insecurity.

Gender-based differences in awareness and health perception were also observed. All male respondents believed that climate change affects health, compared to 81% of female participants ($p = 0.000$). While global data often show that women express greater concern about environmental risks [21], this finding suggests localized gendered experiences may influence perceptions differently. Men are sometimes reported to show greater belief in environmental risk when framed in terms of health threats, whereas women often emphasize emotional or social vulnerability [22].

There was also a strong association between climate change awareness and perceived health impacts. Participants who believed climate change could affect health were more likely to take protective health measures ($p = 0.021$), supporting the theory that perceived personal health risks drive both awareness and adaptive behaviour [23, 24].

Moreover, awareness was significantly linked to specific perceived health threats such as vector-borne diseases ($p = 0.001$), poor air quality ($p = 0.052$), and poor water quality ($p = 0.045$). These findings reflect a growing body of literature connecting climate variability to health risks [25].

Environmental resource access also showed significant associations with awareness. Participants with access to clean air ($p = 0.029$), clean water ($p = 0.032$), and healthcare ($p = 0.032$) were more aware of climate change, reinforcing the idea that lived environmental realities may outweigh demographic predictors like marital status or education [26].

Interestingly, while men in this study were unanimously aware of the health impacts of climate change, only 81% of women agreed ($p = 0.000$). This contradicts broader research indicating that women are generally more environmentally concerned [21]. Such findings point to contextual differences possibly driven by gendered roles or information access.

Furthermore, participants who defined climate change as a long-term shift in temperature and weather patterns were significantly more aware ($p = 0.034$), reinforcing the role of scientific literacy in shaping environmental awareness [27].

Environmental stressors such as drought ($p = 0.000$) and flooding ($p = 0.050$) were also linked to increased perception of health impacts. These results echo studies showing that extreme weather events enhance public recognition of the health dimensions of climate change [28].

Multivariate analysis supported these findings: younger age ($p = 0.003$), recognition of anthropogenic drivers like fossil fuel use and deforestation, and understanding of CO_2 as a key greenhouse gas ($p = 0.000$) were strong predictors of awareness. These results emphasize the value of climate science literacy [29].

Lastly, the strong association between trusted information sources such as family and NGOs ($p = 0.021$ and $p = 0.001$, respectively) and awareness highlights the critical role of localized and personal communication strategies, especially in contexts of low institutional trust [30].

Conclusion

This study identified several significant predictors of climate change awareness, including age, educational level, accurate knowledge of causes and consequences, trusted sources of information, gendered health perceptions, and access to essential resources. Younger and more educated individuals demonstrated higher awareness, highlighting the roles of formal education in climate change awareness and effects on health. Accurate understanding of anthropogenic drivers and climate-related health threats also strongly influenced awareness. Furthermore, trusted community-based information sources like family and NGOs were more effective in raising awareness than institutional channels. The findings emphasize the need for targeted, gender-sensitive, and context-specific public education strategies that prioritize scientific literacy and leverage trusted social networks to enhance climate change awareness and health preparedness.

Overall, the findings emphasize that climate change awareness is influenced not just by demographic variables, but also by accurate scientific understanding, the relevance of information to lived experience, and trust in the source of information. Strategies aimed at improving awareness should thus consider both informational content and the channels through which it is delivered.

The results suggest that enhancing public understanding of climate change requires multidimensional strategies. These include integrating climate content into formal education, utilizing trusted communication networks such as family and NGOs, and ensuring scientific accuracy in public messaging. Moreover, acknowledging gender and age-specific communication preferences may enhance engagement and policy support.

Conflict of Interest

The author reports no conflict of interest in this study.

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Community Engagement for Malaria Elimination

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Abstract

More and more, Community Engagement (CE) is recognized as an important component of malaria elimination efforts. Findings from 22 peer-reviewed empirical studies published between 2015 and 2023, examining the role, impact, and challenges of CE in malaria programs worldwide are synthesized in this systematic review. The implementation of CE remains highly variable in both depth and effectiveness since it has been identified as indispensable for enhancing intervention uptake, program sustainability, and empowering affected communities. High-quality participatory CE which is characterized by collaboration, co-decision-making, cultural alignment, and capacity building, is consistently associated with improved health outcomes, including increased bed net usage, early malaria detection, and better treatment adherence. Still, many CE initiatives are undermined by short-term donor-driven agendas, restricted to superficial or tokenistic participation, lack of standardized evaluation frameworks, inadequate funding, and restricted community decision-making power. In other to achieve sustainable malaria elimination, the review pinpoints the urgent need for structural integration of CE into national strategies, emphasizing long-term partnerships, continuous funding, community leadership, and equity-focused frameworks.

Keywords: *Barriers, Community Engagement, Health Outcomes, Malaria Elimination, Participatory Approaches, Sustainability.*

Introduction

Malaria continues to pose a formidable challenge to global health, despite notable advances made over the past two decades. According to the World Health Organization [21], there were an estimated 247 million cases of malaria and over 600,000 deaths reported in 2021, with the vast majority of cases and fatalities occurring in sub-Saharan Africa and Southeast Asia. These figures underscore the enduring burden of malaria and the urgent need for sustained, multifaceted efforts to achieve complete elimination. While biomedical interventions, such as antimalarial drugs, insecticide-treated bed nets (ITNs), and indoor residual spraying (IRS), have been central to malaria control and elimination strategies, it has become increasingly evident that technical solutions alone are insufficient. Social and behavioral factors play a critical role in the success and sustainability of malaria programs, and Community Engagement has emerged as a vital, though often underutilized, component in this endeavor.

Since 2015, Community Engagement has been elevated as a strategic priority within major global health frameworks. The WHO's *Global Technical Strategy for Malaria 2016–2030* and the *Framework for Malaria Elimination* explicitly emphasize the importance of involving communities not merely as passive recipients of health services but as active partners in the design, delivery, and evaluation of interventions [20, 22]. CE encompasses a wide spectrum of participatory practices aimed at empowering local

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populations [8]. Describe CE as encompassing a range of activities, from basic dissemination of information and community mobilization efforts to more sophisticated forms of shared decision-making and co-implementation of health initiatives. Through these participatory approaches, CE aims to build long-term trust between communities and health systems, tailor interventions to local social, cultural, and ecological contexts, enhance surveillance mechanisms through community-based reporting, and address persistent access and equity barriers.

Despite the increasing recognition of its importance, the integration of CE into malaria elimination programs has been uneven and, in many cases, inadequately documented. Engagement often fluctuates along a continuum, from superficial, one-way communication to deeper, collaborative models where communities are genuinely empowered to influence outcomes [19] and [15] caution that many programs fall short of meaningful engagement, operating instead at a tokenistic level where community input is solicited but rarely acted upon. In such instances, CE is treated as an ancillary activity rather than a central pillar of malaria elimination strategies. This superficiality limits the potential of CE to address deeper systemic and behavioral barriers that impede progress toward malaria eradication.

Moreover, the inconsistent application of CE methodologies across malaria programs suggests a need for greater clarity about what constitutes effective engagement, how it should be operationalized, and under what conditions it yields the greatest impact. There is also a pressing need to systematically document the outcomes of CE initiatives, both in terms of malaria-specific health indicators and broader metrics such as community empowerment, trust-building, and system resilience. Without a strong evidence base, CE risks being sidelined in favor of more readily quantifiable biomedical interventions, perpetuating a narrow approach to malaria elimination that overlooks the complex social dynamics underlying transmission and control [19, 15].

Understanding the nuances of CE in the context of malaria elimination is particularly important as the global health community shifts focus from malaria control, reducing incidence and mortality to full elimination and ultimately eradication. Unlike control efforts, elimination demands sustained community commitment, active case detection, and responsiveness to residual transmission pockets, all of which are difficult to achieve without strong community partnerships. The role of CE becomes even more critical in addressing emerging challenges, such as drug and insecticide resistance, climate change impacts on malaria epidemiology, and health system disruptions caused by concurrent public health emergencies like COVID-19.

Given these considerations, this systematic review seeks to provide a comprehensive synthesis of peer-reviewed literature published between 2015 and 2023 on the role of Community Engagement in malaria elimination programs. Specifically, the review is guided by three primary objectives:

1. **Assessing Definitions and Implementations of CE:**

First, the review aims to explore how CE has been conceptualized and implemented across different malaria elimination contexts. This includes examining the range of engagement strategies used, the level of community participation achieved (e.g., information-sharing, consultation, collaboration, or community-led initiatives), and the degree to which CE efforts were integrated into broader program designs.

2. **Evaluating Impacts of CE on Health Outcomes:**

Second, the review seeks to assess the documented impacts of CE on malaria-specific health outcomes. These may include changes in malaria incidence and

prevalence, improvements in treatment-seeking behaviors, enhanced adherence to preventive measures, and greater community involvement in surveillance and case management activities. Where possible, the review will also consider the indirect effects of CE, such as increased trust in health authorities and strengthened local health governance structures.

3. **Identifying Barriers and Enabling Factors:**

Finally, the review will identify key barriers that have impeded effective and sustainable CE in malaria programs, as well as factors that have facilitated success. Barriers may range from structural issues such as resource constraints and limited political will to socio-cultural challenges like community mistrust or divergent health beliefs. Conversely, enabling factors might include strong leadership, inclusive governance structures, tailored communication strategies, and continuous capacity building among community members and health workers alike.

In addressing these objectives, the review aims to contribute to a deeper understanding of how community engagement can be optimized to support malaria elimination goals. By highlighting best practices, common pitfalls, and context-specific insights, the findings will inform future program design and policy development, ensuring that communities are not just passive beneficiaries but active architects of malaria-free futures.

Ultimately, the transition from malaria control to elimination will not be achieved through technological innovations alone. It will require genuine partnerships with communities, built on mutual respect, shared ownership, and sustained collaboration. By systematically examining the role of Community Engagement in malaria programs over the past decade, this review endeavors to shed light on pathways toward more equitable, effective, and sustainable malaria elimination efforts.

Despite its growing prominence, the application of CE in malaria programs remains inconsistent and is often under-documented. Engagement varies from passive consultation to active community governance, with many programs still operating at a tokenistic level [19, 15]. As a result, the true potential of CE in advancing malaria elimination remains under-realized.

This systematic review synthesizes peer-reviewed literature from 2015 to 2023 to:

1. Assess how CE has been defined and implemented in malaria elimination programs.
2. Evaluate the documented impacts of CE on malaria-related health outcomes.
3. Identify key barriers and enabling factors to effective and sustainable CE in diverse settings.

Methods

A comprehensive systematic review was conducted to examine the role of community engagement (CE) in malaria elimination. Literature was sourced from four major databases: PubMed, Google Scholar, Scopus, and Web of Science, using a Boolean search string (“community engagement” OR “community participation” OR “community involvement”) AND (“malaria elimination” OR “malaria control”) AND (“2015” : “2023”).

Inclusion Criteria

Studies were included if they met the following conditions:

1. Peer-reviewed and published in English between January 2015 and December 2023.
2. Empirical studies using qualitative, quantitative, or mixed methods, or systematic reviews with detailed empirical analysis.
3. Focused specifically on community engagement within malaria prevention, control, or elimination programs.

Exclusion Criteria

Studies were excluded if they:

1. Did not focus specifically on malaria-related interventions.
2. Were editorials, theoretical pieces, or opinion articles without primary data.
3. Addressed general health topics without a clear focus on CE in malaria.

Screening and Selection

178 articles were returned from an initial search, 54 full-text articles were reviewed in detail after title and abstract screening. Based on methodological rigor, relevance to CE in malaria contexts, and richness of data, a total of 22 studies were selected and included in the final synthesis. The review process emphasized the inclusion of studies with clear documentation of CE strategies, outcomes, and contextual factors.

Results

Study Characteristics

Findings from 23 peer-reviewed studies conducted between 2015 and 2023, covering 14, with the majority based in Africa (n=12) and Southeast Asia (n=6) were synthesized in this review. The studies employed a range of methodologies including mixed methods (n=13), qualitative (n=6), and quantitative (n=4). The most common interventions examined included:

1. Deployment of community health workers (CHWs) and village malaria workers (VMWs)
2. Participatory surveillance and mapping
3. Community-led bed net distribution
4. Local health education campaigns

Definitions and Models of Community Engagement

Community engagement was defined across a broad spectrum, from simple information dissemination to collaborative and empowered participation. Most studies mapped their CE models using frameworks like the IAP2 spectrum and Arnstein's Ladder, identifying the following categories:

1. Inform/Consult: Top-down campaigns and training [14, 17].
2. Involve/Collaborate: Participatory mapping and CHW programs [12, 13].
3. Empower: Community-led initiatives with decision-making roles [2, 7].

Some studies, such as those by [15], criticized the tendency to equate engagement with compliance rather than partnership, a sentiment echoed across multiple cases.

Impact on Malaria-Related Outcomes

The review found strong associations between high-quality CE and improved health outcomes:

1. Cambodia: By 41%, community-based surveillance increased malaria case detection [4].
2. Tanzania: Household net usage was raised by 29–30% through participatory net distribution [13].
3. Zambia: Earlier outbreak detection and improved surveillance resulted from community-directed programs [7].
4. Ghana and Zambia: Better treatment adherence came as a result of trusted CHW networks [23].

Key Enablers of Effective Community Engagement

Successful CE programs shared several enablers:

1. Cultural focus: Programs embedded in local customs and languages achieved greater acceptance [9, 19].
2. Training and incentives: Performance and retention was improved by continuous training and compensation of CHWs and VMWs [3].
3. Community ownership: Active involvement in planning and governance led to better sustainability and accountability [5].

Barriers and Limitations

Despite the demonstrated value, CE efforts often faced significant barriers:

1. Tokenism: Many initiatives limited CE to implementation, excluding communities from planning and decision-making [2].
2. Funding instability: Once donor support ended, programs often collapsed [10].
3. Evaluation challenges: Only 3 out of 22 studies used validated tools to assess the depth or effectiveness of CE [1, 6].
4. Power dynamics: Top-down approaches and exclusion of marginalized groups weakened trust and long-term outcomes [3].

Lessons Learned and Best Practices

Studies that demonstrated long-term success generally emphasized co-creation, participatory planning, and integration of local knowledge. Effective tools for fostering meaningful engagement came from strategies such as community advisory boards, participatory mapping, and co-designed training. Locally focused strategies that invest in community capacity and build on traditional governance structures were encouraged by WHO (2016).

Discussion

This review affirms a clear and reliable finding where community engagement significantly improves malaria-related outcomes and plays an essential role in the success and long-term sustainability of malaria elimination programs. This is true only when it is deep, meaningful, inclusive, and sustained. Effective CE, when approached as a true partnership rather than as a one-way communication strategy, fosters trust, promotes local ownership of health initiatives, increases the uptake of interventions, and contributes to enduring health gains. However, despite widespread recognition of its critical importance, CE is still too often implemented in a tokenistic or top-down manner, where communities are treated as passive recipients rather than as active partners. This undermines the full potential of CE and limits its ability to drive meaningful and lasting change.

Shifting from Tokenism to True Partnership

Many studies have shown that just the involvement of community health workers (CHWs) or volunteers does not automatically lead to improved outcomes or lasting impact. What matters is the quality and depth of engagement. Programs that limit CE to resource distribution or awareness campaigns, without involving communities in more meaningful ways, often fail to build sustainable change. In contrast, in Zambia and Ghana, CE models that emphasized shared planning, decision-making, implementation, and monitoring, led to substantial and lasting reductions in malaria burden [7, 2]. These examples highlight the very important need to shift from the instrumental use of communities toward models of shared governance, genuine partnership, and co-ownership to achieve transformative outcomes.

Sustainability and Donor Dynamics

A recurring issue across the literature is the fragility of donor-dependent programs. A critical challenge identified is the short-term nature of donor funding, which often leads to the collapse of community engagement initiatives once external support ends. Many community-based efforts have failed to sustain themselves after the withdrawal of international funding, highlighting the vulnerability of programs that are not fully embedded within local systems. In contrast, CE initiatives in Laos and Cambodia demonstrated resilience and long-term success when local leadership was institutionalized and CE was supported through national policy frameworks [11, 12]. These examples underscore the importance of stable financing, institutionalizing community leadership, and fully integrating CE into

national systems to ensure program resilience, continuity, and lasting impact.

Need for Standardized Evaluation Frameworks

A major barrier to advancing community engagement in malaria elimination is the lack of standardized evaluation tools. Only a small number of studies [1, 6, 5] have used validated frameworks like Arnstein's Ladder or the IAP2 Spectrum to systematically assess the depth and quality of engagement. The absence of standardized evaluation methods limits the ability to compare programs across different contexts, weakens the development of evidence-based policies, and undermines efforts to improve CE practices. To strengthen the field, future research must prioritize the development, application, and consistent use of robust, validated CE metrics.

Gender and Equity Considerations

A major gap identified in this review is the limited attention to gender and equity within community engagement strategies. Most studies failed to disaggregate community involvement by gender or to explore how marginalized groups, such as women, youth, and minority populations, were included in planning, decision-making, and implementation. This oversight risks reinforcing existing power imbalances and undermines the potential of CE to function as a truly inclusive and transformative force. As [8] argue, addressing gender and equity in CE is not only an ethical imperative but also a practical necessity—ensuring that the voices and needs of the most vulnerable are represented, empowered, and effectively reached. Equity-focused engagement is therefore critical to the success and sustainability of malaria elimination efforts.

Policy and Programmatic Implications

National malaria control programs must stop treating community engagement as a peripheral activity and instead embed it as a core strategic pillar of malaria elimination efforts. Unlocking the full potential of CE requires comprehensive action, including:

1. Policy integration of community-led approaches and embedding CE into program design.
2. Institutional support for participatory structures and ensuring community representation in decision-making bodies.
3. Training, capacity building, and incentive structures to empower local actors.
4. Establishment of accountability mechanisms and feedback loops to enable ongoing program adaptation.

In summary, CE must evolve from rhetoric to reality, from passive compliance to active, community-driven leadership, rooted in shared power, cultural respect, and long-term commitment. Only through this shift can malaria programs achieve true effectiveness, sustainability, and resilience.

Conclusion

Community engagement has evolved from a supplementary role to a foundational element of malaria elimination strategies between 2015 and 2023. Studies and experiences during this period show that when communities are genuinely involved, interventions become more relevant, widely accepted, and sustainable, leading to significantly improved outcomes. Despite this growing recognition, CE implementation remains uneven, with many programs continuing to rely on top-down models where decisions are made without true collaboration. Such approaches often fail to build trust or foster lasting behaviour change. True CE demands mutual respect, shared decision-making, and the treatment of communities as equal stakeholders, not passive recipients. Moreover, a one-size-fits-all model for CE does not work; malaria programs must design context-specific, participatory, and culturally integrated frameworks that involve community members at every stage, that is planning, implementation, and evaluation,

ensuring interventions align with local realities and needs. To sustain progress, CE must be formally inserted into national policies and health systems, with stable funding, strong local leadership that reflects community diversity, consistent feedback mechanisms for real-time adaptation, and the development of strong, standardized evaluation metrics to measure participation quality. Ultimately, the success of malaria elimination depends on genuinely empowering the communities most affected, giving them real authority and ownership in shaping and leading elimination efforts, building investment, resilience, and sustainability, especially in regions where malaria remains endemic. Without this deep, inclusive, and sustained engagement, malaria elimination efforts will continue to fall short of their full potential.

Recommendations

1. Shift from Tokenism to Genuine Partnership: Programs must move beyond superficial engagement (e.g., information campaigns) and promote shared decision-making where communities actively co-design, implement, and evaluate malaria interventions.
2. Institutionalize Community Engagement in Policy and Health Systems: National malaria control programs should embed CE into formal strategies and program structures, treating it as a core pillar, not a side activity.
3. Ensure Long-Term Sustainability Through Local Ownership: Build local leadership and institutional capacity so that community-driven efforts persist beyond donor funding. CE efforts should be rooted in local governance and national health systems for durability.
4. Develop and Use Standardized CE Evaluation Frameworks: Adopt validated tools (like Arnstein's Ladder or the IAP2 Spectrum) to systematically assess the quality and depth of community engagement across programs and contexts.
5. Focus on Gender and Equity in Community Engagement: Design CE strategies that actively include women, youth, and marginalized groups, ensuring equitable participation and leadership to avoid reinforcing existing inequalities.
6. Prioritize Continuous Training, Capacity Building, and Incentives: Equip community health workers and volunteers with ongoing training, resources, and appropriate incentives to maintain high motivation and program quality.
7. Embed Cultural Sensitivity in Engagement Approaches: Tailor interventions to local cultural, linguistic, and social contexts to improve acceptance, trust, and relevance of malaria initiatives.
8. Establish Strong Feedback and Accountability Mechanisms: Create real-time feedback loops where community members can provide input during program implementation, allowing for adaptive management and ongoing improvements.
9. Secure Stable and Long-Term Funding for CE Initiatives: Advocate for sustained financial investment from both national governments and international partners to ensure that CE activities are not vulnerable to funding cycles.
10. Promote Participatory Surveillance and Community-Based Monitoring: Involve communities in data collection, case detection, and surveillance, empowering them as key actors in monitoring malaria transmission and elimination progress.

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Knowledge, Attitude and Practices of Care Takers About Malaria Epidemiology Among Children Below the Age of Five Years Attending Munuki PHCC in Juba City

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Abstract

It is noted globally over 95 countries and territories have on going malaria transmission with an estimated 3.2 billion people who are at risk of getting infected. The WHO indicates that 214 million people are infected with malaria worldwide and of these 438,000cases result in deaths. Children below five years are the most susceptible to malaria illness which accounts for estimated deaths of 303,000 before reaching age five globally and 292,000 occur in the African region. The purpose of the study was to determining the prevalence of malaria and the associated risk factors among children below 5 years in Munuki PHCC, Juba Capital City, South Sudan. The study was a quantitative and cross section survey which involved a sample size of 243 care takers of 243 children below the age of five who attended Munuki PHCC. A convenient sampling method allowed data to be collected about malaria prevalence and the associated factors simultaneously in the months of August and September 2023. The prevalence of malaria was high 118(48.6%) and the factors that were significant with malaria prevalence included; house hold source of light (x^2= 8.560, P=0.036), care taker knowledge of signs and symptoms (loss of appetite) x^2=4.023, P=0.045) and environmental factor about presence of garbage heaps (x^2=4.322, P=0.038).

Keywords: *Determinants, Malaria, Prevalence, Under-Five.*

Introduction

Malaria is one of the world's most deadly diseases caused by an infection with single celled parasitic female anopheles mosquito. This remains a burden especially in the sub Saharan Africa despite all the efforts put in by the various countries to control and eradicate the disease in these areas. Its problem has further contributed to low economic progress especially among countries that have been affected by the disease.

In South Sudan malaria is still a major public health problem associated with slow economic development and poverty and is the most frequently reported disease at both public and private health facilities in Uganda. It accounts 30 - 50% of the outpatient visits at health facilities and 15 -20% of in patients or hospital admissions. Malaria accounts for 27.7% of deaths amongst children under the age of five. [2].

South Sudan is ranked third in the total number of malaria cases in sub Saharan Africa [3]. Malaria is the leading cause of morbidity in South Sudan with 90 -95% of the population at risk and contributing approximately 13% of the under-five mortality [4].

Children under five years are most vulnerable to malaria infection as their immunity is not yet developed to fight any disease [5]. Statistics from the ministry of health show that malaria is still the leading cause of death in Uganda accounting for 27% of deaths and that Uganda has the world's highest malaria incidence with a rate of 478 cases per 1.000 populations per year.

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In Munuki Juba where the study area is located, malaria is the most common cause of death in children and the district suffers the highest malaria burden in the country. This creates a reason to find out the prevalence of malaria and the associated factors in children below the age of five years.

The South Sudan's government's long-term objective is to ensure total eradication of malaria in all the endemic areas of the country and as such a lot of effort through funding has been sourced both internally and externally towards the above cause. A lot of sensitization and prevention measures of malaria such as education of individuals and families to sleep under insecticide treated nets, vector control through spraying (IRS), eliminating breeding places, and reducing infections through prophylaxis and treatment with ACTs. The government has also through the years 2009 - 2015 conducted several programs including integrated community case management (ICCM), integrated management of childhood illness (IMCI) and training of BHWs to offer curative malaria treatment at community level. [4].

Despite all these efforts malaria cases continues to remain high and one of the leading causes of ill-health and deaths in South Sudan. According to the records available in MoH, Juba the trend for the last three years indicated that malaria prevalence was at 17,216, in 2020, 17,322 in 2021, and 12,790 in 2022 both outpatient and inpatient of which 242 deaths were registered.

In Munuki Payam alone 7437 cases were registered in the same period of 3 years. The overall trend indicates that malaria is still a threat in the payam being one among the affected areas still has a high number of malaria cases being reported in the outpatient department. This therefore verifies that there could be several reasons or factors contributing to the high prevalence of malaria in Munuki PHCC despite all the efforts that the government has put in place to reduce on the infections.

As a result of this trend therefore, malaria infection has led to a high number of referrals due to complicated malaria which has resulted into complications like cerebral malaria, hypoglycemia, jaundice, severe anemia leading to increased number of in-patient admissions and deaths. The infection has also led to malnutrition, growth retardation, reduced school attendances and dropouts among the children. Malaria infection has also led to low economic growth as a lot is spent on treatment of the disease and this has left the people poor and economically devastated. It also contributes to low productivity as parents spend most of the time attending to the sick children.

Knowledge about malaria prevention transmission, but should have a positive attitude on the implementation of the preventive measures of malaria. Health unit workers, community health workers and VHTs together with stakeholders should put in more effort to ensure that information about malaria is communicated to the caretakers in languages best understood and should mainly target the vulnerable households in the community. The City council authorities and local leaders need to work with community to ensure proper garbage disposal. The city council health team has to liaise with the district health team to strengthen the health system on prevention and control of malaria through sustainable messages like posters on malaria, TV messages and programs on malaria.

According to the secondary data analysis of 2014 which was done in South Sudan conducted in December 2014 and January 2015 using a stratified two stage cluster design overall 938(19.04%, 95%CI 16.63-21.71) children under five out of 4930 in 2014 had malaria parasitaemia by microscopy and 95.65% of all these cases were due to p. falciparum. Foresight of fever in 2 weeks prior to the survey was reported in 285 out of the 938(30.33%)

children diagnosed with malaria parasitaemia. [16].

Children under five years are most vulnerable to malaria infection as their immunity is not yet developed to fight any disease. (CDC- Global health division for parasitic diseases and malaria, [17]. Statistics from the ministry of health show that malaria is still the leading cause of death in Uganda accounting for 27% of deaths and that Uganda has the world's highest malaria incidence with a rate of 478 cases per 1.000 populations per year.

Some 1,939 care givers of young children were recruited through a school-based survey in two states. A 20-item multidimensional survey instrument was developed and used to rank care givers knowledge in five dimensions which included the cause, transmission, vulnerability, symptoms and treatment. The predictor for ITN use was ITN ownership, however ownership only explains 43% 0f variance in net use. The total knowledge index for the study population was significantly associated with ITN ownership. Care givers knowledge of malaria and its causes was found to be poor were only 50% of the respondents knew that malaria is transmitted by female anopheles' mosquito and 65% still believe that too much exposure to the sun is a risk factor for malaria. Knowledge about the population vulnerable to malaria was 83% and knowledge of malaria transmission was 32% were the domain with highest and lowest average correct answers. [18].

Malaria is the main cause of morbidity and mortality among children under age five years in Malawi. Study was done to compare the prevalence and associated factors with malaria parasitaemia among children under the age of five years between 2012 and 2014 malaria indicator surveys. A multistage cluster sampling method was employed were total of 4040 children underage of five years were involved in the study. The 2112 (52%) were from the 2012 MIS and 1928 (48%) were from the 2014 MIS and these showed that the prevalence among the children underage of five years increased from 28% in 2012 to 33% in 2014($P>0.05$) and these showed a high prevalence of malaria among children below the age of five years [19].

A cross-sectional study was conducted in the district of Bata of the mainland of Equatorial Guinea involving 440 houses selected from 18 rural villages and 26 urban neighbourhoods were a total of 428 care givers were interviewed and the significant difference between rural and urban households was observed. On care giver malaria knowledge and beliefs, it showed that about 42% of the urban and 65% of rural care givers were un aware as to how malaria is transmitted (OR=2.69; 95%CL: 1.78-4.05) The presence of a malaria case was1.2 times more frequent in rural than in urban Bata were 78.91% of the household had experienced at least one case of malaria compared to 62.15 household in urban areas. The factors most significant and associated with the malaria knowledge were the level of education of care giver and the social economic status of the household. [20].

The study is limited to urban settlements and can not be applicable to rural settings.

To determine the prevalence of malaria and the associated factors among children under the age of five who attend OPD of Munuki PHCC, Juba City during the period of August and September. 2023.

Methodology

Study design: The study was quantitative using the cross- sectional survey design because the design was to allow data to be collected on prevalence of malaria and associated factors simultaneously at a particular point in time.

Study setting: The study setting was Munuki PHCC a government owned health unit located in Juba City. The health center serves a catchment area of five payams of Nukuki, Gudele, Kator and Togpiny It serves a total catchment population of 29,297 and 4,746 children under age of five years. The health center has a total of nineteen (19) staff who

include 2 clinical officers, 2 nursing officers, 3 enrolled nurses, 4 enrolled midwives, 2 laboratory technicians, 1 laboratory assistant, 1 health assistant, 1 nursing assistant, 1 information officer, 1 askari, and 1 cleaner. About 80 patients are seen on a daily basis in outpatient's department antenatal not inclusive. The health unit offers the following services; outpatient services, antenatal and maternity services, immunization and child health services, school and community outreaches, HIV/AIDS and ART clinics, tuberculosis testing and treatment services, Family planning, safe male circumcision, health education and STI screening and testing.

Study Populations

The target population was all the caretakers plus children under five years attending health care in Munuki PHCC. Accessible population included children under the age of five years and their caretakers who attended in Munuki PHCC Study population included caregivers and children under the age of five years who met inclusion criteria.

Sample Size Determination

The sample size was determined by calculations using the Kish and Leslie formula

$$N=\frac{Z2.P(1-P)}{D2}$$

Where;

N = Total number of subjects required in the sample.

Z = a standardized normal deviate value that correspond to the level of statistical significance

equal to 1.96.

P = estimate of prevalence of malaria in children under age 5 years in South Sudan which is 19.7% according to Danielle Roberts and Mathew Glenda 2016 [4] study on malaria prevalence in under 5 years.

D = margin of error which corresponds to the level of precisions of results desired= 0.05.

$$N=\frac{1.96x1.96x0.197(1-0.197)}{0.05x0.05}$$

$$N = 243$$

Sampling Method

Probability sampling technique was used to collect data where consecutive sampling method to enrol all the care givers of children below the age of five years to participate was used. All the children below five years who came in OPD were first seen by the clinician and those who had the signs and symptoms were sent to the laboratory for testing using mRDT and microscopy. The care givers of these children sent to the laboratory were requested to participate in the study and those willing were enrolled until when the sample size was reached. The children Who tested positive were used to determine the sample size.

Study Variables

The variables were the dependent and independent variables.

Dependent variable

The prevalence of malaria among children under five years old in Munuki PHCC was the dependent variable.

Independent variables

1. Caregiver factors which included, age of care giver, health seeking behaviors, knowledge about the disease, education level, marital status, occupation, attitude and practice.
2. Environmental factors included drainage system, bushy surroundings, garbage heaps, climate and altitude.
3. Household factors included number of household members, type of house, social economic status, sleeping patterns, place of residence, use of ITNs.

Data Collection Methods

Source of Data

Caretakers of children under 5 years were the primary source of data in this study.

Study Tool/ Instrument

A structured questionnaire was used to collect raw information on social demographic factors, care giver factors e.g. Knowledge about, the transmission and prevention of malaria, utilization and coverage of insecticide treated nets, environmental factors, and household factors. This was administered to the eligible participants were parents or guardians of children under the age of five years and were interviewed. The questionnaire comprised comprise of both closed and open-ended questions in English language.

Procedure for Data Collection

The researcher was introduced to the in-charge of the health center who then introduced her to the staff and the patients. The study was then explained to them to identify those who were eligible for the study. The children who were eligible for the study were seen by the clinical officer(s) who requested for microscopy or mRDT tests in the laboratory to screen those with positive and negative results respectively. The care givers of the children who were subjected to the test were interviewed by the research assistants using the questionnaire that were provided as they waited for the children to be tested. The questions were interpreted by the research assistants in local languages both English and Arabic respectively. The children who tested positive were used to determine the prevalence of malaria in children under the age of five years attending Munuki PHCC. The prevalence was the number of children who tested positive over the total number of children who engaged in the study. Vector species data was collected as secondary data from the facility health management information system (HMS).

Plasmodium falciparum was the most common malaria parasite which was readily detected by Rapid Diagnostic Tests (RDTs). RDTs, particularly using the Histidine-Rich Protein 2 (HRP2) protein.

Breeding places of anopheles vectors was investigated and primary data of near wetland or bushy areas, was collected from the participants.

Data Analysis Plan

This included descriptive analysis, and bivariate analysis.

Descriptive Analysis

Data concerning categorical variables was summarized and presented in frequency tables, bar graphs. Computing means, standard deviation was used to summarize data of numerical variables.

Bivariate Analysis

The association between proportions of the under five children who tested positive and those who tested negative was compared using a chi square. The relationship between independent variables and dependent was analyzed using chi square. Independent variables with P-value less than 0.05 were considered to influence the prevalence of malaria among children below age five.

Quality Assurance

1. Pretesting of the questionnaire to minimize and avoid errors with duplication.
2. Training and use of research assistants to ensure accuracy in the information given by all is not duplicated and to avoid bias in the study.
3. Supervision of data collection by the researcher.
4. Data was coded entered in Epidata software and cleaned in SPSS before analysis.

Ethical Considerations

Ethical committee approval from the MoH was granted, authorisation letter from the local authority to collect data was obtained, informed consents from the eligible participants were obtained, privacy and confidentiality of data was clearly stipulated in the consent form.

Results

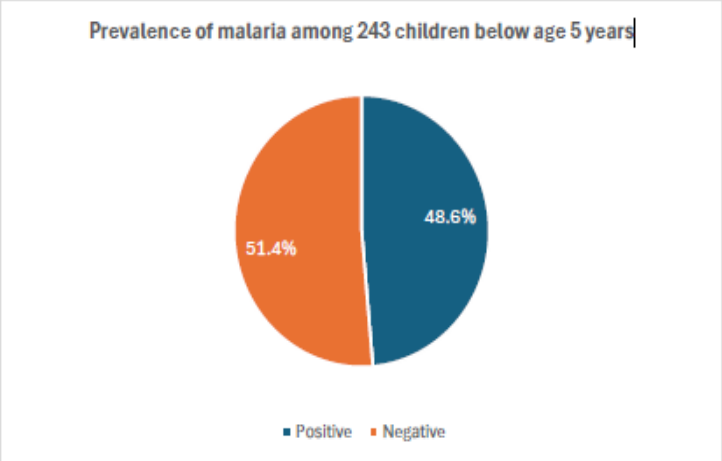
Table 1. Demographic Characteristics of 243 Caretakers of Children Aged Below 5 Years Munuki PHCC

Variable	Category	N	Percent
Gender	Female	187	77.0
	Male	56	23.0
Age	15-24	55	22.6
	25-34	92	37.9
	35-44	74	30.5
	45+	22	9.1
Marital Status	Single	44	18.1
	Married	145	59.1
	Separated	36	14.8
	Widowed	18	7.4
Level of education	None	46	18.9
	Primary	81	33.3
	Secondary	81	33.3
	Tertiary	35	14.4
Location	Close to a swamp	107	44.0
	Not close to a swamp	136	56.0

The total number of respondents was 243 and majority 187(77.0%) were females, 94(37.9%) were between the ages of 25-34years, 145(59.1 %) were married, most, 81(33.3%), had both primary and secondary level of education and 136(56.0%) did not stay close to a swamp as reflected in table 1.

Prevalence of Malaria

Figure 1. Prevalence of Malaria Among 243 Children Below age 5 Years in Munuki PHCC



A total of 243 children below age 5 years who attended Munuki PHCC coming from different locations of the town council were subjected to malaria diagnostic tests using both mRDT and microscopy. Of the 243 children,

118(48.6%) tested positive and 125(51.4%) negative as shown in figure 1.

Caretaker factors: Part 1

Table 2. Caretaker Factors (Demographic) Influencing Prevalence of Malaria Among 243 Children Below 5 Years in Munuki PHCC

Variable	Category	Positive	Negative	Chi-Square	P-Value
Gender	Female	91(77.1)	96(76.8)	0.003	0.953
	Male	27(22.9)	29(23.2)		
Age	15-24	18(15.3)	37(29.6)	7.637	0.054
	25-34	51(43.2)	41(32.8)		
	35-44	37(31.4)	37(29.6)		
	44+	12(10.2)	10(8.0)		
Marital Status	Single	20(16.9)	24(19.2)	1.002	0.801
	Married	70(59.3)	75(60.0)		
	Separated	20(16.9)	16(12.8)		
	Widowed	8(6.8)	10(8.0)		
Level of Education	None	26(22.0)	20(16.0)	2.600	0.457
	Primary	37(31.4)	44(35.2)		
	Secondary	41(34.7)	40(32.0)		
	Tertiary	14(11.9)	21(16.8)		
Location	Close to a swamp	59(50.0)	48(38.4)	3.314	0.069
	Not close to a swamp	59(50.0)	77(61.6)		

All caretaker demographic factors showed no statistically significant relationship with prevalence of malaria among children below age 5 years as indicated in table 2.

Caretaker factors: part 2

Table 3. Caretaker Factors (Knowledge) on Malaria Transmission and Prevention Influencing Prevalence of Malaria Among 243 Children Below 5 years in Munuki PHCC

Variable	Category	Positive N/%	Negative N/%	Chi-Square	P-Value
Ever heard about malaria	Yes	114(96.6)	119(95.2)	0.306	0.58
	No	4(3.4)	6(4.8)		
Mode of transmission	Mosquitoes	101(85.6)	110(88.0)	0.308	0.62
	Fly/animals	17(14.4)	15(12.0)		
Sleeping under nets	Yes	113(95.8)	121(96.8)	0.183	0.669
	No	5(4.2)	4(3.2)		
Wearing long-sleeved clothes	Yes	52(44.1)	51(40.8)	0.295	0.606
	No	66(55.9)	74(59.6)		
Spraying with insecticide	Yes	80(67.8)	90(72.0)	0.51	0.475
	No	38(32.2)	35(28.0)		

Destroying breeding places	Yes	100(84.7)	103(82.4)	0.243	0.622
	No	18(15.3)	22(17.6)		
Closing windows early	Yes	84(71.2)	88(70.4)	0.018	0.893
	No	34(28.8)	37(29.6)		
Use repellants	Yes	29(24.6)	42(33.6)	2.39	0.122
	No	89(75.4)	83(66.4)		
Clearing bushes	Yes	102(86.4)	99(79.2)	2.226	0.136
	No	16(13.6)	26(20.8)		
Time mosquito bites	Day time	7(5.9)	9(7.2)	2.164	0.539
	Nighttime	64(54.2)	67(53.6)		
	Day and night	45(38.1)	43(34.4)		
	I don't know	2(1.7)	6(4.8)		

No caretaker factors on knowledge about the transmission and prevention of malaria was significantly related to the prevalence of malaria among children below the age of five years in Munuki PHCC as shown in table 3.

Care giver factors: Part 2: cont.

Table 4. Caretaker Factors (knowledge) on Signs and Symptoms of Malaria in Children Below 5 Years in Munuki PHCC

Variable	**Category**	**Positive**	**Negative**	**Chi-Square**	**p-value**
High temperature	Yes	111(94.1)	118(94.4)	0.012	0.912
	No	7(5.9)	7(5.6)		
Loss of energy	Yes	79(66.9)	98(78.4)	4.023	0.045
	No	39(33.1)	27(21.6)		
Vomiting	Yes	102(86.4)	112(89.6)	0.576	0.448
	No	16(13.6)	13(10.4)		
Sweating	Yes	42(35.6)	48(38.4)	0.250	0.651
	No	76(64.4)	77(61.6)		
Headache	Yes	75(63.6)	92(73.6)	2.847	0.092
	No	43(36.4)	33(26.4)		
Joint pains	Yes	36(30.5)	53(42.4)	3.698	0.054
	No	82(69.5)	72(57.6)		
Loss of appetite	Yes	102(86.4)	109(87.2)	0.031	0.861
	No	16(13.6)	16(12.8)		
Chills	Yes	74(62.7)	78(62.4)	0.003	0.960
	No	44(37.3)	47(37.6)		
Convulsions	Yes	81(68.9)	77(61.6)	1.324	0.250
	No	37(31.4)	48(38.4)		

With the care take knowledge of the signs and symptoms of malaria, loss of energy (P=0.045, x^2=4.023) was significantly associated with prevalence of malaria in children below five years. However other factors were not significantly associated with malaria prevalence as shown in table 4.

Care giver factors: part 3.

Table 5. Caretaker Factors (Attitudes) Influencing Prevalence of Malaria Among243 Children Below 5 Years in Munuki PHCC Below 5 Years in Munuki PHCC

Variable	Category	Positive N/%	Negative N/%	Chi-Square	P-Value
I think malaria is a serious and threatening disease	Yes	108(91.5)	114(91.4)	0.008	0.928
	No	10(8.5)	11(8.8)		
I think the best way to prevent myself from getting malaria is to avoid malaria	Yes	92(78.0)	106(84.8)	1.879	0.17
	No	26(22.0)	19(15.2)		
I believe sleeping under a mosquito net during the night is one way to prevent malaria	Yes	106(89.8)	115(92.0)	0.347	0.556
	No	12(10.2)	10(8.0)		
Am sure that I can treat the child if he or she gets malaria	Yes	53(44.9)	61(48.8)	0.368	0.544
	No	65(55.1)	64(51.2)		
In my opinion children and pregnant mothers are at greater risk of getting malaria	Yes	99(83.9)	101(80.8)	0.4	0.527
	No	19(16.1)	24(19.2)		
I think that one can recover from malaria without any treatment	Yes	28(23.7)	39(31.2)	1.697	0.193
	No	90(76.3)	86(68.8)		
I think that it is dangerous if malaria medicine is not taken completely	Yes	105(89.0)	110(88.0)	0.058	0.81
	No	13(11.0)	15(12.0)		
I think that I should go to the health center to have my child's blood test	Yes	112(94.9)	110(88.0)	3.677	0.055
	No	6(5.1)	15(12.0)		

Caretaker attitudes towards prevention of malaria did not have significant influence on prevalence of malaria as presented in Table 5.

Table 6. Household Factors Influencing Prevalence of Malaria Among Children Below 5 Years

Variable	Category	Positive	Negative	Chi-Square	p-value
Type of house	Permanent house	43(36.4)	59(47.2)	2.885	0.236
	Semi-permanent house	58(49.2)	51(40.8)		
	Grass thatched	17(14.4)	15(12.0)		
Number of people in a house	<6	66(55.9)	69(55.2)	0.013	0.909
	>6	52(44.1)	56(44.8)		
Source of light	Firewood	6(5.1)	10(8.0)	8.560	0.036
	Candle	15(12.7)	29(23.2)		

	Lantern	59(50.0)	42(33.6)		
	Electricity	38(32.2)	44(35.2)		
Nature of rooms	Small	65(55.1)	73(58.4)	0.272	0.602
	Big	53(44.9)	52(41.6)		
Time to go to bed for children	6:00pm-7:00pm	33(28.0)	31(24.8)	1.051	0.591
	8:00pm-9:00pm	76(64.4)	80(64.0)		
	>10:00pm	9(7.6)	14(11.2)		
Use mosquito net	Yes	98(83.1)	107(85.6)	0.299	0.585
	No	20(16.9)	18(14.4)		

Prevalence of malaria among children below five years varied significantly with over different types of source of light used in the house (x^2 = 8.560, p=0.036) as shown in table 6.

Table 7. Environmental Factors Influencing Prevalence of Malaria Among Children Below 5years in Munuki PHCC

Variable	**Category**	**Positive**	**Negative**	**Chi-sqare**	**P-Value**
Water drainage	Good	66(55.6)	71(56.8)	0.019	0.892
	Bad	52(44.1)	54(43.2)		
CClear stagnant water	Yes	93(78.8)	90(72.0)	1.515	0.218
	No	25(21.2)	35(28.0)		
Have bushes around the home	Yes	62(52.5)	52(41.6)	2.918	0.088
	No	56(47.5)	73(58.4)		
Have garbage heaps	Yes	49(41.5)	36(28.8)	4.322	0.038
	No	69(58.5)	89(71.2)		
Monthly income	-135,000ssp	62(52.5)	68(54.4)	0.084	0.772
	>135,000ssp	56(47.5)	57(45.6)		

The prevalence of malaria among children below 5 years was dependent on whether garbage heaps in the environment were cleared or not (x^2=4.322, P=0.038 as indicated in table above.

Discussion of the Results

Prevalence of Malaria Among Children Below the Age of Five Years

The study findings showed that almost half of the children in this study were found to be sick with the parasite causing malaria which indicated a high prevalence of malaria among children below five years in Munuki PHCC which was the study area. This is almost three times a higher prevalence compared to the national prevalence of 19.7% [4] in their study that was carried out in South Sudan.

The probable reasons for the high prevalence is probably failure to effectively use preventive measures despite the caregivers having good knowledge on prevention and transmission of malaria. Measures like possession of ITNs cannot determine how it is effectively used to prevent the mosquito bites at night. Also caregiver's knowledge about malaria does not determine their effective application of these measures and their attitudes towards their

utilization. This may be the other reason for the high prevalence of malaria in the study area.

Future studies therefore need to assess the caregiver's knowledge on malaria in relation to the utilization of preventive measures as this was not investigated in this study. Comparing with the sample size and the population in obtaining the data the prevalence in the study area remained high compared to the national prevalence which is at 19.7% [6] malaria remains the number one killer disease in children below 5 years despite its decrease in prevalence to 19% and this has remained constant since 2009 when it dropped from 42% to 19% being highest in the east central region. [7].

The high prevalence of malaria has led to a high public expenditure both in the health system and the individual house holds on procurement of anti-malaria drugs, low productivity where care takers are seen spending a lot of time attending to the sick children, high school drop outs, poverty, retardation among children and the increased morbidity and mortality due to severe anemia, hypoglycemia and cerebral malaria as the common causes of death in children as compared to adults- though this was not investigated but can be proved from other studies or information for example the WHO over view on malaria indicates that children below five years were the most affected with malaria disease and this accounted for 69% of deaths among children in 2015.[8]. Strategies like improving the general prevention and control measure of malaria infections by involving all the stake holders in the community and the community at large to implement the measures and not stopping at only having the knowledge on malaria.

Caretaker Factors Influencing the Prevalence of Malaria

Considering the findings of the study on the care takers factors, demographic factors had no statically significant relationship with malaria prevalence among children below age five years. Caretaker's knowledge on malaria prevention; control and transmission were not significantly associated with malaria prevalence among these children. The findings of this study are not different from the study that was done in Malawi were a MIS indicated an increase in prevalence (P> 0.05) 33% in 2014 in children below 5 years of age despite the caretakers knowledge on prevention, transmission and control of malaria infection [9].

Loss of appetite and loss of energy among the signs and symptoms of malaria were significantly related to high malaria prevalence. The caretaker's attitude towards the prevention of malaria was not significantly associated with malaria prevalence according to the study. This is contrary to the study carried out in Nigeria were caregivers did not have enough knowledge on how malaria is prevented, controlled and even transmitted [10].

In another study that was carried out in Okomesi- Ekiti state [11] caregivers had good knowledge 99.7% on the prevention and transmission of malaria.

Though the caregivers had enough knowledge and good attitudes on malaria prevention, it still showed that little was done on the side of preventive measures and this could be associated with the care takers social economic status and this can be compared to a study that was done in Gambia which showed that children from families with low social economic status were more likely to suffer from malaria compared to those with a high social economic status [12].

There could be new breeding sites that have not been identified for example congested rooms, under chairs, in birth rooms in case of self-contained houses or houses that have birth rooms near residents with stagnant waters may be acting as breeding sites for mosquitos therefore there is need for further investigation on the same. The other probable reason may be lack of a boosting method of prevention like

IRS which had not been implemented in the study area as in other areas were similar studies have been done before for example in Botswana were significant progress has been noticed in the reduction of malaria prevalence in children below age of five through a sustained provision of both LLINs and IRS. [13]. In the similar study that was conducted in Uganda children who suffered from malaria were 7.6 times in households that were not sprayed compared to those from sprayed households. There is need for implementation of IRS in Munuki households as this is one of the recommended WHO strategies for eliminating malaria infection.

Other reasons for the caretaker factors that could be influencing the prevalence of malaria in children below five years would include sharing of drugs among the sick children, long distances to the health units, use of local herbs and delay in seeking for medical treatment. This is related to a study in Nigeria where 37% of caregivers preferred using herbs and only 17% could visit the dispensary for treatment of malaria [11].

Caretaker's lack of knowledge on signs like loss of energy and loss of appetite as signs of malaria can affect proper diagnosis and treatment seeking for children who might present with no other signs other than these two signs and this can lead to severe disease of complicated malaria increasing on hospital admissions and even mortality rates. There is need for proper and intense health education on the signs and symptoms of malaria so that none of the signs is neglected by the caregivers.

Environmental Factors Influencing the Prevalence of Malaria in Children below Age Five Years

With the environmental factor influencing malaria prevalence, garbage heaps was seen to be significantly associated with malaria prevalence among children below age of five years. A lot is needed to be done as this has been proved with other studies as being a breeding site of mosquitoes for example a study that was carried out in Bata district, Equatorial Guinea were care givers (24.77%) responded that garbage was a breeding site for mosquitoes both urban and rural [14].

In a similar study which was done in Bolifamba –Cameroon also proved that garbage heaps among other environmental factors like stagnant waters, swampy/bushy surroundings were highly associated with malaria infection [15]. Being a town council and seen to be a crowded place and over populated there is no free space for people to dispose their garbage so it is heaped around the house holds increasing or creating a favorable site for mosquitoes to breed and bite children. There is need for an organized system of environmental control programs to improve garbage disposal by the town council team and also households should be sensitized on storage before it is disposed to a specified destination. Proper use of preventive measures like sleeping under bed nets is another strategy to avoid mosquito bites to the children.

Household Factors Influencing Malaria Prevalence in Children Below Age Five Years

Malaria prevalence in children below age of five years in the study area varied significantly over the different type of sources of light used in the individual households as presented earlier in the results. This probably is due to failure of caretakers to utilize the preventive measures available with a miss conception that mosquitoes don't bite when there is light and they do bite only in the dark. This is contrary to the study done in Uganda where Children in households without electricity were more than one and a half times more likely to have malaria than those children in households with electricity (OR 1.756, 95 % CI 1.072–2.877). [4]. Caretakers should be encouraged to use the preventive measures despite the type of source of light they use in their households. They should ensure that the children sleep under the

mosquito nets regardless of the available type of source of light in the household.

Conclusions

1. The prevalence of malaria among children below age five was very high with as almost half of the sample size of children were tested positive with a proportion (48.6%), negative (51.4%).
2. Knowing that malaria causes loss of energy and loss of appetite were the only caretaker factors that influenced prevalence of malaria.
3. Source of light was the only household's factors that significantly influenced prevalence of malaria among children below five years.
4. Similarly occurrence of malaria among children below five years was significantly influenced by presence or absence of garbage heaps in the home environment.

Recommendations

The following recommendations can help control high malaria prevalence in among children below five years of age attending Munuki PHCC.

Re enforcement of communication strategies and information dissemination to change individual and community behavior and attitudes towards the control and prevention of malaria and insist that they should not only have knowledge of the transmission and control but put in practice or implement the acquired knowledge practically both individually and as a community at large. This should be delivered by well and appropriate trained community health workers, BHWs, health unit staffs in the local languages that are most understood and mainly to vulnerable households.

Efforts should be made for these care takers to know and understand every sign and symptoms of malaria especially those that significantly contributed to the high prevalence of malaria for example loss of appetite and loss of energy which are serous signs of severe malaria.

The City council administrators should find a way of how to dispose garbage to avoid heaps around the households and also find and strategize a way of involving the entire town council community and the surrounding communities on how to avoid garbage in their households as this is another suitable breeding site for mosquitoes. The City council authorities should liaise with the district officials to lobby for electrify as a better source of light in the house as variant source of light was seen to be significantly influencing malaria prevalence in children below age of five years.

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Evaluating the Resiliency and Business Survival Strategies of Private Security Agencies during Covid-19 and Implications for marginalized Communities: A Study of Selected Cases in Ontario, Canada

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Abstract

The COVID-19 pandemic disrupted global business operations, placing private security agencies under significant operational strain. In Ontario, Canada, these agencies faced increased demand for services in healthcare and critical infrastructure, while also contending with workforce vulnerabilities, shifting regulatory requirements, and fluctuating public trust. This study uses a comparative case study of Securitas Canada, Paragon Security, and G4S Security Canada to evaluate their resiliency and survival strategies during the pandemic. Framed by Mitroff's Five Phases of Crisis Management and the Social Vulnerability Framework, the research examines how these strategies affected marginalized communities, particularly low-income and immigrant populations. While technological innovation, distributed teams, and service diversification supported operational continuity, they also introduced ethical concerns around over-surveillance, limited inclusivity, and uneven service delivery. The findings reveal that agencies with equity-oriented operational frameworks were better positioned to maintain public trust and service quality. This study underscores the importance of integrating cultural competency, robust accountability mechanisms, and inclusive engagement into private security governance. It advocates for a model of private security that prioritize both resilience and equity in future crisis preparedness

Keywords: *Business Resiliency, Canada, COVID-19 Pandemic, Crisis Management, Ethical Considerations, G4S Security, Marginalized Communities, Ontario, Paragon Security, Private Security Agencies, Public Safety, Securitas Canada, Social Vulnerability, Survival Strategies, Technological Surveillance.*

Introduction

Background and Context

The COVID-19 pandemic served as a watershed moment for global business systems, prompting rapid changes in organizational operations, workforce structures, and public-private partnerships. In Ontario, Canada, private security agencies became indispensable in maintaining order and securing essential services, particularly as public law enforcement agencies faced capacity constraints. These firms were tasked with enforcing health mandates, safeguarding healthcare and critical infrastructure, and regulating compliance with public safety protocols. However, their commercial foundations and client-driven priorities raised concerns about legitimacy, accountability, and ethical conduct, especially as their roles increasingly encroached on traditional state functions.

These challenges were most acute in marginalized communities, where the effects of the pandemic were disproportionately severe. Low-income, immigrant, and racialized populations faced not only heightened health and economic vulnerabilities but also increased exposure to technologically enhanced

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surveillance and enforcement activities. Many private security personnel lacked training in cultural competence and trauma-informed practice, which amplified community mistrust. In areas with histories of over-policing, the introduction of AI-enabled surveillance systems, although efficient, intensified concerns around privacy, transparency, and consent. While some agencies attempted to adopt inclusive practices, such as local recruitment or partnerships with grassroots organizations, these efforts were inconsistent and unsupported by a unified regulatory framework.

This study examines how three leading private security agencies in Ontario—Securitas Canada, Paragon Security, and G4S Security—adapted their operations, addressed workforce challenges, and interacted with marginalized communities during the COVID-19 pandemic. Using Mitroff's Five Phases of Crisis Management and the Social Vulnerability Framework as guiding lenses, the research explores the intersection between organizational resiliency strategies and social equity outcomes. By analyzing these agencies' pandemic responses, the paper contributes to ongoing debates about privatized security governance, ethical crisis management, and the need for inclusive emergency preparedness frameworks.

Problem Statement

The strategies implemented by private security agencies to navigate the crisis have yet to be thoroughly explored in the academic literature. Studies on 'private security' in other sectors have tended to analyze business responses to crises without considering the broader socio-economic implications. Thus, private security has not been studied in detail regarding its role in facilitating other business operations. In addition, the disproportionate effects of the pandemic on marginalized groups, such as low-income and immigrant populations, demonstrates the importance of investigating what role these agencies played (or did not play) in systemic vulnerabilities during the pandemic period [18].

Research Objectives

This study aims to:

1. Evaluate the resiliency and survival strategies adopted by private security agencies in Ontario during the COVID-19 pandemic.
2. Analyze the socio-economic implications of these strategies for marginalized communities, particularly regarding access to safety and security services.
3. Provide policy recommendations to enhance the inclusivity and effectiveness of private security operations in future crises.

Research Questions

1. What strategies did private security agencies in Ontario employ to ensure business survival during the pandemic?
2. How did these strategies align with established resiliency and crisis management models?
3. What were the socio-economic impacts of these strategies on marginalized communities, particularly in terms of equitable access to security services?

Relevance of the Study

In this regard, the context of this research significantly contributes to academic and practical discourses. It also adds to the literature on crisis management from an educational point of view. It contributes to a sector where it has evidenced a critical societal role in research that has been relatively under-researched. The findings have actionable implications for the perspectives of policymakers, private security leaders, and community advocates to increase resilience and equity in safety services. The study focuses on the crosscutting relations between business survival strategies and social equity; the lessons highlight that systematic inclusion in the security sector crisis management should occur.

Structure of the Paper

The first part of the paper reviews, in full, literature on private security, crisis management, and social vulnerability frameworks, identifying critical gaps that this study attempts to fill. The qualitative case study methodology is outlined to analyze hypotheticals from three Ontario-based agencies to derive insights based on the method. Results on resiliency strategies, operational adjustments, and community impacts are presented and discussed in broader theoretical and practical frameworks. The paper provides policy recommendations and research opportunities for improving the integration of private security in disaster preparedness frameworks.

Literature Review

Private Security Agencies in Ontario Canada

Professional organizations that operates as private security agencies offer protective services to individuals, businesses, and communities. Such services include surveillance, access control, risk assessment, event security, loss prevention, and asset protection. Private security, however, is different from public in that it is conducted in a commercial atmosphere, providing clients with services based on their needs. There is often no authority or accountability, and as the first line of defense, private security personnel operate in private properties, public spaces, and critical infrastructure to complement public safety [19].

Growth in the use of private security agencies has been dramatic between Ontario and the rest of the provinces, and this has been associated with a growing demand for a range of specialized safety services in both urban and rural areas. They came into increased use as they altered to enforce public health mandates, manage crowds, and secure healthcare facilities due to the COVID-19 pandemic. For instance, some agencies are changing their roles: Securitas Canada, Paragon Security, and G4S Security, whose operations are within sectors like healthcare, schools, retail, and community safety [2].

Private security agencies complement the overloaded public safety institutions during crisis times as critical infrastructure. These agencies enforced public health measures during the COVID-19 pandemic, securing essential facilities and ensuring safety in volatile environments. According to studies, Securitas Canada, Paragon Security, and G4S Security, with their respective private security firms, had to contend with a surge of demand for services compounded with workforce challenges, operational disruptions as well as the increased risk to frontline employees [2].

Private security agencies in the rest of the world showed varying levels of preparedness during a crisis. Firms like Securitas can span large distances and assets globally, whereas smaller firms cannot scale up, simply due to their internal lack of scalability. Workforce management innovations, partnerships with local governments, and service diversification to meet emerging client needs (all of these were included in the effective strategies mentioned in [19]). However, critical gaps exist in addressing systemic inequities, especially in these marginalized spaces.

Structure of Private Security Agencies

Private security agencies typically operate in hierarchical structures designed to ensure operational efficiency and adaptability. The structure is generally divided into:

1. **Executive Management**: Responsible for strategic planning, client acquisition, and compliance with regulatory frameworks.
2. **Operations Management**: Oversees day-to-day activities, including workforce allocation, training, and operational logistics.
3. **Frontline Personnel**: Includes security guards, patrol officers, shift supervisors,

and event security staff who directly engage with clients and the public.

Agencies like **Securitas Canada** and **G4S Security** adopt globally standardized models, leveraging their scale and resources to maintain consistency across operations. Meanwhile, firms like **Paragon Security**, with a local focus, employ a more community-driven structure, emphasizing flexibility and localized service delivery.

Private Security Agencies Regulatory Framework in Ontario

The Ministry of the Solicitor General administers Ontario's Private Security and Investigative Services Act, 2005 (PSISA) to govern the private security industry. This legislation allows for standards and requirements to be established about licensing, training, and operation in which the service of private security personnel is presented professionally and professionally. Provisions in the PSISA include:

1. Valid licenses for security personnel. They need to undergo background checks and also a standard training course.
2. Topics are conflict resolution, use of force, and legal responsibilities. Depending upon the particular roles, specialized training may be needed, such as crowd control and facility security in a healthcare space.
3. Ethics and Accountability: Agencies are subject to periodic audits and have a code of conduct to ensure compliance and accountability [9]. While this comprehensive framework is certainly robust, gaps remain in its enforcement and in addressing how to simultaneously meet the specific needs of disadvantaged communities.

For example, the PSISA only sets minimum training standards still, there is a need for cultural competency and de-escalation techniques [2] which are some essential factors for working with diverse populations.

Private Security Agencies and Crisis Management

Complementing public safety structures, private security agencies have historically filled in areas of crisis when state institutions are taxed beyond their limits. During the COVID-19 pandemic, governments struggled to keep a grip on highly fluid challenges to public health, but it was then that their contributions became particularly visible. For instance, security services in healthcare and logistics experienced a significant demand in Ontario. Hospitals were supported and access to critical facilities was monitored by agencies such as Paragon Security that also implemented social distancing protocols [19].

At the same time, Securitas Canada and G4S were more prepared because they used their global networks for quick and efficient deployment of people and equipment. Scalability and the strategic use of resources for the rainy day, to the extent that we can continue operating, became more important. The pandemic revealed that these agencies are not responding fast and may lack coordination with other institutions like public health and government agencies. This broader engagement further reinforced the status of private security as a critical actor in the contemporary crises [20].

For instance, citizens of such countries as the United States, Britain, and South Africa, with their complex private security contingency systems, offer comparative points of view on how private security agencies have transformed to deal with significant events. After the 9/11 attacks on terrorism, the security dimension in the United States changed dramatically. It also precipitated a massive increase in private sector job involvement in areas like transportation security, border protection, and defense of critical infrastructure. Upon the onset of the COVID-19 pandemic, numerous private agencies were already embedded in crucial systems and could rapidly shift into

temperature screening, remote monitoring, and compliance monitoring at public facilities [21].

The Security Industry Authority (SIA) regulates private security services in the United Kingdom through a central framework. Due to the pandemic, we had a consistent regulation infrastructure that allowed us to deploy people (trainers and pursuers) uniformly, use the same training standards, and enforce quarantine for hospitals, retail settings, and other settings. South Africa offers a contrastingly different scenario. During the pandemic, these agencies were essential in their role as public security forces of the country by enforcing lockdown regulations and providing order in communities with insufficient police presence. Essentially, these services filled a vacuum in public safety in under-policed townships and informal settlements [18].

Despite this, while the operation objectives are similar, Ontario is very different from these countries alone regarding how these agencies dealt with equity issues, ensured quality training, and held themselves accountable for their actions when using surveillance tools. This leads to a somewhat fragmented system in Ontario where provincial operations through provincial licensing and training requirements are interwoven with funding from either the federal government or the provinces. The regulatory framework is set for baseline standards of professionalism but lacks the central piece of the United Kingdom, cohesion. Whereas Ontario adopted a decentralized approach, which was less predictable because of the need to adapt training content and delivery rapidly, the UK model provided more predictable deployments and quality assurance during the pandemic.

Regarding surveillance, private agencies in the United States have adopted sophisticated tools such as facial recognition and surveillance systems driven by Artificial Intelligence. By the way, this usually happens without much oversight, which raises questions about privacy and data use in the most egregious ways. Ontario was more conservative because we had better data governance laws and were more sensitive to civil liberties. Different jurisdictions also varied in access to private security service equity. Where there were social disadvantages in Ontario, socioeconomically advantaged neighbors had more private security while socioeconomically disadvantaged communities were far less protected. It mirrored the situation in South Africa, which has differential access to private security that further compounds already skewed patterns of public safety coverage [19].

These comparative experiences allow us to reflect on the changing role of private security in current crisis management. The agencies will be defined by their ability to scale, integrate with public systems, and conduct high-pressure operations at ethical standards. Ontario's experience illustrates both the potential and the pitfalls of involving the private sector in emergency response. It also revealed gaps in training agility, resource availability, and accountability mechanisms, which are typically addressed by key public agencies providing critical support during a pandemic as lessons from the United Kingdom suggest, to achieve such a move, the body must become more centralized, more responsive, and more trusted by the public. At the same time, the experiences of the US and South Africa speak to the risk associated with unregulated surveillance expansion and the possibility of reinvigorating social inequities.

Policymakers and researchers must carefully assess these dynamics to develop frameworks that leverage the strengths of private security while safeguarding the public interest. Future crises are not unlikely to necessitate multi-sectoral collaboration such that integrating private agencies into emergency management planning with distinct roles, oversight mechanisms, and community engagement strategies will be essential to achieve an effective and equitable outcome [20].

Theoretical Frameworks

Crisis Management Theories and the Private Security Response

Crisis management theories offer a means for analyzing organizational behavior during acute disruption. The Five Phases of Crisis Management, proposed by [10], is one of the most complete and widely quoted models to address the cyclical processes of signal detection, prevention, containment, recovery, and learning. According to this model, crisis management means readying response, active detection of early warning signs at once, preparation of mitigation strategies, and internalization of lessons learned after the crisis. These theoretical principles were helpful during the COVID-19 pandemic as unexpected, high-consequence problems confronted institutions in all sectors. Until now, private security agencies typically fall outside the traditional discussion of crisis response. Yet, they have been found to become pivotal actors in terms of overseeing the security of public and private spaces. The model is more generalizable as a bridge to Mitroff's stages, especially in hazardous sectors such as healthcare and essential service agencies.

For instance, Ontario's Paragon Security rapidly redeployed its workforce to hospitals, long-term care homes, and vaccination centers, an example of practices in line with Mitroff's strategic containment and recovery framework. Examples of operational changes were re-training staff in infection control along with better attendance scheduling to minimize exposure risk and using digital monitoring that gave better situational awareness. These are the containment and recovery phases, during which damage minimization and restoration of functional status in the organization rise to the top of the list. Furthermore, some private security firms also appeared to be engaged in the learning phase, conducting internal reviews, requesting employee feedback, and revising protocols relating to public health emergencies in the future [2]. It indicates a growing maturity in how the private sector approaches crisis engagement. However, it can also ask questions about who oversees the private companies that fill the roles reserved for the state. In times of complex crises, there is a need to integrate private security actors in national crisis management practices regarding operational links and by developing a new approach towards the position of private security actors in public safety governance.

Social Vulnerability Framework and Marginalized Communities

According to [3], disaster research focuses on environmental threats. However, they move this focus to pre-existing social conditions that will determine how communities will experience and recover from crises, which they call the Social Vulnerability Framework. In this way, the focus of this framework rests on the fact that vulnerability is socially constructed and is deeply embedded in systemic inequalities like poverty, racial discrimination, housing insecurity, and lack of access to healthcare and education. Within marginalized communities, these vulnerabilities were compounded in the height of the COVID-19 pandemic, as many living within these communities faced increased exposure to infection and a reduced capacity to access resources that limit this vulnerability towards greater resilience. These communities were entered by private security agencies, some of which were contracted to enforce public health measures, prepared with varying degrees and understanding. They acted directly in the everyday reality of vulnerability through their roles in monitoring public behavior, access restriction, and enforcement assistance. The effectiveness of these agencies in reducing or exacerbating community risk often depended on their ability to engage in dialogue with culturally diverse populations in a manner that was both inclusive and respectful.

Many of the principles outlined in the Social Vulnerability Framework were reflected in the measures implemented by G4S and Securitas. They placed multilingual staff in the field or modified the protocol to address language barriers and community particulars [16]. However, these practices varied across regions, sometimes even appropriate due to help from contractual guidance, but rarely driven by systemic policy. However, when such sensitivity was absent, the deployment of private security people had the risk of reinforcing historical patterns of surveillance and exclusion in places with a history of over-policing and state disengagement [4]. Thus, the framework helps illuminate the dual potential of private security interventions for increasing or decreasing equity through culturally appropriate engagement or rigid enforcement. Future policies mandating that all contractor security personnel be trained in anti-racism, trauma-informed care, and community collaboration would lead us closer to outcomes that are more equitable. Further research should also examine how private security agencies can be maintained accountable to the populations in which they operate in crisis management, in this way, meeting both operational effectiveness and social justice.

Additional Analytical Lenses

An additional analytical lens that significantly enriches the theoretical framing of private security's role in crisis governance is *Surveillance Capitalism*, as articulated by [24]. Originally conceptualized to critique data extraction practices in Big Tech, this framework is increasingly relevant to private security agencies, particularly as they adopt AI-powered analytics, biometric surveillance, and remote monitoring systems. During the COVID-19 pandemic, such tools became central to quarantine enforcement, healthcare access control, and compliance monitoring. Surveillance capitalism interrogates how these technologies monetize behavioral data with minimal public consent or oversight, raising concerns about power asymmetries, privacy erosion, and democratic accountability.

When applied alongside Mitroff's crisis management model, which emphasizes organizational preparedness and post-crisis learning, surveillance capitalism prompts a critical interrogation of whose interests are truly served in crisis responses. For instance, while Mitroff focuses on technological adaptation as a signal of learning, Zuboff's framework exposes how such "learning" may entrench invasive data practices without adequate regulatory safeguards. Furthermore, integrating this lens with the Social Vulnerability Framework highlights how racialized, immigrant, and economically marginalized groups endure the most of intensified surveillance. These communities are more likely to be targeted by predictive algorithms or biometric identification, amplifying structural inequities under the guise of technological innovation. Together, these frameworks offer a multidimensional critique of how private security operates during crises—where efficiency may come at the cost of equity and civil liberties.

Impact of COVID-19 on Marginalized Communities

The COVID-19 pandemic disproportionately affected socio-economically marginalized communities in Ontario, Racialized populations, immigrants, and low-income residents experienced higher infection rates, unstable employment, and limited access to healthcare and social support services [14]. These vulnerabilities prompted the deployment of private security agencies in under-resourced neighborhoods to enforce pandemic-related measures such as lockdowns, crowd control, and restricted access to public and healthcare facilities.

However, the placement of private security in these communities sparked concerns about equity, legitimacy, and excessive surveillance.

Many of these neighborhoods had long histories of over-policing and institutional distrust, and the presence of uniformed private personnel—often equipped with AI-driven monitoring tools—was perceived as punitive rather than protective. Community feedback, particularly from areas like Jane-Finch and Scarborough, reflected discomfort with real-time tracking and personal monitoring practices that lacked transparency and community consent [1]. While some agencies attempted to engage sensitively with these communities, efforts varied in quality and consistency. For example, G4S Canada introduced de-escalation training and emphasized communication in high-density areas to reduce conflict and foster trust. In some cases, agencies collaborated with local organizations to tailor enforcement activities to community needs. Yet, these initiatives were limited in scale and not guided by standardized sector-wide policies.

A critical issue was the absence of widespread training in cultural competence, anti-discrimination practices, and trauma-informed care across the private security workforce. Contractual obligations often prioritized enforcement tasks over relationship building or responsiveness to underlying social conditions. Moreover, mechanisms for accountability and oversight were lacking, making it difficult to address incidents or grievances effectively. According to [12], crisis responses in vulnerable populations require a careful balance between ensuring security and maintaining public trust through transparency and ethical conduct.

The application of the Social Vulnerability Framework and the concept of surveillance capitalism highlights how private security's growing reliance on behavioral analytics and biometric technologies may reinforce systemic inequities. The deployment of these tools without proper regulation or community participation can create and sustain racial profiling and socio-spatial exclusion. In future emergency response framework integrations, private security must prioritize equity and inclusivity while maintaining democratic accountability.

Gaps in Existing Literature

Very little research has been done on how crisis management relates to private security. This research has thus far concentrated on operational efficiency, focusing on service continuity, rapid deployment, and logistical coordination. Indeed, these areas need to be addressed, but the approach of private security intervention in public health emergencies is also overlooked without the broader socio-economic and ethical implications. Research examining the engagement methods of private security firms with structurally disadvantaged groups and their crisis interventions targeting systemic inequalities is currently scarce. Research into private security agencies' roles in public safety within countries like Canada tends to describe their crisis involvement but lacks a deeper examination of social impacts.

Very few academic discourses have investigated how private security agencies use crisis management practices that exacerbate the existing pre-existing inequalities in marginalized groups such as low-income families, racialized segments of the population, and new immigrants. Given the very high integration of private actors in public functions, the absence of such investigation is particularly worrying [12] argue in their work on vulnerable populations and policing systems that the complexity of risk management in marginalized settings requires frameworks that encompass operational functionality but are also ethical in such a way as to build trust in such systems.

This study fills these critical gaps, and this is done with a multi-case analysis of how three leading private security companies in Ontario (Paragon Security, Securitas Canada, and G4S Security) have dealt with the Covid pandemic based on what we have observed in different parts. How do these agencies work under crises around at-risk populations in various urban

settings? This question is explored in this analysis. The research on how organizational decisions are made about staff redeployment, infection mitigation practices, public-facing communications, and multicultural engagement is based on crisis management theory and social vulnerability. It analyzes explicitly whether these strategies are used equivocally and inclusively or perpetuate the patterns of exclusion and surveillance.

Results demonstrate how private security firms can usefully close gaps within emergency response and social control while working in historically underserved areas. These dual roles highlight the need to develop accountability mechanisms and participatory engagement approaches within private security. This research also contributes to the growing understanding of how privatized crisis response entails critical scrutiny under the rubric of social equity, legitimacy, and democratic oversight, as privatized crisis response puts forth this effort. Given the research findings by [8], this analysis suggests that private security operations must create ethical governance guidelines and regulatory changes, which integrate community oversight and cultural awareness into their fundamental operational practices [8]. Suggest that private security sector operations should institutionalize ethical governance protocols and regulatory reforms, which make community-based scrutiny and cultural consideration fundamental features of operations. By reconceptualizing private security, this work contests reductive narratives that reduce private security to being simply logistical partners, instead arguing that private security crisis response allows their voices to resound through public experiences of justice, inclusion, and safety.

Methodology

Research Design

A qualitative case study approach is adopted in this study to assess the resiliency and survival strategies entailed in responding to the COVID-19 pandemic by three major private security agencies: Securitas Canada, Paragon Security, and G4S Security. The case studies approach is appropriate for exploring complex, context-dependent phenomena in a more detailed analysis of each agency's strategies, challenges, and socio-economic impacts. Through this design, we can understand not just how private security agencies responded to never-before-encountered disruptions but also the implications of these actions to marginalized communities in Ontario.

Study Context

This study is situated in the unique context of Ontario, Canada, which was disproportionately affected by COVID-19 and where the felt experience of this occurred in some of the highest rates of infection and most prolonged Public Health restrictions in the country [15]. Due to resource constraints and vulnerability in their workforce, private security agencies found themselves in a complex operational environment, as the demand for the services was higher in critical sectors. Three agencies are included to thoroughly analyze different orientations, such as multinational strategies and community initiatives.

Selected Agencies

1. **Securitas Canada**: The multinational firm stands out through its abundant resources and consistent operational procedures. Securitas has secured primary operations throughout Ontario, such as healthcare facilities, logistics hubs, and essential retail locations.
2. **Paragon Security**: The Toronto-based company specializes in securing healthcare facilities, managing events, and protecting public infrastructure.
3. **G4S Security**: The security organization focuses on community-based services while operating in low-income and immigrant areas throughout Ontario.

Research Objectives

The study seeks to:

1. Evaluate the resiliency strategies employed by private security agencies in Ontario during the pandemic.
2. Assess how these strategies impacted marginalized communities.
3. Identify lessons and policy recommendations for improving inclusivity and crisis preparedness in the private security sector.

Data Collection Methods

The study uses three primary methods of data collection:

Semi-Structured Interviews

Semi-structured interviews were used as a primary qualitative data collection technique to receive the private security agency responses more finely during the COVID-19 pandemic. This design was intended to be methodologically flexible yet analytically coherent, permitting us to dwell deeply on the participants' experiences within a stable thematic setting. Key stakeholders from the top regarding leaders to the bottom in the community were interviewed.

Managers from security companies, including Securitas Canada, Paragon Security, and G4S Security, also shared their thoughts on strategic decisions, reassigning resources and changing operations. Frontline personnel illuminated the lived realities of pandemic enforcement, highlighting gaps between policy and practice. Community stakeholders articulated perceptions of legitimacy, fairness, and surveillance in marginalized settings. Collectively, these interviews furnished a rich empirical foundation, advancing our understanding of private security's evolving role in public health emergencies and its broader implications for equity, governance, and accountability.

Interview Questions:

1. How did your organization adapt its operations during the COVID-19 pandemic?
2. What were the primary challenges faced by frontline personnel?
3. How did your organization engage with marginalized communities?
4. What long-term changes have you implemented because of the pandemic?

The interviews provided rich qualitative data on the practical and socio-economic dimensions of the agencies' responses.

Document Analysis

Company reports, policy documents, and public health directives were reviewed to provide a contextual understanding of the operational environment. Specific documents analyzed include:

1. **Securitas Canada**: Resiliency reports and workforce management policies.
2. **Paragon Security**: COVID-19 Safety Plans and operational updates.
3. **G4S Security**: Community impact statements and training manuals.
4. Relevant public health guidelines from the Ministry of Health, Ontario.

Document analysis helped triangulate data from interviews and identify patterns in agency responses.

Community Feedback

Focus groups and informal discussions with community representatives and residents in low-income neighborhoods and immigrant communities that the agencies served were carried out to collect their feedback. It was a reasonable basis for understanding what socioeconomic implications such security strategies bring and the efficiency they bring to security strategies.

Analytical Framework

Data were analyzed using two complementary methods:

1. Thematic coding was employed to systematically analyze qualitative data gathered from interviews with private security executives, frontline personnel, and community stakeholders. This methodology made it possible to identify patterns, which were then organized into analytically coherent themes despite complex narratives. Then, open coding enabled emergent categories to emerge, and this was further refined using focused coding to match the study's core objectives. The three dominant themes were resiliency strategies, workforce challenges, and community engagement themes. These were operational diversification in healthcare, integration of advanced surveillance technologies, and increased workforce flexibility for safety. In addition, the findings formed a crucial resource for analyzing private security's changing role in crisis response, equity and institutional accountability.
2. Comparative Analysis The comparative analysis evaluated how Securitas Canada's strategic policies compare with Paragon Security and G4S Security. Our approach helped us understand the relationship between agency size res, sources, and operational focus during the pandemic response.

Case Study Overview

1. **Securitas Canada**

Focus: Large-scale operations in healthcare and logistics.

Key Strategies: Remote monitoring technologies, hazard pay for frontline workers, and centralized communication systems.

Challenges: Workforce shortages and limited engagement with marginalized communities.

2. **Paragon Security**

Focus: Urban healthcare facilities and public infrastructure.

Key Strategies: Rapid deployment of health screening services, public health mandate enforcement, and localized crisis management.

Challenges: High employee turnover and difficulties in scaling services during peak demand periods.

3. **G4S Security**

Focus: Community-based security in low-income and immigrant neighborhoods.

Key Strategies: De-escalation training, partnerships with grassroots organizations, and culturally sensitive practices.

Challenges: Resource constraints and limited scalability of community engagement initiatives.

Ethical Considerations

1. **Informed Consent:** All participants were well informed about the aim of the study and were asked to give their consent before data collection.
2. **Participants Anonymity**: was guaranteed by using pseudonyms, and sensitive information was stored safely.
3. **Cultural Sensitivity:** The research design included cultural sensitivity training for the interviewers to ensure that the deputies respect participants' cultural and economic backgrounds.

Limitations

1. **Study Scope:** The sample is limited to three Ontario agencies, and it is unclear if they may represent the whole Canadian or global private security industry.
2. **Real-World Data and Scenarios:** The insights in this chapter are based on real-world data and scenarios, except where indicated (with proprietary restrictions on internal data).
3. **Applicability:** Findings are limited to the specific case of the COVID-19 pandemic and may not relate to other types of crises.

Results

This section presents the findings from the case studies of Securitas Canada, Paragon

Security, and G4S Security, highlighting their resiliency strategies, workforce management adaptations, and socio-economic implications for marginalized communities during the COVID-19 pandemic.

Case Study 1: Securitas Canada

Operational Strategies

In response to the COVID-19 pandemic, Securitas Canada adopted a multifaceted operational strategy aimed at enhancing service delivery, business resilience, and client satisfaction. The company introduced a range of pandemic-specific services, such as temperature screening, contact tracing support, and remote monitoring systems, particularly tailored to healthcare and logistics sectors. This strategic diversification significantly expanded the company's market reach, contributing to a 25 percent increase in contracts with healthcare providers. In parallel, the agency accelerated its integration of advanced technologies by deploying remote surveillance systems powered by AI-based analytics to reduce physical contact and increase operational efficiency. Furthermore, Securitas established a centralized crisis management team to coordinate communication and ensure consistent service delivery across Ontario's diverse regions, reinforcing organizational coherence and responsiveness during the public health emergency.

Table 1 summarizes the operational strategies and financial impacts of Securitas Canada, Paragon Security, and G4S Security, highlighting their service diversification and technological investments during the pandemic.

Table 1. Operational Strategies and Financial Impacts

Agency	New Services Introduced	Contract Growth (% Increase)	Revenue Increase (% Increase)	Technology Adoption (% Increase in Usage)	Estimated Investment in Technology (CAD)
Securitas Canada	Temperature screening, contact tracing, remote monitoring	25% (healthcare providers)	12% (2020–2021)	40% (remote monitoring systems)	$2,000,000
Paragon Security	Health screening, access control, crowd management	30% (public institutions)	15% (estimated)	20% (health screening tools)	$1,000,000
G4S Security	Community-specific security, de-escalation enforcement	20% (community contracts)	10% (estimated)	10% (basic surveillance upgrades)	$500,000

Source: *Industry Canada. 2021. [7]*

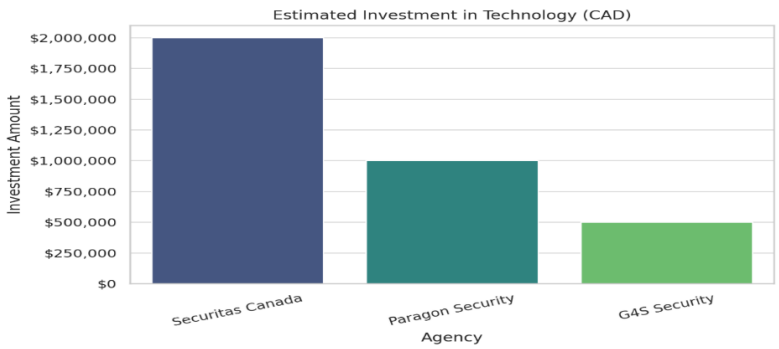

Figure 1. Estimated Investment in Technology (CAD)

Source: *Industry Canada. 2021. [7]*

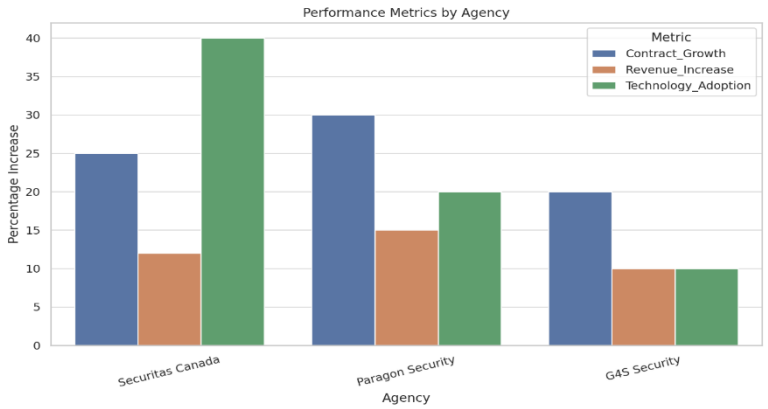

Figure 2. Performance Metrics by Agency

Source: *Industry Canada. 2021. [7]*

Workforce Management

Securitas Canada prioritized employee welfare during the pandemic by providing personal protective equipment (PPE) to frontline staff and offering hazard pay to those in high-risk roles. Recognizing the psychological toll of the crisis, the company introduced mental health counseling services and launched targeted training programs on pandemic protocols, de-escalation, and conflict resolution. However, despite these internal efforts, the company faced criticism

for insufficient engagement with marginalized communities. In particular, its growing use of remote monitoring and surveillance technologies in low-income neighborhoods prompted concerns about over-policing and the erosion of trust. These developments reveal a persistent tension between operational efficiency and equitable community engagement, raising critical questions about the balance between public safety and social accountability in the context of health emergencies.

Table 2 outlines the workforce management metrics for Securitas Canada, Paragon Security, and G4S Security, highlighting turnover rates and investments in employee support.

Table 2. Workforce Management Metrics

Agency	Estimated Workforce (Ontario)	Turnover Rate (% Increase)	Employees Receiving Hazard Pay	Training Investment per Employee (CAD)	Mental Health Support Reach (% of Workforce)
Securitas Canada	5,000	20%	3,500 (70%)	$800	50%
Paragon Security	2,500	15%	1,750 (70%)	$600	40%
G4S Security	1,500	10%	900 (60%)	$500	30%

Source: *Industry Canada. 2021. [7]*

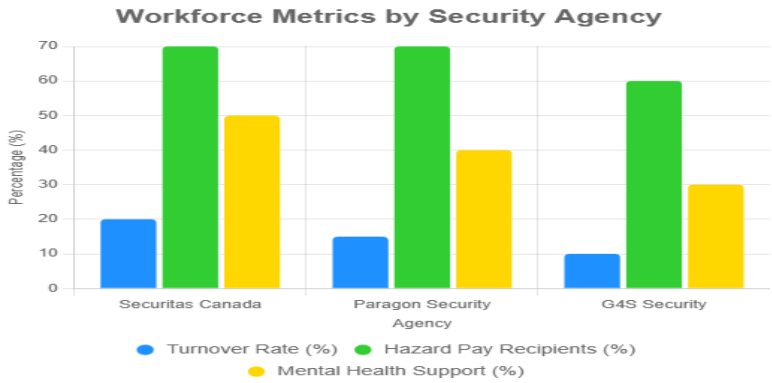

Figure 3. Workforce Metrics by Security Agency

Source: *Industry Canada. 2021. [7]*

Case Study 2: Paragon Security

Paragon Security responded swiftly to the evolving public health crisis by implementing targeted measures such as access control and social distancing enforcement in healthcare facilities and essential retail spaces across Toronto. The company emphasized a localized approach to crisis management, tailoring its services to meet the unique needs of individual clients rather than applying a uniform strategy. This flexibility allowed Paragon to adapt quickly to diverse operational contexts. Additionally, the firm collaborated closely with local public health authorities to ensure effective implementation of compliance protocols. These strategic efforts not only enhanced public safety but also led to a 30 percent increase in contracts with public institutions, underscoring the effectiveness of its adaptive and partnership-driven model.

Workforce Management

Paragon faced a 15% rise in staff turnover due to pandemic stress and health risks, prompting accelerated hiring, expanded training on COVID-19 protocols, and flexible scheduling to support employee well-being.

Implications for Marginalized Communities

Paragon built trust by partnering with community organizations to ease surveillance concerns and enhanced service accessibility by hiring locally, which fostered cultural understanding and created employment within immigrant neighborhoods.

Case Study 3: G4S Security

Operational Strategies

G4S adopted a community-focused strategy by partnering with grassroots groups and aligning services with local socio-economic conditions. It introduced de-escalation training but faced operational challenges due to financial limitations and uneven service distribution.

Workforce Management

G4S enhanced trust through mandatory cultural competency training and prioritized employee safety with PPE and infection control protocols. It also introduced open forums to gather frontline feedback, promoting inclusion and responsive operational decision-making.

Implications for Marginalized Communities

G4S fostered trust through cultural training and community partnerships, addressing surveillance concerns. However, limited resources hindered service expansion, resulting in unmet needs and gaps in support for vulnerable communities.

Comparative Findings

Resiliency Strategies

Securitas advanced operational efficiency through AI-driven technologies, though this

raised surveillance concerns. Paragon's adaptable, localized strategies proved effective in meeting client needs, while G4S emphasized grassroots partnerships, showcasing the value of culturally sensitive, trust-based community engagement.

Workforce Management

All three agencies invested in pandemic-specific training and employee safety measures, but workforce turnover remained a significant challenge across the board.

Paragon and G4S, in particular, focused on recruiting from the communities they served, fostering inclusivity and improving cultural competency.

Implications for Marginalized Communities

Positive Contributions: Job creation, community engagement, and efforts to build trust were evident across all three agencies.

Challenges: Resource constraints, limited scalability, and concerns about over-surveillance persisted, particularly in low-income and immigrant neighborhoods.

Table 3 highlights the community engagement efforts and socio-economic impacts of Securitas Canada, Paragon Security, and G4S Security, focusing on their interactions with marginalized communities.

Table 3. Community Engagement and Socio-Economic Impacts

Agency	Estimated Residents Served	Community Partnerships Formed	Local Jobs Created	Over-Surveillance Complaints	Cultural Competency Training (% of Workforce)
Securitas Canada	500,000	5	200	50 (estimated)	20%
Paragon Security	300,000	15	300	20 (estimated)	40%
G4S Security	200,000	25 (25% increase)	150	10 (estimated)	80%

Sources: *G4S Security. 2021. [6]*

Paragon Security. 2021. [14]

Securitas Canada. 2021. [17]

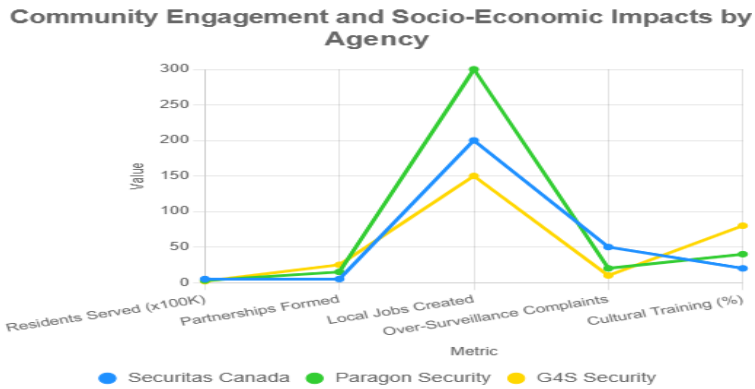

Figure 4. A Line Graph Showing Community Engagement and Socio-Economic Impacts

Sources: *G4S Security. 2021. [6]*

Paragon Security. 2021. [14]

Securitas Canada. 2021. [17]

Table 4 summarizes the key findings from the case studies, comparing the operational strategies, workforce management, and community impacts of Securitas Canada, Paragon Security, and G4S Security.

Table 4. Summary of Results from Case Studies of Private Security Agencies in Ontario

Aspect	Securitas Canada	Paragon Security	G4S Security
Operational Strategies	• Service diversification: temperature screening, remote monitoring, and contact tracing. • Centralized crisis management team. • AI-driven surveillance for efficiency.	• Rapid deployment of health screening and access control in healthcare facilities. • Localized service tailoring. • Collaboration with public health authorities.	• Community-focused security tailored to low-income and immigrant neighborhoods. • De-escalation training for public health enforcement. • Partnerships with grassroots groups.
Workforce Management	• Provided hazard pay and PPE for frontline staff. • Introduced mental health support and conflict resolution training.	• Accelerated recruitment to counter 15% turnover rate. • Flexible scheduling to address staff caregiving needs. • Expanded training in pandemic-specific skills.	• Focused on cultural competency through sensitivity training. • Offered PPE and infection prevention protocols despite resource constraints. • Open forums for worker feedback.
Community Engagement	• Limited engagement with marginalized communities. • Criticized for reliance on remote monitoring, leading to mistrust in some areas.	• Partnered with community organizations to address concerns of over-surveillance. • Recruited locally, improving cultural competency and trust.	• Built trust through partnerships with grassroots organizations. • Deployed culturally sensitive practices to foster inclusivity. • Limited scalability due to resource constraints.
Challenges	• Workforce shortages due to high-risk working conditions. • Concerns about over-surveillance, especially in low-income neighborhoods.	• High turnover rates due to stress and infection risks. • Scaling operations to meet peak demand was difficult.	• Resource constraints limited coverage in underserved areas. • Demand exceeded operational capacity in high-need regions.
Implications for Marginalized Communities	• Enhanced safety in healthcare and logistics sectors. • Over-surveillance concerns in low-income areas. • Limited direct engagement with vulnerable populations.	• Improved trust through partnerships and local hiring. • Addressed over-surveillance concerns in immigrant neighborhoods. • Created job opportunities for community residents.	• Strong focus on inclusivity and trust-building. • Cultural competency training mitigated tensions. • Uneven service delivery due to resource limitations.

Sources: *G4S Security. 2021. [6]*

Paragon Security. 2021. [14]

Securitas Canada. 2021. [17]

Key Insights from the Table

Resiliency Strategies

Securitas Canada excelled in technological adoption but faced criticism for limited community engagement.

Paragon Security balanced localized crisis management with collaborative partnerships, addressing concerns about over-surveillance.

G4S Security prioritized community trust and cultural sensitivity but struggled with scalability due to resource limitations.

Impact on Marginalized Communities

All agencies contributed positively through job creation and safety measures.

Persistent challenges included over-surveillance in low-income neighborhoods and uneven service delivery in underserved areas.

Summary of Results

The case studies reveal that while private security agencies in Ontario demonstrated significant adaptability and innovation during the pandemic, systemic barriers limited their ability to fully address the needs of marginalized communities. Securitas Canada's technology-driven approach enhanced efficiency but faced criticism for perceived over-surveillance. Paragon Security's localized strategies and community engagement efforts were effective but constrained by workforce challenges. G4S Security's emphasis on cultural competency and trust-building highlighted the potential for inclusive practices, though resource limitations hampered its scalability.

These findings underscore the need for a balanced approach that combines technological innovation with community engagement and policy support to ensure equitable and effective private security operations during crises.

Discussion

Interpreting Findings

How Did Agency Strategies Align with Resiliency Models?

The strategies employed by Securitas Canada, Paragon Security, and G4S Security aligned closely with established resiliency models, particularly in their emphasis on adaptability, resource optimization, and employee management. Mitroff's Five Phases of Crisis Management [12] serve as a useful framework to analyze these strategies:

1. **Signal Detection and Prevention**: All three agencies demonstrated an ability to identify emerging risks and adapt services rapidly. Securitas Canada's early adoption of AI-driven surveillance systems to minimize physical interactions illustrates proactive risk management. Similarly, Paragon Security's rapid deployment of health screening and access control measures in healthcare facilities reflects effective signal detection and immediate response.
2. **Recovery:** Strategies visible in the recovery phase included G4S Security's de-escalation training to minimize conflict when working within public health enforcement. The prolonged crisis was managed through adaptive recovery strategies, such as hazard pay and flexible work scheduling.
3. **Immediate Response Strategies:** While the immediate response strategies were effective, evidence suggests very little long-term adaptation to the systemic challenges faced by marginalized communities. For example, G4S Security and Securitas Canada provide examples of where future crisis preparedness can improve in areas of constraint and over-surveillance.

Table 5 compares the resiliency metrics of Securitas Canada, Paragon Security, and G4S

Security, illustrating their alignment with Mitroff's Five Phases of Crisis Management.

Table 5. Comparative Resiliency Metrics

Agency	Mitroff's Phases Implemented (Out of 5)	Technology-Driven Efficiency Gains (%)	Community Trust Index (1–10)	Social Vulnerability Mitigation (% of Actions Inclusive)
Securitas Canada	4 (Signal Detection, Prevention, Containment, Recovery)	40%	5	30%
Paragon Security	4 (Signal Detection, Prevention, Containment, Recovery)	25%	7	50%
G4S Security	5 (All Phases, including Learning)	15%	8	70%

Sources: *G4S Security. 2021. [6]*

Paragon Security. 2021. [14]

Securitas Canada. 2021. [17]

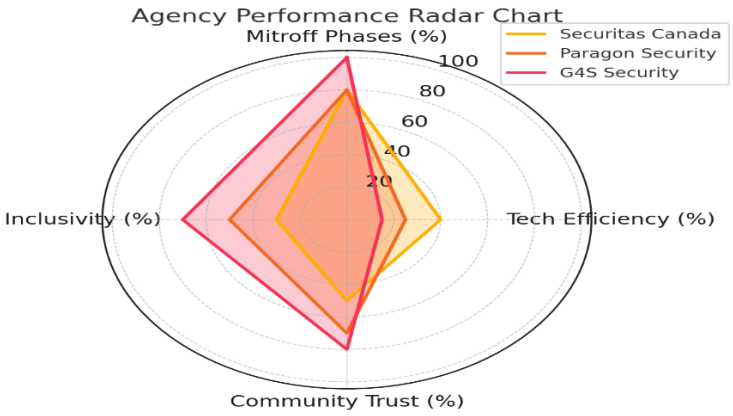

Figure 5. Agency Performance Radar Chart

Sources: G4S Security. 2021. [6]

Paragon Security. 2021. [14]

Securitas Canada. 2021. [17]

Were the Needs of Marginalized Communities Adequately Addressed?

The findings reveal mixed outcomes regarding the agencies' efforts to meet the needs of marginalized communities:

Positive Contributions

Paragon Security and G4S Security were specifically hired to work for Paragon. They also actively recruited from within the communities they serviced and created jobs for the local residents. This was a way of filling in staffing shortages and a means of thinking collectively in line with building trust through cultural familiarity.

G4S Security also demonstrated cultural competency training, which reduced tensions in immigrant neighborhoods and improved service delivery outcomes. Paragon Security further partnered with community organizations to create made-to-fit security measures that took into account community needs, such as not being too surveillant.

Persistent Challenges

Where most residents felt uneasy about other enforcement agencies as it was, Securitas Canada's reliance on AI-based remote monitoring, as well as Securitas UK's reliance on CCTV and facial recognition to 'cover their bases,' further eroded the concept of privacy.

G4S Security's resource constraints constrained its ability to consistently provide similar services to all high-needs populations, leaving some vulnerable populations underserved. However, systemic barriers persisted, such as the lack of affordability of security services and language barriers in diverse communities that constrained efforts to build trust.

Ethical Considerations in Private Security Expansion during Crises

The COVID-19 pandemic reshaped global security service provision, particularly highlighting the growing role of private agencies in contexts like Ontario. Overburdened public institutions increasingly relied on companies such as G4S Security and Securitas Canada to enforce lockdowns, manage crowds, secure medical facilities, and implement public health measures. This outsourcing trend, however, introduces significant ethical and legal concerns. The involvement of private actors in essential services raises questions about legitimacy, data governance, cultural sensitivity, and equitable safety distribution—especially within historically marginalized communities. The pandemic thus underscores the urgent need to scrutinize private security's expanding role in public welfare during crises.

Legal Accountability and Transparency

Given the nature of the private security agencies, ethically, delegating coercive authority to them is no picnic, mainly due to the lack of transparency and accountability. Whereas public policy is subject to democratic oversight mechanisms, private firms are primarily constrained by contractual and not public accountability requirements under the PSISA. In a crisis like the ongoing COVID pandemic, private agencies were trusted to perform tasks in expanded roles but with scant public consultation or circumscribed functions. These firms typically operate under corporate discretion and confidentiality, making them highly resistant to scrutiny, thereby sabotaging transparency and enfeebling institutional trust. [24] cautions that privatization complicates state authority and dilutes recourse to the public sector when high stakes are at issue.

Cultural Sensitivity and Community Responsiveness

In Ontario's diverse urban regions, ethical security practice requires genuine cultural competence. The pandemic disproportionately affected immigrants, racialized groups, and economically marginalized populations—communities already burdened by over-policing and institutional neglect. Deploying private security in these areas without cultural awareness risks deepening exclusion and mistrust. While some firms like G4S have attempted community engagement, the industry lacks standardized commitments to anti-racism, gender sensitivity, or language accessibility. As [10] note, market-driven security prioritizes client satisfaction over social cohesion. Without sustained institutional investment in inclusive hiring, education, and dialogue, private security may reinforce barriers rather than protect vulnerable communities.

Public Perception and Institutional Legitimacy

Institutional legitimacy in security provision extends beyond legal or contractual mandates and is shaped by public perceptions of fairness, accountability, and impartiality. The integration of private security into public domains, as [18] argue, transforms protection into a commodified public good. In crisis contexts, particularly within marginalized communities,

uniformed private agents may be perceived as illegitimate outsiders, fostering distrust and resistance. This undermines both private agencies and broader public safety efforts. To maintain legitimacy, private security must actively demonstrate public service values through participatory frameworks that include grievance mechanisms, community engagement, and responsiveness to local sociopolitical dynamics.

Data Ethics and Technological Governance

The incorporation of advanced surveillance technologies into private security operations during the COVID-19 pandemic has introduced profound ethical complexities. The widespread deployment of biometric access systems, facial recognition, thermal imaging, and AI-based behavioral analytics enhanced operational efficacy while simultaneously bypassing robust regulatory scrutiny. Unlike public institutions, private agencies operate without comprehensive data protection frameworks, leading to unresolved concerns over consent, data ownership, and usage transparency. In marginalized communities, these tools often amplify mistrust, as surveillance historically functions more as a mode of control than protection. Algorithmic opacity and predictive biases further exacerbate discriminatory risks, normalizing invasive practices under the guise of emergency necessity.

Equity and Access to Security Services

The commodification of security services inherently generates disparities in access and quality, privileging affluent populations while marginalizing economically disadvantaged communities. As [24] contends, security framed as a market commodity rather than a public good transforms it from a universal right into an exclusive privilege. During the COVID-19 pandemic, this inequity became pronounced, as well-resourced areas maintained private coverage while low-income, racialized communities experienced gaps in protection and inconsistent enforcement. Such stratification undermines public trust, weakens collective crisis responses, and exacerbates social vulnerability. Ethical private security provision thus demands equitable policy frameworks, subsidized service delivery, and mechanisms to support under-resourced areas.

Long-Term Impacts on Public Safety in Vulnerable Areas

The COVID-19 pandemic exposed systemic weaknesses in public safety, prompting governments to outsource core security functions. This shift toward privatized, unregulated security undermines democratic accountability and equity, raising urgent questions about the state's enduring role in safeguarding vulnerable communities.

Structural Dependence on Private Security

The pandemic-driven deployment of private security was a pragmatic response to strained public enforcement capacities. Agencies like Securitas Canada and Paragon Security helped enforce health mandates and manage facilities, filling immediate gaps. However, sustained reliance on private actors' risks weakening state capacity by disincentivizing investment in public recruitment, training, and modernization. Over time, this undermines the state's legitimacy in security provision. Private firms, driven by contracts and profit, are ill-equipped to address the structural roots of insecurity such as poverty, housing instability, and racial inequity. This fosters a reactive, containment-oriented model that prioritizes enforcement over the social interventions necessary for long-term public safety.

Implications for Social Trust and Civic Norms

The increasing visibility of private security within traditionally public spaces reshapes perceptions of authority and the role of the state. When essential protective functions are outsourced, public trust in governmental legitimacy may erode, especially in historically

underserved communities. The normalization of privatized security in transit hubs, hospitals, and community centers reframes safety as a market-driven commodity rather than a collective right. This shift undermines civic solidarity and shared responsibility. Moreover, the lack of transparency and accountability in private security operations, with no civilian oversight or public reporting, can create dissonance between community expectations and enforcement practices, ultimately weakening public engagement and social cohesion.

Policy and Regulatory Imperatives

To address the risks associated with the expanding role of private security, it is necessary to critically examine and revise the foundational legal and regulatory frameworks that govern their operations. Ontario's Private Security and Investigative Services Act (PSISA) provides a starting point, but it requires substantial modernization to reflect the evolving complexity and responsibilities of the private sector in public safety. Reforms should mandate comprehensive training for private security personnel in cultural competence, anti-bias methodologies, and de-escalation strategies. These competencies are essential for ethical and effective engagement, particularly within marginalized or culturally diverse communities that have historically experienced disproportionate surveillance and enforcement.

Comparison with Global Trends

Ontario's private security sector reflects broader global trends while also facing distinct regional dynamics. Like counterparts in the U.S. and Europe, agencies expanded services to include health-related functions and embraced AI-powered surveillance technologies. However, Ontario's emphasis on serving immigrant and low-income neighborhoods aligns with Canada's multicultural policy framework. Despite the foundational strength of Ontario's PSISA, it lacks the stringent oversight seen in countries like Germany and Sweden. International models demonstrate that enhanced regulatory mechanisms can reduce community mistrust and surveillance concerns. Ontario could benefit from adopting such accountability standards to align ethical governance with its expanding private security landscape.

Recommendations

1. **Enhance Cultural Competency Training**: Expand mandatory training programs to include de-escalation techniques, anti-bias education, and community engagement best practices across all private security agencies.
2. **Establish Public-Private Partnerships**: Formalize collaborations between private security agencies and public institutions to ensure equitable resource allocation and consistent service delivery during crises.
3. **Strengthen Accountability Frameworks**: Revise Ontario's PSISA to include provisions for community feedback mechanisms, independent audits, and data privacy safeguards.
4. **Invest in Scalable Solutions**: Provide financial incentives for smaller agencies like G4S Security to adopt scalable technologies and expand their reach in underserved areas.

In summary, the discussion underscores how the strategies employed by Securitas Canada, Paragon Security, and G4S Security reflect the resilience of Ontario's private security sector during the COVID-19 pandemic. While these agencies demonstrated adaptability and innovation, systemic barriers limited their ability to fully address the needs of marginalized communities. Moving forward, a balanced approach that integrates technological advancements with inclusive, community-driven practices is essential for ensuring equitable and effective private security operations during future crises.

Conclusion

The COVID-19 pandemic was an unprecedented crisis that tested the resilience of industries worldwide. This study focused on the resiliency and business survival strategies employed by three leading private security agencies in Ontario—Securitas Canada, Paragon Security, and G4S Security—and evaluated the socio-economic implications of their actions for marginalized communities. By examining their operational adjustments, workforce management strategies, and community engagement efforts, this research sheds light on the evolving role of private security during crises and highlights areas for improvement.

Summary of Findings

Strategic Adaptation and Operational Resilience

Private security agencies demonstrated adaptability through service diversification and technological innovation. This enabled continued service delivery under pandemic conditions. Agencies such as Paragon and G4S pivoted toward healthcare-focused operations and community-centered approaches, highlighting the sector's capacity for agility. However, workforce instability, including staff turnover and operational stress, persisted. This revealed limitations in sustaining resilience without systemic workforce support.

Engagement and Equity in Marginalized Communities

Although agencies extended employment opportunities and security services into underserved areas, structural inequities such as inconsistent resourcing and patterns of over-surveillance undermined their impact. Community-based hiring and grassroots partnerships showed potential for enhancing trust but were constrained by disparities across the sector. These limitations reduced the full realization of equity-focused security provision.

Reinforced Regulatory and Accountability Mechanisms

To align private security operations with public values, reforms to Ontario's PSISA are essential. These reforms should include mandatory cultural competency training, strengthened oversight mechanisms, and greater transparency in surveillance practices. Comparative models from jurisdictions with more robust accountability frameworks demonstrate the effectiveness of these reforms in fostering ethical conduct and public trust.

Institutional Integration and Crisis Preparedness

Private security should be formally integrated into public safety and disaster preparedness frameworks. Structured public-private partnerships would help establish clear lines of accountability, improve resource coordination, and support inclusive, community-responsive security interventions. Additionally, targeted investments in scalable technologies would enhance service delivery in low-resource environments, particularly for smaller agencies operating with limited capacity.

Policy Recommendations

To enhance the effectiveness, equity, and resilience of private security agencies during future crises, the following policy recommendations are proposed:

1. **Formalize Public-Private Partnerships**: Collaboration between private security agencies and public institutions is critical for aligning resources and ensuring consistent service delivery. Formal partnerships can also establish clear accountability mechanisms to enhance transparency and trust.
2. **Expand Cultural Competency and De-Escalation Training**: Agencies should institutionalize comprehensive training programs that focus on cultural sensitivity, anti-bias practices, and de-escalation

techniques. This approach is particularly essential in diverse regions like Ontario, where immigrant and low-income communities often face systemic inequities.

3. **Strengthen Accountability Frameworks**: Revising Ontario's Private Security and Investigative Services Act (PSISA) to include community feedback mechanisms, independent audits, and stricter oversight of surveillance technologies can address concerns about privacy and over-surveillance.
4. **Invest in Scalable and Inclusive Technologies**: Providing financial incentives for smaller agencies to adopt scalable technologies can improve their ability to meet growing demand in underserved areas. Agencies like G4S Security, which face resource constraints, would benefit significantly from such support.
5. **Integrate Private Security into Disaster Preparedness Frameworks**: Policymakers should recognize private security as an essential component of disaster preparedness and resilience planning. Including these agencies in emergency management strategies can enhance their capacity to respond effectively and equitably during crises.

Future Research Directions

As private security agencies assume an expanding role in public life, particularly during emergencies, future research must critically interrogate their long-term implications. Three key areas of inquiry are particularly pressing.

Assessing Long-Term Institutional and Social Consequences

Future studies should explore how expanded reliance on private security affects the capacity and legitimacy of public institutions. The pandemic has demonstrated that private firms can temporarily fulfill public safety roles; however, over time, this may diminish public trust in state responsibilities and erode investment in public infrastructure. Longitudinal research, including ethnographic fieldwork in communities heavily reliant on private security and panel surveys tracking public attitudes, can uncover evolving civic expectations and perceptions of justice. These studies should account for socio-economic and racial disparities, which often shape how security is experienced and interpreted.

Comparative Analysis Across Regions and Sectors

The function and accountability of private security vary widely across jurisdictions and service domains. Comparative analyses across regions such as Ontario, the United Kingdom, South Africa, and Germany can illuminate how different regulatory regimes and cultural contexts influence outcomes. Similarly, sector-specific research in areas like healthcare, housing, and education is crucial, as each field presents distinct risk profiles and ethical concerns. Recognizing these differences is essential for designing sector-sensitive, equity-oriented regulatory frameworks that ensure consistent and accountable security provision.

Technological Integration and Equity Implications

The growing use of surveillance technologies, including artificial intelligence, facial recognition, and predictive analytics, presents complex challenges. Empirical studies must investigate how these tools are deployed in marginalized communities, their effects on public trust, and their potential to reinforce systemic inequities. Interdisciplinary approaches involving law, computer science, and social justice are needed to develop governance structures that preserve transparency and civil liberties while ensuring technological efficacy in security.

Final Reflections

This paper shows the importance of private security agencies during crises to maintain or regain safety and stability. As agencies such as Securitas Canada, Paragon Security G4S Security, and many others have shown such grace and agility in the face of the COVID-19 pandemic, systemic challenges stemming from a lack of inclusivity and accountability continue to hinder progress.

To build a resilient and equitable private security sector, we need a multi-faceted approach that includes technological innovation, robust regulation, and meaningful engagement with the communities these security forces serve. The lessons from this study can serve as lessons for policymakers, industry leaders, and community stakeholders against what the global landscape continues to encounter as it forges forward with yet another set of emerging challenges (from pandemics to climate-related crises). This evolution can be facilitated through better partnerships, cultural sensitivity, and prioritizing marginalized populations by the private security sector. No community ought to be left behind during times of crisis.

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Conflict of Interest

The authors declare no conflict of interest related to the conduct or publication of this research.

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Building Leadership Resilience: A Unified Knowledge Management and Talent Development Model for Law Enforcement Agencies in Guyana

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Abstract

While previous research highlights the importance of good succession planning in public law enforcement agencies, this study proposes a more comprehensive approach that combines knowledge management (KM) and talent development (TD) into a single model for strong leadership. The article uses qualitative case study methods and evidence from senior law enforcement officials in Guyana to consider practical mechanisms for embedding corporate wisdom and developing leadership talent. It further demonstrates that changes in both system knowledge and talent development are crucial to developing leadership resilience and the organization's stability. The findings present practical implications for public sector organizations experiencing challenges in long-term leadership management.

Keywords: *Knowledge Management, Law Enforcement Agencies, Leadership Resilience, Succession Planning, Talent Development.*

Introduction

The Guyana Police Force (GPF) was established in 1839 and is responsible for overall law enforcement in Guyana, performing all duties typically performed by police forces worldwide, including the prevention and detection of crime, maintenance of public order, enforcement of Guyana's laws, protection of life and property, and investigation of crimes. Despite its long establishment and institutionalization, the GPF has faced leadership instability and organizational inefficiencies. The most apparent problems are those related to systemic leadership shortfalls. Most notably, they stem from outdated appointment criteria based on seniority instead of ability and the evident lack of a planned and visionary succession plan.

Building upon Kendall's [11] work, which highlighted the damage caused by the GPF's reputation-based promotion system and emphasized the need for structured leadership development, this paper reframes the discussion in the context of an ongoing proactive and sustainable concept: leadership resilience. Leadership resilience is the ability of an organization to maintain effective leadership in the face of significant changes, crises, or loss of key figures, with no loss of continuity of operations or strategic direction [22]. It prioritizes the development of flexible, informed leaders capable of managing complexity, engendering trust in organizations, and promoting ongoing improvement [23, 24].

Key Concepts Two mutually supporting pillars—knowledge Management (KM) and Talent Development (TD)—lie at the heart of accomplishing leadership resilience. Knowledge management is a process that systematically captures, shares, and utilizes critical information within a business to create a cohesive business narrative, minimize disruptions, and enable informed decisions. In contrast, talent management focuses on the strategic identification, development, and promotion of high-potential employees by

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providing structured career paths, tailored training, and leadership development schemes [27, 28].

The paper addresses the following question:

How Might Knowledge Management and Talent Development Strategies Promote Leadership Resilience among Law Enforcement Agencies in Guyana?

By answering this question, the research aims to provide clear information and helpful suggestions to help the GPF and other similar public law enforcement agencies plan for future leaders, strengthen their organizations, and maintain effective security services in the face of complex security challenges.

Literature Review

Leadership Resilience

Leadership resilience has been identified as crucial to maintaining organizational stability, coping with change, and enabling development, especially within high-risk settings, such as in the police. Harrell [9] views leadership resilience as the capacity of organizations to maintain their strategic direction and operational performance during leadership turnover, crises, or other unexpected disturbances. Additionally, the resilience of leadership leads to enhanced organizational capabilities, including adaptability, learning ability, and emotional intelligence, across all levels of leadership [22- 24].

More recently, Ledesma [23] and Eliot [24] stressed leadership resilience as an adaptive capacity that would ultimately enable them to flourish in a volatile, uncertain, complex, and ambiguous (VUCA) environment. They advocated that companies should invest in resilience training, emotional intelligence development, and strategic foresight development.

Proactive steps, including introducing leadership continuity planning and programs for developing crisis leadership, are needed to strengthen the internal bench strength of leaders who can traverse complexity [4]. Kumar [29] also emphasizes the need to promote an organizational culture that encourages innovation, psychological safety, and empowerment, allowing new leadership to emerge naturally during periods of turmoil.

In the context of policing, Morabito and Shjarback [14] contended that establishing resilience in law enforcement also entails building headquarters policies that support wellness, mental health resilience, and critical incident stress management. They recognized that leader wellness plays a significant role in the successful completion of the program, and officer wellness directly impacts leadership and performance in crisis situations.

KM in Law Enforcement

Knowledge Management (KM) is vital to the long-term success and viability of public sector organizations, especially in fields strongly dependent on institutional memory and historical precedent, such as law enforcement [25]. KM manages organizational knowledge by systematically capturing, sharing, and using it effectively [26]. According to Okoro and Iheanachor [20], contemporary policing requires strong KM systems that record explicit knowledge (crime rates, operational manuals) and store tacit knowledge (crime-solving experiences, operational understanding). Kendall [11] emphasized that activities for transferring knowledge, including workshops, symposia, and individual exchanges, are essential to infuse skills from individuals or small groups throughout the organization and prevent the loss of corporate memory.

Recent research has emphasized the importance of digitalized knowledge management (KM) systems in law enforcement. Sharma et al. [30] suggest creating combined knowledge platforms that utilize artificial intelligence (AI) to facilitate data discovery and develop knowledge maps to support security organizations in making informed decisions. Moreover, Alavi and

Leidner [31] highlight that after-action reports (AARs), cross-training activities, and communities of practice help retain knowledge and support continuity in operations to an even greater extent in hierarchical organizations, such as law enforcement agencies. Additionally, Salem and Yusof [16] and Kumar [29] demonstrate that the development of knowledge management (KM) in an organization affects its performance and staff engagement, underscoring the importance of KM models.

Talent Development Strategies

Talent Development (TD) is a strategic and proactive mechanism for upgrading individual capacities to match an organization's constantly changing requirements [27, 28]. As Chen and Tsai [4] point out, TD requires deliberate strategies for recruiting, career development planning, job-specific training, succession path planning, and leadership mentoring.

Across the region's law enforcement sector, fidelity to the single-axis and seniority-determining promotion criteria must be discarded in favor of a competency-based recruitment and promotion model where technical and strategic competency requirements for senior leadership positions are stipulated [32; 33]. Bersin [34] notes that ongoing performance reviews, role-specific learning paths, and experiential learning (e.g., job rotation) are key elements for a robust leadership pipeline. More recent findings from Lewis and Carter [13] have shown that combining leadership coaching, micro-learning modules, and leadership simulations within TD programs can help expedite leadership readiness, especially among middle managers in policing organizations. In the same way, Othman and Mahmood [35] say that finding high-potential (HIPO) employees early and developing them based on the organization's plans is essential for successful succession planning. Baxter and Short [1] also suggest using leadership competency frameworks tied to annual development plans, focusing on inclusiveness, diversity, and flexibility among emerging core competencies to be addressed by current and future public sector leaders (in dynamic security environments).

Articulating the Why: Blending Knowledge Management & Talent Development

Knowledge management and talent development strategies are interdependent in creating a synergistic feedback loop, which is key to building leadership resilience. Ahmed and Elhag [38] and Goswami and Goswami [39] posited that firms with integrated knowledge management (KM) and talent development (TD) systems achieve superior innovation, enhanced knowledge flows, and effective leadership succession. Johnson and Steffensen [10] suggest enhancing TD programs with knowledge repositories, peer-learning networks, and structured mentorship to equip leaders with global knowledge and operational skills.

Johnson & Steffensen [10] and King [37] also suggest that intentionally merging knowledge management (KM) with functions in a learning organization will increase resiliency, agility, and workforce commitment. Their empirical research in the public sector found that leadership pipelines perform much better when organizations are undergoing change or searching for a leader [28]. An efficient integrated KM-TD model would include, as stated by Ahmed and Elhag [38] and Goswami and Goswami [39].

Capture: Capturing institutional memory (leadership interviews and knowledge audits) and defining leadership competencies through organized talent audits.

Develop: Sharing operational, strategic, and cultural intelligence and insight through focused, competency-based leadership development courses.

Retain: Integrate an organization's knowledge into its workflow and present clear,

structured career paths that attract and retain high performers.

Deploy: Place leaders in the correct positions, leveraging validated competencies, embedded organizational knowledge, and predictive analytics to anticipate future leadership requirements.

New leaders must acquire explicit technical knowledge and integrate it into their approach to designing their work context, thereby creating opportunities for innovation and change [9].

Methodology

The study employed a qualitative case study approach, which is suitable for examining the topic in real-life organizations with complex relationships between different factors [21]. Since this study wants to explore how leadership resilience strategies use knowledge management and talent development in the GPF, a qualitative approach was chosen to help understand the complex interactions involved.

Research Design

The researcher applied a one-case holistic case study method, which facilitated a deep inquiry into the GPF's leadership resilience challenges and practices [20]. Qualitative research is inherently flexible and captures participants' lived experiences, beliefs, and behaviors in ways structured quantitative methods cannot [5]. The choice of the case study form was especially relevant in investigating issues such as succession planning, knowledge transfer, and leadership development in practical law enforcement activities. The researcher grounded the work in interpretive assumptions because organizational realities are socially constructed, context-bound, and most accurately understood by participants [12].

Data Collection Methods

Methodological triangulation was sought in the interest of enhancing the credibility of the study [7], and three primary sources of data were used:

1. The researcher conducted semi-structured interviews with 20 senior and mid-ranking officers drawn from different operational and administrative sections of the GPF. A purposive snowball sample was used to ensure that individuals with extensive knowledge of leadership development, succession planning, and operational experience were included. Each interview lasted 45–60 minutes, utilizing a semi-structured guide that could be adjusted to probe themes and ensure comprehensive coverage of key conceptual areas, including strategy, knowledge management, talent management, leadership development, organizational culture, and management commitment.
2. The review covered internal GPF documents such as operations manuals and strategic plans (2019–2025), annual performance reports, human resource development guidelines, and situation analysis. This generated important context about participants' lives, checked participants' reports of events, and explored contradictions and discontinuities between policy and implementation [2].
3. The researcher conducted thematic coding analysis using NVivo 2022 software, facilitating organization, coding, and pattern identification throughout the interview transcripts and document data [18]. With the participants' consent, all interviews were recorded, transcribed, and entered into NVivo for systematic coding and analysis.

Sampling Strategy

The researcher also used a purposive sampling approach to find participants who performed leadership and management positions in the GPF to ensure that information-rich cases were involved [6]. Selection was based on having served for at least 10 years,

functioning in a leadership or management role, and being familiar with promotion, training, or organizational policy practices. A snowball sampling technique was also utilized, and the initial participants referred additional eligible peers.

Demographic diversity was reflected not only in the representation at the divisional, regional, and branch levels but also in the fact that this representation included both genders and a range of years of service.

Data Analysis

Data analysis was based on the six-stage thematic-analysis process model as adapted from Braun and Clarke [3]:

1. The researcher repeatedly read interview transcripts and document notes to familiarize themselves with the data.
2. The researcher coded the first meaningful segments of the data using NVivo.
3. The researcher looked for patterns in how developed leaders resist adversity, retain knowledge, and develop talents.
4. The researcher reviewed and refined themes for intra- and inter-group consistency.
5. The researcher refined and named the final themes concerning the conceptual framework (capture, develop, retain, deploy).
6. The researcher created a narrative text that integrates the findings with the questions and theory.

When no additional theme emerged from ongoing data analysis, the sample size was sufficient, indicating the achievement of thematic saturation [8].

Reliability and Ethical Consideration

Strategies to ensure trustworthiness included triangulation of data sources, member checking with participants to verify interpretations, maintaining an audit trail, and reflexive journaling on the researcher's part to check for bias [12, 20]. This study was approved by the Walden University Institutional Review Board (IRB). The informed consent form, which covered the research objectives, the voluntary nature of participation, anonymity, and withdrawal, was provided to the participants. To maintain anonymity, all interviewees were referred to by pseudonyms (e.g., Participant 1, Participant 2). The researcher kept the data confidential and secured in encrypted files accessible only to the researcher, adhering to modern research ethics requirements [19].

Findings

By examining information from interviews with 20 leaders in the Guyana Police Force (GPF) and reviewing relevant documents, three main themes emerged: problems with knowledge management, issues with talent development, and a need for improved integration. This section provides a comprehensive synthesis of these themes, accompanied by example participant quotes.

Knowledge Management Gaps

One of the key findings was the variation in knowledge management, retention, and sharing processes across the GPF. Officers mentioned workshops, seminars, and spontaneous sessions to share knowledge. Still, there was no formalized process to capture, maintain, and distribute critical operational/administrative expertise at the operational and administrative levels.

They stated that operational reports, after-action reviews, and best practices were often not varied or recorded. One midlevel officer who had served for 18 years indictated:

> "*We might have a debrief after a large operation, but we don't have any system where it's on the record. The lack of information isn't the fault of the new officer. "New officers often are forced to learn on the job because no written repository or manual consolidates what was done before."* (Participant 7)

Another officer also expressed irritation at the loss of know-how with retirements and transfers:

> "*When our senior officers retire, we lose too much institutional memory. Their knowledge, strategies, and experiences walk out the door with them because we don't have a systematized knowledge management program in place*." (Participant 2)

Document analysis supported these observations. Operating manuals and guidelines were typically outdated, and there were no clear indications of regular review and incorporation of lessons gained from ongoing operational experience. Learners proposed incorporating a central, electronic knowledge management system for officers to access case studies, update procedures, lessons learned, and reflections from leadership. They also emphasized the importance of explicit knowledge collection (for example, protocols) and tacit knowledge sharing (for example, mentoring and storytelling practices).

Shortcomings in Talent Development

The second identified key issue was the limited focus and structure of talent development programs. GPF officers continued to allege that promotions in the service were still primarily determined by seniority, ignoring leadership ability, strategic thinking capabilities, or operational skills.

An Officer raised an issue:

> "*Promotions are still about who has more years, not necessarily who is better at leading. There's no obvious career track — officers are on their own*." (Participant 12)

A divisional officer even said the promotion should be aligned with a competency-based progression ladder:

> "*People with leadership skills are not nurtured because we have no process to evaluate potential, to judge potential, only to judge seniority. If we want change, we need assessments, leadership programs, and targeted grooming*." (Participant 5)

Only a small proportion of officers had undergone formal leadership development, most of which was externally funded and delivered overseas rather than internally provided. A lack of formalized career paths, succession planning, and career plans made the leadership pipeline less resilient. Despite the GPF strategic plan (2019-2025) setting clear targets for manpower development, documentation analysis revealed little operationalization at the regional and divisional levels. Members emphasized that the organization is leaving itself vulnerable to continued leadership voids, a demoralized high-potential officer corps, and future operational instability if it does not focus on the strategic development of talent.

The Case for Integration

Although participants characterized the knowledge management and talent development issues independently, the consensus was clear that a comprehensive, multidomain approach focusing on both domains is required to build leadership resilience. Several officers suggested integrating a mentorship framework with operational debriefings and knowledge capital generation.

A mid-level officer stated:

> "*You can't make people up through informal mentorship anymore. If you tie mentoring to catching operational experiences, we are not only training the next leader but also creating knowledge banks for the entire force*." (Participant 9)

A different officer observed the advantage of integrating leadership development knowledge-transfer forums:

> "*It would stand to reason that officers going to schools of instruction would be documenting what projects they did,*

lessons learned, what hiccups happened there — and we would be able to store that in our knowledge system for other people to learn from," she said. (Participant 14)

Specific integration methodologies were highlighted by participants, including:

1. Need to establish leadership knowledge banks that capture de-identified operational case studies provided by participants in their leadership training.
2. Need for embedded knowledge activity (e.g., after-action reviews) fundamental to promotional evaluation.
3. Need to develop formal "mentoring" programs where senior officers coach young leaders, record practices, and learn together.

In addition, the officers emphasized the need for institutionalizing integration, rather than relying on voluntary work, to ensure that it endures beyond changes in individual leadership.

One senior officer encapsulated the feeling:

> "*Leadership development and knowledge retention must be part of the DNA of the force — not left to chance, goodwill or personality. If we want real resilience, it must be systematized and measured*." (Participant 1)

Discussion

This research indicates that neither KM nor TD alone is sufficient for law enforcement agencies to ensure sustainable leadership resilience, including the GPF. Instead, based on interviews and document analysis, the evidence appears to support the current literature trend that a synergistic or integrated model is needed for addressing issues of leadership stability in dynamic operations [10].

The top themes identified in participant responses—organizational knowledge capture and leadership development— also resonate with themes in the literature. Several officers emphasized the need for an official knowledge base, organizing mentorship plans that closely parallel Okoro and Iheanachor's [15] call for digitized knowledge management frameworks in policing and Lewis and Carter's [13] plea for formalized leadership tracks. Indeed, contributors commented on the loss of institutional memory due to retirement and the ad hoc sharing of know-how, which was a significant challenge to operational continuity, and their argument was supported in the literature [16]. Moving beyond selection-related issues and talent development, participants' words echoed the criticisms of Ready and Conger [33] regarding the inadequacy of using seniority-based promotions. Officers were also unhappy about the absence of career development models linked to skills, supporting research that says promotions to leadership positions in modern law enforcement agencies should be based on ability (i.e., potential) instead of just how long someone has been there.

In contrast, while the literature discusses KM and TD as separate topics, participants highlighted a key practical point: that combining the two is essential for everyday resilience. Officers envisioned a future where capturing knowledge and developing leaders go hand in hand, with lessons from operations included in mentoring programs and promotions linked to proven skills and contributions to learning within the organization. This pragmatic vision is also consistent with Johnson and Steffensen's [10] and King's [37] concept of the learning organization, which intentionally integrates KM and TD for a sustainable leadership pipeline [38, 39].

Based on both participants' responses and academic literature, a streamlined, explanatory model is shown in Table 1:

Table 1. This Framework Integrates Two Pivotal Domains—Knowledge Management (KM) and Talent Development (TD)—to Build Leadership Resilience in Law Enforcement Organizations

Element	Knowledge Management	Talent Development
Capture	Documenting institutional memory through centralized knowledge systems [*Participants 2 &7*; 11; 15; 38].	Assessing individual competencies through performance appraisals and leadership assessments [*Participants 5 & 12; 35*; 34].
Develop	Disseminating operational and strategic knowledge through workshops, case studies, and knowledge platforms [*Participant 14*; 11; 15; 38].	Offering customized leadership training programs tailored to role requirements [*Participant 5*; 13].
Retain	Embedding knowledge into systems, SOPs, and institutional databases [*Participant 9; 38*].	Establishing clear career pathways, succession plans, and leadership incentive programs [*Participant 12*; 13].
Deploy	Enabling knowledge-based decision-making and organizational learning [10; 37; 38].	Strategically positioning leaders into roles based on readiness assessments and future organizational needs [38; 39].

By incorporating this comprehensive approach into the GPF regularly, leadership resilience can shift from a response based on individual personalities to a planned, organized, and lasting practice.

This study further substantiates prior theorizing while rendering new practical insights for frontline officers on thinking about and enacting integration. It emphasizes the need to rethink how integration is made "real" in the day-to-day shaping of organizational life rather than relying on formal policies or ad hoc programs.

Recommendations

The following practical recommendations are based on the findings and comparisons with existing literature reports.

Install an Electronic Knowledge Repository

The GPF must establish an electronic repository of knowledge that is central, secure, and readily available, tied to officers' profiles, performance appraisals, skill lists, training histories, and other relevant information [31]. This platform should store after-action reviews, leadership vignettes, operational guidelines, and standard operation protocols. AI-enhanced search services may enable rapid access to needed knowledge when an emergency or discontinuity makes direct reliance on human memory insufficient, even in augmented forms [30].

Create Formalized Talent Pipelines

It is recommended that the GPF develop defined career paths along with rotational opportunities, tailored leadership programs, and stated advancement opportunities. Law Enforcement Agencies can develop a competency framework that outlines the competencies of various leadership roles [13]. Formal mentoring programs for senior leaders and high-potential officers will provide opportunities to build the next generation of leaders and enhance knowledge transfer [4].

Embrace 360-degree Review Process

Promotability and readiness for leadership should be assessed through a 360-degree feedback process whereby the promotion process gathers performance appraisals from the candidate's supervisors, subordinates, and

peers to have a well-rounded view of the candidate's leadership ability [1]. Leadership skills—strategic thinking, decision-making in challenging environments, flexibility, and ethical leadership—should be evaluated, as well as operational capacity and participation in knowledge-sharing activities [36, 40].

Create Knowledge-Sharing Events

The GPF should require quarterly symposia, leadership roundtables, and officer-to-officer exchange programs, at which officers can brief lessons learned from operations, discuss strategic objectives, and share creative practices. The electronic arsenal must publish and archive these discussion groups as part of a knowledge-development culture [31, 40].

Implement an Annual Leadership Succession Audit

Leadership Succession Audits should be a part of the organization's fabric and completed annually to measure leadership readiness, acknowledge succession gaps, and enhance talent development efforts [11]. Workforce planning, promotion timelines, and leadership program distribution should incorporate the audit results [15]. Transparency in the auditing findings may also increase trust and morale in potential leadership-track officers [17].

Conclusion

The strength of policing leadership in Guyana is based on maintaining institutional memory while forging new leaders in a changing landscape. As this study suggests, neither Knowledge Management (KM) nor Talent Development (TD) alone can address all the complex leadership challenges public security organizations face. Instead, a framework that is part of the organization's DNA offers a supportable answer by treating the retention of knowledge and the growth of leaders in a symbiotic way.

It can be inferred from the results that an incoherent knowledge base and the absence of a career progression plan often hinder leaders' succession in GPF. If the situation is not addressed in a timely manner, the organization will be exposed to perpetual leadership instability, operational disruption, and weakened public confidence as the security environment becomes increasingly complex and rapidly changing. Integrating KM and TD provides a strategic course that shields valuable institutional memory and prepares forward-thinking, knowledgeable, and skilled future leaders with the agility to weather crises, implement reform, and preserve the fundamental public safety mission. Including knowledge-sharing practices in leadership development programs guarantees the retention of crucial experiential learning, even during retirement, relocation, or transition. At the same time, developing these competency-based, structured talent pipelines fosters a leadership cadre that can innovate, motivate, and lead in response to the challenges facing modern policing.

To ensure strong and lasting leadership, political officers, organization executives, and stakeholders must move past temporary fixes and make the integrated KM-TD framework a key part of the company's main goals. The process involves adopting formal policy, developing infrastructure (for example, electronic knowledge repositories and leadership academies), and ongoing investment in programs that support leadership development, mentoring, and assessment. Ultimately, future-proof leadership models in the GPF and beyond require an organizational culture shift from mere institutional memory to creativity, lifelong learning, and strategic leadership development. Movements of this nature are not just necessary; they are essential for maintaining service delivery, public confidence, and the endurance of Guyana's national security organizations in a changed political and social context.

The current research usefully adds to the existing leadership resilience literature by providing a grounded model of resilience at the

tactical level that integrates theoretical understanding with practical significance. Future studies could build on this research by examining the technology, funding, and social factors needed to apply integrated leadership resilience frameworks in similar public sector environments.

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Conflict of Interest

The author has no conflicts of interest regarding the authorship of this study.

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Awareness and Knowledge of Medical Tourism Among Medical Practitioners in Tertiary Hospitals in the Federal Capital Territory (FCT), Nigeria

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Abstract

The problem of low-level knowledge about medical tourism often makes medical practitioners and stakeholders ignorant of the eventual consequences of outbound medical tourism and the possible advantages of inbound medical tourism. This study assesses the awareness and knowledge of medical tourism among medical practitioners in tertiary hospitals in the Federal Capital Territory (FCT), Nigeria. This was a descriptive cross-sectional study carried out among 160 medical doctors who have made referrals for medical tourism in other countries. A multi-stage sampling technique was used and data was collected using an Interviewer-administered structured questionnaire. The Mean years of experience among the doctors was = 17.6±9.5 years; 48 (30.00%) had a work experience of 11 – 20 years, 42 (26.25%) 21 – 30 years, while 20 (12.50%) had worked for more than 30 years. About 148 (92.50%) of the doctors were aware of medical tourism. Of the proportion that were aware (n = 160), 34(21.25%) reported their colleagues as their source of information, and 65 (40.63%) indicated their workplace as their source. Outbound and inbound medical tourism were the most popular categories of medical tourism among the doctors, 56 (35.00%) and 51 (31.88%), respectively. In summary, 83 (51.9%) of the doctors had fair knowledge of medical tourism, while 43 (26.9%) had poor knowledge, and 34 (21.3%) had good knowledge. High awareness of medical tourism among Nigerian doctors is crucial for safeguarding public health, improving local healthcare services, and reducing medical tourism-related risks. It also positions Nigeria to potentially benefit from inbound medical tourism in the future.

Keywords: *Awareness, Inbound Medical Tourism, Knowledge, Outbound Medical Tourism.*

Introduction

Knowledge and awareness about medical tourism are gradually increasing as the world experiences a much closer nature for trade in health services. Different studies [1-3] have shown different levels of knowledge on the subject matter. One description for medical tourism is planned travel away from one's home for medical treatment. Other names for it include offshore healthcare, cross-border care, medical travel, and health tourism. The practice of patients travelling outside of their nation to receive medical care, diagnostic testing, consulting, and other healthcare services and procedures is known as global healthcare. [4-7] The term was coined by travel agencies and mass media to publicize this new form of travel and medical services, but now it is no longer a jargon; it has become a common phrase that is widely acceptable to describe the rapidly-growing practice of travelling beyond international borders to access healthcare.[8-12] Although the whole range of health services is covered by medical tourism, the majority of trips are only allowed for a select few medical operations, such as organ and cell

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transplantation, orthopaedic surgery, heart surgery, cosmetic surgery, and fertility treatments.[4, 13] "Health tourism," "wellness tourism," and "spa tourism" are terms frequently used to describe travel to resorts, hot springs, and therapeutic retreats (spas). Generally speaking, travel that involves diagnostic tests and medical procedures is referred to as "medical tourism." [9, 12, 14].

The problem of lack of knowledge or low-level knowledge about medical tourism often makes the medical practitioners and stakeholders ignorant of the eventual consequences of the outbound medical tourism and the possible advantages of inbound medical tourism. With the increasing globalization of healthcare services, globalized learning opportunities, and huge travel traffic, knowledge and awareness of medical tourism are increasing. This advancing knowledge can be useful for developing countries to improve their infrastructure and standardize their care to attract foreign healthcare travelers [15-17].

As popularity and awareness of medical tourism increase locally and globally, there will be a need for policies that direct and control the medical tourism sector, which were created by the World Health Organization [18].This is to regulate the operations of dishonest traffickers in human beings and organs for transplantation. Due to these associated problems, laws have been passed and international accrediting organizations such as Joint Commission International (JCI) and the National Accreditation Board for Hospitals and Health Care Providers (NABH) have been established to safeguard prospective medical tourists from deception and to help ensure that the host healthcare provider will provide the high-quality care that they have promised [7, 8, 18-23]. In order to help hospitals and governments worldwide establish patient safety policies and practices that can become especially pertinent while offering medical tourism services, the World Health Organization also established the World Alliance for Patient Safety. To restrict the various forms of illicit human organ trade for transplantation, the Declaration of Istanbul was also released in 2008 regarding the morally dubious notions of transplant tourism [8, 20, 23-25]. Patients are usually referred for medical tourism by medical experts in hospitals. that provide tertiary and highly specialized health services. Some patients decide to go on their own. In both rich and developing nations, medical tourism is intended to be regulated by the Medical Practitioners Licensing Council, national medical associations, and health ministries. This study objective is to assess awareness and knowledge of medical tourism among Medical Practitioners in Tertiary Hospitals in the Federal Capital Territory (FCT), Nigeria.

Methodology

A descriptive cross-sectional study design was carried out among Medical Practitioners in Tertiary Hospitals in the Federal Capital Territory (FCT), Nigeria. Abuja-FCT. Abuja is a city in central Nigeria that serves as the country's capital and is located within the Federal Capital Territory (FCT). The Federal Capital City (FCC) occupies around 250 square kilometers of the landmass, with a population count of 778,567 for the Abuja Municipal Area Council. [26-28] Abuja was chosen for this study as it is now one of Nigeria's ten most populous cities and one of the world's fastest growing cities with an increasing number of the population with the representation of all tribes living in Nigeria, it has 3 major government-owned teaching hospitals. University of Abuja Teaching Hospital, Gwagwalada; National Hospital, Abuja, and Federal Medical Center, Jabi, Abuja, who have easy access to experts who can recommend treatment outside the country.

The study population for this study were fully licensed medical doctors practicing in Government-owned tertiary hospitals in Abuja City. The study was done in 2024 and carried out over six months. Data collection was carried

out over four months, while analysis and write-up of the study was done over a period of eight weeks.

The minimum sample size for medical doctors was calculated using Cochran's formula for minimum sample size determination in cross-sectional study:[29].

$$n = \frac{Z^2 pq}{d^2}$$

n= the desired sample size when the population is less than 10,000

z= standard normal deviate set at 1.96, corresponding to the 95% confidence level.

In a previous study conducted in India, UAE, Jordan, and China, 13.0% of patients were referred by their doctors [30].

p = 0.13

q= 1-p = 1- 0.13 = 0.87

d= degree of precision desired, which is set at 5 % (0.05).

Minimum sample size= $(1.96)^2 \times (0.13 \text{ X } 0.87) / (0.05)^2 = 173.8 = 174$

However, since the total number of medical doctors in Abuja City is less than 10,000, the final sample size *nf* will be determined using the formula [31, 32]:

$$nf = n/(1 + n/N) \quad nf = \frac{174}{1+\frac{174}{596}} = 134.7$$

Where, nf = the desired sample size when population is less than 10,000.

n = the desired sample size when population is more than 10,000.

N = the estimated population size.

Allowing for a non-response rate of 10%, i.e. (134.7 x 0.10), the minimum sample size will be approximately 134.7 + 13.5 = 148.2 ≈150.

A minimum of 160 questionnaires was used for data collection amongst the medical doctors.

A multi-stage sampling technique was used in selecting the respondents for this study. Data on Medical doctors' knowledge of medical tourism was collected using an interviewer-administered questionnaire. A structured, interviewer-administered questionnaire based on a simplified set of questions was used in this study. The first section contains information on the socio-demographic characteristics of the medical doctors, while the second section assesses the knowledge and awareness levels. These questions were adapted from medical tourism publications in Canada, the United States, Malaysia, and India. [1, 3, 33-35].

A one-week training program was conducted for 6 research assistants who were medical interns. Training covered the use of questionnaires on the research topic, ethical considerations, and quality control. Emphasis was laid on proper conduct during interviews and discussion as well as how to recognize the progression of interviews in line with themes.

The study instruments were pretested among medical doctors in Federal Medical Center Keffi, Nasarawa State, located about 120km away from the study area. All ambiguous questions were reviewed to reduce the possibility of information bias. Questions were rewritten or deleted to reflect specific aspects of medical tourism related to the study objectives. Questionnaires was screened for completeness, coded and entered by the researcher into the Statistical package for scientific solutions (SPSS) version 22.0 software for analysis. Discrete data was presented as proportions (percentages) while continuous variables such as age were expressed as means ± standard deviation. Where continuous data are skewed, median values were stated as well.

A self-designed scoring system was used to categorize knowledge as poor, fair, and good. Questions 13 a-g, 14a-g was used to assess respondents' knowledge of medical tourism. There are a total of 14 items. These items were subjected to the Chronbach's reliability test. Only a resultant alpha value >0.7; demonstrated internal consistency. Responses were graded as 'Yes=1'; and 'No=0'; giving a cumulative grade score of 14. This total score of correct responses was converted to a percentage and used to categorise respondents' knowledge of medical tourism as follows:

Knowledge Scores

1- 6= (Poor knowledge): ≤49%;
7 - 9= (Fair knowledge): 50-69%;
≥10= (Good knowledge): ≥70%.

Ethical clearance to conduct this research was sought and obtained from the Bingham University Teaching Hospital Research Ethics Committee before the commencement of the study. Permission to conduct this study was sought from all the Health facilities that were used in this study. Written informed consent was obtained from each respondent before the conduct of interviews after adequate information must have been given to the respondents by the interviewers concerning (i) the identity of the researcher and the university; (ii) the purpose of the research; (iii) the nature of the questions; (iv) the approximate length of time required to complete the survey; and (v) advice on how to make a complaint to the university if desired.

Confidentiality and privacy were respected during the interview. Participants will be treated with dignity and respect. All data shall be kept secure and made available only to the researcher. Findings from this research will be made public and will contribute to the knowledge of the scientific community.

Results

Distribution of Work Characteristics of the Doctors

Table 1 shows that the Mean years of experience among the doctors was = 17.6±9.5 years, 84 (52.50%) of the doctors had memberships, while 56(35%) had fellowships as their highest qualification. Junior residents comprised the largest group in the study, 56 (35.0%), while 52 (32.50%) were consultants.

Forty eight 48 (30.00%) had a work experience of 11 – 20 years, 42 (26.25%) 21 – 30 years, while 20 (12.50%) had worked for more than 30 years.

Two hundred and twenty-eight 82 (51.25%) of the doctors practiced privately on part time basis, 68 (42.50%) had no other practice, while 10 (6.25%) practiced in public hospitals on part time basis.

Awareness, Sources of Information, Knowledge and Types of Medical Tourism Among the Doctors

Table 2 shows that 148 (92.50%) of the doctors were aware of medical tourism, while 12 (7.50%) claimed they were not aware (Figure 1) . Of the proportion that were aware (n = 160), 34(21.25%) reported their colleagues as their source of information, 65 (40.63%) indicated their workplace as their source, while 8 (5.00%) reported television.

135 (84.38%) could correctly define medical tourism, while 25 (15.63%) could not define medical tourism. Health tourism was the most popular synonym of medical tourism as indicated by 52 (32.50%) and 46 (28.75%) who indicated medical travels. Outbound and inbound medical tourism were the most popular categories of medical tourism among the doctors 56 (35.00%) and 51 (31.88%) respectively]. Similarly, 38(23.75.% %) indicated reproductive and transplant tourism as popular types of tourism, 24 (15.00%) indicated cosmetic surgery tourism, while 21(13.13%) stated dental tourism.

Summary of Level of Knowledge on Medical Tourism Among Medical Doctors

Table 3 shows that 83 (51.9%) had fair knowledge of medical tourism, while 43 (26.9%) had poor knowledge, and 34 (21.3%) had good knowledge.

Table 1. Distribution of Work Characteristics of the Doctors

Work Characteristics	Frequency (n = 160)	Percent
Facility		
Surgery	40	25
Internal Medicine	28	17.5
General outpatient	26	16.25
Paediatrics	20	12.5
Obs &Gyn	18	11.25
Dentistry	18	11.25
Pathology	10	6.25
Highest Qualification		
MBBS	20	12.5
Membership	84	52.5
Fellowship	56	35
Rank in Hospital		
Medical officer	20	12.5
Junior resident	56	35
Senior resident	32	20
Consultant	52	32.5
Work Experience (years)		
≤ 10	50	31.25
11 – 20	48	30
21 – 30	42	26.25
≥ 31	20	12.5
Other Places of Practice		
Full time Public	68	42.5
Part time Public	10	6.25
Part time Private	82	51.25

Mean experience = 17.6±9.5 years

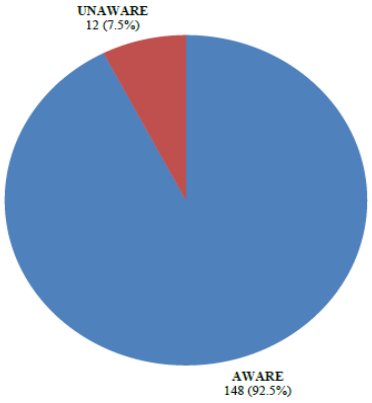

Figure 1. Awareness of Medical Tourism Among Medical Doctors

One hundred and Forty eight 148 (92.3%) of the doctors were aware of medical tourism.

Table 2. Awareness, Sources of Information, Knowledge and Types of Medical Tourism Among the Doctors

Variable	Frequency (n = 160)	Percent
Awareness of Medical Tourism (n = 160)		
Aware	148	92.50
Not aware	12	7.50
Sources of Information*		
Colleague	34	21.25
Workplace	65	40.63
Television	8	5.00
Newspaper	4	2.50
Internet	38	23.75
Radio	8	5.00
Books	3	1.88
Knowledge of the Definition		
Correct	135	84.38
Incorrect	25	15.63
Knowledge of Synonyms*		
Health tourism	52	32.50
Medical travels	46	28.75
Oversea travels	16	10.00
Holiday tourism	13	8.13
Offshore healthcare	11	6.88
Cross border care	10	6.25
Leisure tourism	12	7.50
Categories of Medical Tourism*		
Outbound medical tourism	56	35.00
Inbound medical tourism	51	31.88
Intrabound medical tourism	29	18.13
Offbound medical tourism	24	15.00
Knowledge of Types*		
Reproductive tourism	38	23.75
Transplant tourism	38	23.75
Cosmetic surgery tourism	24	15.00
Dental tourism	21	13.13
Lipotourism	19	11.88
Suicide tourism	10	6.25
Abortion tourism	10	6.25

Multiple responses

Table 3. Level of Knowledge on Medical Tourism Among Medical Doctors

Knowledge of medical tourism	Frequency (n = 160)	Percent
Poor	43	26.9
Fair	83	51.9
Good	34	21.3
Total	160	100

Discussion

Almost all the doctors were aware of medical tourism as it was a common discussion among colleagues and in the workplace. In terms of definition, over 80% could define medical tourism. A third could state health tourism as a synonym of medical tourism, others called it medical travel. This contrasts with a study done in Iran where 91% had not heard about medical tourism in the past. [2] This may be due to the closed health system in Iran or low formal utilization of the term "medical tourism". Such low levels of knowledge were also observed in a study done in Egypt [1]. This level of knowledge is useful in building a medical tourism market for Nigeria, but, in this case, it is "inbound Medical tourism". This will be helpful for our health system. The task is to make our health system attractive and create an agency under the Federal Ministry of Health that will fast-track the achievement of this task of global competitiveness.

A third knew about outbound and inbound medical tourism as the main categories of medical tourism. Other popular types were reproductive and transplant tourism, cosmetic surgery tourism, and dental tourism. With this categorization, 21% of the doctors had good knowledge of medical tourism, 27% had poor knowledge, and half of the doctors had fair knowledge of medical tourism. This finding shows that despite the high level of awareness about medical tourism, only a few had in-depth knowledge of medical tourism.

Doctors with high awareness of medical tourism can better educate patients on the risks and benefits of seeking healthcare abroad. This ensures that patients make informed decisions based on quality, cost, and potential complications [36, 37]. Furthermore, this level of knowledge will make stakeholders to work towards strengthening the Local Healthcare System. When doctors understand why patients seek medical care abroad, they can advocate for improvements in local healthcare services, such as better infrastructure, specialized training, and policy reforms to reduce medical brain drain. Good knowledge of medical tourisms will enable doctors to discuss ethical concerns with patients, such as the credibility of foreign healthcare providers, post-surgical complications, and the risks of unregulated procedures in some countries [38, 39].

It also important to note that patients returning from medical tourism may carry infections, complications, or antibiotic-resistant bacteria. Doctors with strong knowledge of medical tourism can take the necessary precautions and provide appropriate follow-up care. When practitioners have insights into medical tourism trends, it can help policymakers address the factors driving medical tourism, such as high costs of care, long waiting times, or lack of specialized treatments in Nigeria [16, 40, 41].

High awareness of medical tourism among Nigerian doctors is crucial for safeguarding public health, improving local healthcare services, and reducing medical tourism-related

risks. It also positions Nigeria to potentially benefit from inbound medical tourism in the future.

Conclusion

There was high awareness about medical tourism, and most doctors had fair knowledge of medical tourism. Most medical practitioners felt out outbound medical tourism was not good for the Nigerian health system. One hundred and forty-eight (92.50%) of the doctors were aware of medical tourism, mainly from their colleagues and workplace as their source of information. (84.38%) could correctly define medical tourism. In summary, 21.3% had good knowledge, 51.9% had fair knowledge of medical tourism, and 26.9% had poor knowledge.

Recommendations

To Governments

There is a need to sustain the current level of awareness and work towards improving the local healthcare infrastructure and workforce retention.

There is a great need to strengthening Nigeria's Medical Tourism Sector, rather than losing patients to other countries, high awareness among doctors can contribute to developing Nigeria as a medical tourism destination by improving the quality of care and marketing available medical services.

To Medical Associations and Medical Tourism Stakeholders

To work towards sustaining the level of awareness and improving knowledge of medical doctors and other health workers towards medical tourism, this will be essential to develop a more robust health care delivery system to increase inbound medical tourism.

Conflict of Interest

No conflict of interest.

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Reintegration Experiences of Women After Obstetric Fistula Repair, in the Mfantseman Municipal Area in the Central Region of Ghana

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Abstract

Obstetric fistula affects women's social lives, and some women still experience stigma and marital challenges even after successful repair. There is limited information on the experiences of reintegration after a successful fistula repair and a gap remains in the experiences of reintegration services, affecting implementation and policy implications for fistula repair programs. The data for the study was an in-depth interview guide and interviews were audio-taped with permission from participants, transcribed verbatim, and analyzed using thematic analysis. Four (4) main themes, two (2) emerged themes, and thirteen (13) subthemes were generated from the data. All four major themes were derived from the constructs of the socio-ecological model which was used to develop the objectives which guided the study. The findings show that although there is support for treatment, there are no formal support structures for the reintegration of obstetric fistula survivors.

Keywords: *Fistula Repair, Obstetric Fistula, Pregnancy.*

Introduction

Pregnancy is generally perceived as a precious gift that transcends all cultures and beliefs. The period of pregnancy is expected to be a natural phenomenon without actual or potential risks to the expecting mother and foetus no matter the circumstances that may arise [1]. It is expected that the period of pregnancy remains joyful and blissful in the lives of the family. However, some women have negative experiences due to undesirable outcomes like obstetric fistula [2].

Obstetric fistula has been highlighted as one of the most obvious indications of morbidity among women globally and is a serious issue in low-resource nations [3]. Obstetric fistula occurs during prolonged and difficult labour, especially when access to emergency obstetric treatment is limited [3]. The tissues between the vagina and the bladder, or rectum, are damaged during prolonged or obstructed labour due to pressure from the baby's head, which inhibits blood flow and causes necrosis of tissues and fistula formation [4].

WHO estimates that 50,000 to 100,000 new cases of obstetric fistula occur each year worldwide and approximately 2 million women and girls across Africa and Asia are living with untreated obstetric fistula [5]. It is predominant in developing countries like sub-Saharan Africa [6] where an estimated 2% of obstructed labors occur [7].

In Ghana, the prevalent rate of obstetric fistula has been inadequately reported. According to a 2015 UNFPA-sponsored Ghana Health Service report on the prevalence of obstetric fistula in Ghana, there are between an estimated 711 and 1,352 new cases of the

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condition every year. This implies that on average, there are 1.6 to 1.8 cases per 1,000 deliveries. However, only 200 cases (about 40%) of obstetric fistulas are surgically repaired each year [8]. Between the years 2011 and 2014, 1538 cases were identified. The Northern Region recorded the highest number of patients seen with vesico vaginal fistula (527 women; 34.3%), followed by Ashanti (295 women; 19.2%), Western (239 women; 15.5%), Central (148 women; 9.6%), and Upper West Region (104 women; 6.8%) [8].

The treatment capacity of most developing countries is limited to about 6,000 to 7,000 per year, which is low and implies the majority of women who get diagnosed with this dehumanizing condition are forced to endure it for the rest of their lives [9]. Women who experience obstetric fistula are frequently ignored and subjected to severe stigma. Due to the traditional perception of obstetric fistula as a divine punishment or a curse for unpleasant behaviour rather than a medical ailment that can be treated and cured, this stigma may persist even after repair. Although the majority of stigma is addressed in women with obstetric fistula, family members may also experience stigma due to a relative's disease [10].

Most studies in Ghana have focused on the experiences of women with obstetric fistula [11-14] with a few exploring the social acceptance and reintegration barriers faced by obstetric fistula patients' post-treatment and rehabilitation [15, 16]. Hence this study explored the reintegration experiences of women after surgery to help sharpen and strengthen the presentation and packaging of programs, activities, and messages on obstetric fistula to raise awareness of the reintegration experiences to community members and the need for acceptance after a successful repair.

Problem Statement

The UNFPA report shows that each year, about 15% of all pregnancies worldwide end in direct obstetric complication during labour, indicating that Obstetric fistula is still a problem for women and girls in poor nations, even though it has been virtually eradicated in developed nations. This is particularly true for the region of West and Central Africa, which accounts for more than half of the global figures [17].

In addition to the uncontrollable seepage of urine and/or feaces and the related smell, studies on fistula have also shown that untreated obstetric fistula has serious medical, psychosocial, and economic consequences, such as divorce, neglect, and isolation by family and community [18]. Not only are the victims ignorant about the causes of obstetric fistula, but most of them are also unaware of the available treatment options leading to delays in seeking healthcare [19].

Victims of obstetric fistula who recover after successful surgical repair find it extremely difficult to reintegrate back into their communities because of the social scorn associated with this condition [10]. Also, stigmatization associated with genital fistulas has severe health, social, economic, and psychological effects on the well-being of affected women. This, in turn, impairs their recovery and reintegration into their families and communities, even after a successful fistula repair [20]. Although the majority of stigma is addressed to women with obstetric fistula, family members may also experience stigma due to a relative's disease [10]. This may lead to situations where the women are abandoned even after repair and the unavailability of reintegration programs. This is why it is important to explore the reintegration experiences of women after surgery to raise awareness of the reintegration experiences to community members and other stakeholders to influence policy formulation and interventions.

Objectives of the Study

The main purpose of this study was to explore the reintegration experiences of women

after a successful fistula repair in the Mfantseman Municipal area.

Specific Objectives

1. To identify the support provided by family and friends during the reintegration process.
2. To examine the available healthcare services and how they support women after obstetric fistula repair.
3. To explore the available programs in the community that support women after a successful repair. To identify the cultural beliefs and practices that influence the reintegration process.

Significance of the Study

The primary objective of this research is to produce scientific evidence on the experiences of women who had a successful repair and are reintegrating into society in the Mfantseman Municipal area. The study's findings can contribute to policy formulation to guide future health programs and policies aimed at improving the rehabilitation of women after fistula repair, by the provision of not only medical care but also psychosocial care services, financial help, and skill empowerment. This will help the women to cope with the trauma and the negative change that affected their social lives associated with the condition even after a successful repair. After the research is completed, the study's findings will make a significant contribution to improving maternal health services in the district, as well as provide a systematic body of knowledge that can be used for appropriate policy formulation.

The results of this study intend to help formulation and packaging of programs, activities, and messages on obstetric fistula to raise awareness of the reintegration experiences to community members and the need for acceptance after a successful repair. Finally, the study is going to contribute to the creation of new knowledge for use in midwifery practice and assist in gathering crucial midwifery data and viewpoints that support the creation of a nursing and midwifery curriculum on the reintegration aspect of fistula management.

Materials and Methods

Study Site

This study was conducted in the Mfantseman Municipal area in the central region of Ghana. The area is situated along the Atlantic coastline of the Central Region of Ghana. It stretches approximately 21 kilometres along the coastline and about 13 kilometres inland constituting an area of 300.662 square kilometres. The administrative capital of Mfantseman is Saltpond. Many of the ethnic groups distributed around the municipality are Akan, but migration has brought other ethnic groups such as the Gas, Ewes, Ashantis, Akwapems, Northerners, and settlers from other regions of the continent. The Main occupations of the people are agricultural, forestry, and fishery workers. Additionally, the municipality had the fifth-highest number of births (3,537) in the year before the 2010 Census.

According to the [21], MMA in the Central Region of Ghana has the third highest incidence of obstetric fistula in Southern Ghana and the fourth highest in the entire nation [21]. The Mercy Women's Catholic Hospital's Obstetrics Fistula Unit located in Mankesim served as the main study site. The Catholic Archdiocese of Cape Coast founded this facility in 2009 to provide care for women throughout the nation who experience obstetric fistula. The facility is the largest obstetric fistula centre in sub-Saharan Africa, with a 45-bed capacity ward. It has a theatre, a recovery ward, an outpatient clinic, and a patient's family member's residence. The facility receives patients as referrals from other facilities and has an outreach team that plans outreach programs to the villages and sub districts looking for patients with the condition, as well as a repair team made up of surgeons, fistula nurses, and

other paramedics who all work together to provide these patients with comprehensive care. Three hundred and eighty-nine (389) cases have been repaired at no cost to the patients since the clinic opened and 56% of the repairs have been successful [22].

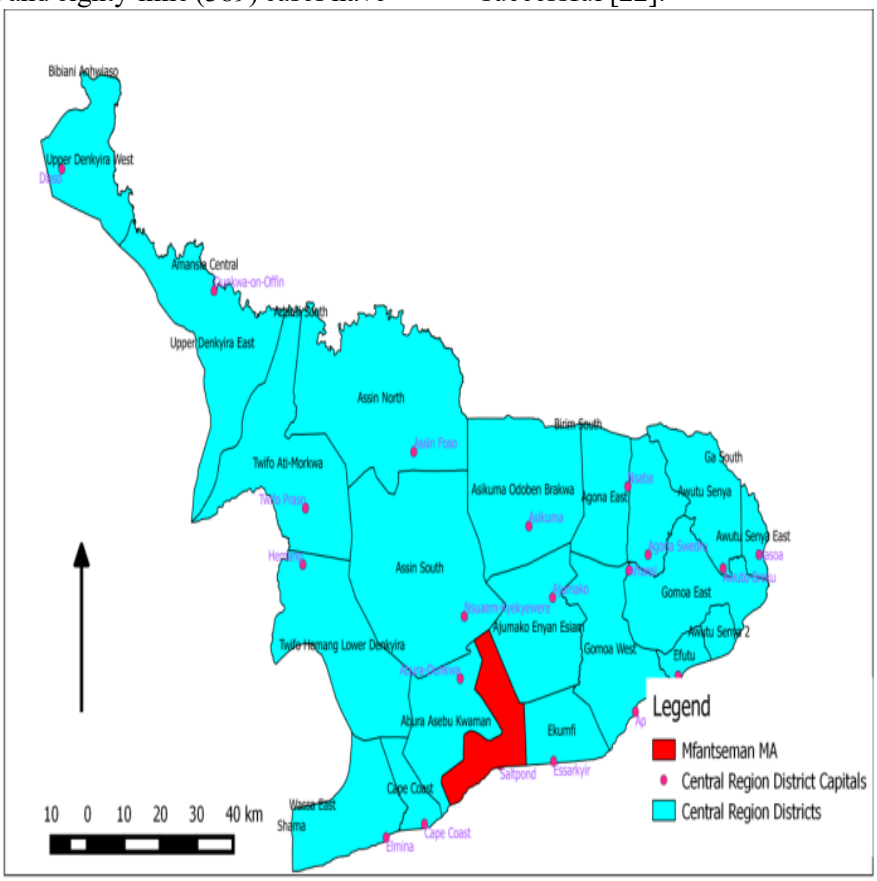

Figure 1. District Map of Mfantseman. Source: Ghana Statistical Service, GIS

Inclusion Criteria

Only women who had a successful repair and lived within the Mfantseman municipal area for at least five years were sampled for the study. To qualify for selection to participate in the study, the women must have had the obstetric fistula condition have undergone successful obstetric fistula repair within the past five years and be willing to be part of the study.

Exclusion Criteria

Women with unsuccessful fistula repair and women who may fit the criteria for selection but were non-residents in any community in the district did not qualify to participate in the study. This was to ensure the data gathered from respondents were the true reflection of the phenomenon being studied in the district. Also, those with successful fistula repair residing in the study area for at least 5 years but were seriously ill, not mentally sound, or declined to be part of the study were excluded.

Sample Size and Sampling Technique

Qualitative research with a purposive sampling technique was employed for this study. This study data saturation was reached by the 13th participant with no emerging new themes.

Data Collection Tool

An in-depth interview guide allowed for the exploration of people's experiences, thus making it the right tool used to gather data from respondents. The interview guide for this study was in four sections. The first section discussed the participants' socio-demographic background. The second section discussed the

obstetric data of participants, the third section discussed experiences of obstetric fistula and the last part discussed experiences after obstetric fistula repair.

Data Collection Procedure

A Rapport was established with potential participants to seek their consent to participate in the study and were informed of the study's purpose to recruit them, and those who expressed interest were chosen to participate. In their preferred language, the research was explained to the participants about the purpose, objectives, potential benefits, and risks, and they were given enough time to decide whether to participate. Participants were also informed that interviews will be audiotaped using a voice recorder. Those who agreed and qualified according to the criteria of the study were asked to sign or thumb-print consent forms. Participants were informed of their right to opt out of the study even after completing the consent forms with no consequences. During the recruitment process, codes were given to each participant to maintain their anonymity, which were then utilized in all notes and transcripts. Codes were replaced by names stated during the interview and later quoted directly from participants. Participants were informed that information provided would not be linked to them without their approval. The interview was a face-to-face encounter between the researcher and the participants, lasting 34-52 minutes and audio recorded with the participants' consent. The aim for tape recording the interviews was to capture every aspect of the participants' responses to ensure accurate and rich data. The period of data collection lasted for one month.

Data Analysis

A thematic content analysis was used to analyse the data. Braun and Clarke created a six-phase method for reflective thematic analysis which was improved by Saunders to create practical theme analysis, using a simplified and educational approach that keeps the important components of their six phases. Braun and Clarke's phase 1 (Being familiar with the data) is reflected in their initial reading process. The second step of coding is phase two, or coding. The third theming stage is a representation of phases 3 (creating initial themes), 4 (developing and reviewing themes), and 5 (refining, defining, and identifying themes). In this third stage of theming, phase 6 (writing up) also takes place, but following a thematic analysis session [23]. After conducting each interview, transcription was done and the initial notes taken, reading over the field notes and transcriptions multiple times helped the researcher become comfortable with the data by highlighting sentences and phrases that were significant. Similar phrases or statements were looked for, sorted into separate files, and given names. The initial codes that resulted in the construction of themes and subthemes were created by combining similar files and grouping them into meaningful units.

Results

Demographic

The demographic characteristics of participants who responded to the research interview show that the majority of participants were within the age range of 40-49 years. Regarding participants' marital status, the majority (seven) of them indicated they were married. Out of the seven who were married, 3 participants were married to new husbands, 2 were still with their old husbands, and 2 separated. One was divorced, two were widows and three never married. Also, about educational level, the majority of the participants indicated they have a primary school certificate. On the issue of occupation, the analysis shows that three participants (3) were petty traders, two (2) were housewives, seamstresses, and Teachers respectively and one (1) indicated she was a Hairdresser.

Table 1. Demographic Characteristics of Participants

CODES	Age	Marital status	Level of Educ.	Occupation	Religion
P001	30-39	Married	Secondary	Medicine Counter Assistant	Christian
P002	Unknown	Widow	No formal education	Rice seller	Christian
P003	40-49	Married	No formal education	Hairdresser	Christian
P004	30-39	Married	Primary	Housewife	Christian
P005	40-49	Widow	Secondary	Food Seller	Muslim
P006	30-39	Married	Secondary	Seamstress	Christian
P007	18-29	Single	Primary	Seamstress	Christian
P008	18-29	Single	Secondary	Teacher	Christian
P009	40-49	Divorced	Tertiary	Teacher	Christian
P010	40-49	Married	Secondary	Trader	Christian
P011	40-49	Married	Primary	Housewife	Christian
P012	40-49	Married	Primary	Hairdresser	Christian
P013	18-29	Single	Primary	Trader	Christian

Organization of Themes

Overall, four (4) main themes, two (2) emerged themes, and thirteen (13) subthemes were generated from the data. All four major themes were derived from the constructs of the socio-ecological model which was used to develop the study objectives. The detailed representation of the four (4) major themes are as follows, Recovery and social support, Availability of healthcare services, community post-repair programs, cultural beliefs and practices. Other themes that emerged are challenges after repair, and suggestions from women after repair. These themes and subthemes help to provide insight into what women experienced as they returned to their normal lives after successful obstetric fistula repair and their opinion on what services ought to be in place to aid their social reintegration. The various themes emerged, and sub-themes are presented in Table 2.

Table 2. Organization of Themes

Main Themes	Emerged Themes	Sub-Themes
Recovery and social support		• Initial experience • Support 1. Partner/ family support 2. Social support
Availability of healthcare services		• Sponsorship • Staff counselling/ Education

Community post repair Programs		• Institutional policies/programs • Media support
Cultural beliefs and practices		• Traditional beliefs • Community perspective
	Challenges after OF repair	• Infertility • Post-surgery complication • Financial
	Suggestions from women after repair	• Government initiatives 1. Awareness creation 2. training • Support groups

Recovery and Social Support

In expressing their reintegration and social support experiences, participants mentioned a profound sense of relief and happiness that their medical condition has been successfully treated. They shared their initial experiences after the repair and how they had support from family.

Initial Experience

Living with Fistula was a depressing experience that affected the woman's daily life, her marriage, her socio-economic life, and her relationship with society. After the surgery, there was a feeling of happiness and relief. The entire family expressed joy at the recovery of their relative's condition. A participant who had suffered for three years expressed how thankful she was to God that the suffering was finally over. To her the feeling was different.

That day I was very happy and knelt at the toilet thanking God, finally this was over. And the day I was discharged home it was all joy when I went home, as if I returned from abroad. ***(P013).***

The feeling of happiness was expressed by most of the participants. Another participant expressed that she became the happiest woman on earth knowing she was free from the condition.

"…I was the happiest woman on earth knowing that finally this condition was no more with me, and I was free now back to myself again…" ***(P001).***

Some participants expressed freedom and a heart filled with joy knowing the condition is no more.

*...I had so much joy in my heart, madam you don't know what I went through, the fact that finally I am free from this bad condition [obstetric fistula] is a big relief for me, and I will be forever grateful to God. (****P008).***

It was a feeling of relief for some participants. To step into the community, one had to be mindful of their dressing so that they don't stain their clothes with urine or feaces, knowing that they could dress without packing more clothes was a relief.

"*…I used to pack myself with old clothes and go to work with them, when it gets wet, I change quickly. Now I don't have to pack any clothes and it makes me relieved*" (***P012).***

"…Now I can go to places without wearing a pad, I am not leaking feaces again, I can go to church, market and everywhere, I feel free…" ***(P006).***

Support

It is beneficial for the woman to regain her psychological, physical, and social health if she receives adequate care following repair. Participants highlighted the support networks

that were accessible to them during this unfortunate situation and how this support played a significant role in facilitating their reintegration. Women were assisted in reintegrating into the community by three support systems: partner and family support, social support, and financial support.

Partner and Family Support

Support received from a partner is very crucial after a successful obstetric fistula repair. One participant reported how his partner has been supportive throughout her moments with the condition and even after the surgery.

*...Life has been good after surgery because I am a happy woman, my husband too was happy after the surgery and he has been with me from the time the problem happened, supporting me every time… (**P006).***

Another participant also recounted:

*"We were all happy and my husband too was very happy, he has shown me love, the way he was with me throughout all these years, supporting me, it helped me to stay positive" (**P012).***

Participants whose partners neglected them when they developed obstetric fistula had no support before and after the surgery. These were their experiences:

*The man I was pregnant with left us after I had the condition, he said he did not have money and that he lost his job, so he was never supportive, and he never came back even though I had the surgery and has never been supportive (**P008).***

*...I can't tell whether my husband is happy I had the surgery or not because he did not show it and he is not even supporting me; he gives me money for our upkeep when he wants to and it is not even enough… (**P011).***

Support from family members helped most of these women go through the condition without losing their sanity. Some participants mentioned that the support they received from their immediate family members before and after the surgery has been enormous.

*My family members have been so supportive since I had the condition, they have been financially supportive and physically present. They even helped me bury my husband, the few who knew in my church were also supportive. They come and pray with me once in a while and give you something small. So, it has been so great that finally everything is over (**P002).***

Also, another woman in the study narrated her story as:

*...I had so much joy in my heart, my mother and two sisters were very happy and supportive, they have been encouraging me and I am living with my son hoping to get the strength to take care of him… (**P008).***

Another participant stated that:

"…my children have been so supportive all these years and I know God will bless them. My family too has been there for me visiting and calling to check up on me…" **(P010).**

Social Support

Participants who had social support were able to get through with the condition, were positive, and were able to have the surgery with good recovery outcomes. Support in the form of receiving words of encouragement from their neighbors, and prayers from their pastors and church members came in handy. Two participants had their stories to share.

*Now I can go to places without wearing a pad, I am not leaking feaces again, and I go to church, market, and everywhere. My church leaders are happy I can now partake in church activities, some other people also got to know me after the surgery and they are happy for me, in all the support has been great. The people in my church were happy and were with me in prayers, when they heard I went to do my surgery and I went to testify at church (**P006).***

The people in my community were happy and were with me in prayers when they heard I went to do my surgery after I came home everyone was glad to see me cheerful again **(*P013).***

Some participants hid the condition from their community due to fear of stigma, but those

who found out later were supportive, these were some of the statements they shared:

A lot of people did not know, I never told a lot of people because I kept myself very well, I don't want anyone to see me and laugh at me because I am a shy person. Some church members knew too. Even the woman I was buying Pampers from was wondering what I was using the Pampers for, so I eventually told her, and she even made one woman who also had the same problem come and see me, and I sent her to the in charge of the fistula center ***(P003).***

*In my area nobody knew about my condition, I don't even have friends, so nobody knew I went through such a situation, it was the lady at my workplace who got to know before I had the surgery, but she was okay and seemed happy when I returned (**P001).***

It was some few church members and some few family members who knew I had the condition initially and there were no issues with them. Some friends and people in my area got to know later, I lost a lot of my friends, they never visited to even check up on me, even though they knew I was sick. I kept myself well so I was not smelling, but people would not stand and chat with me or invite me to their programs. So, I started distancing myself (**P002).**

Some participants also shared their plight on the fact that they are still struggling to be accepted back and get the support needed from their community. These are some of their comments:

*Hmm when I went back people did not believe that this time, I was free from urine, some people still believe I am sick, even though I tried to explain to them that I am no longer leaking, they believe it will come back again, so I am still trying to build my relationship with some of my friends, but some are not just good people (**P002).***

P008 also added:

*Nobody has come here to visit me, my head teacher called me and sent me some money, but she didn't ask me when I should return to school, so I can't tell how they feel about my return home (**P008).***

Availability of Healthcare Services

Positive reintegration experiences of women after fistula begin with the care given to them by the hospital in the form of sponsorship, staff support through counselling, and education on how to care for themselves after the surgery.

Sponsorship

Participants acknowledged that they received sponsorship for the surgery and that was a major source of relief for them. Many people are still living with the condition because they do not know about the free surgery services provided in some hospitals.

*I thought I would pay so much money for the surgery, so I stayed at home for a long time, but I heard about the free surgery on the radio. Maybe some people like me also don't know about it (**P010).***

Another participant said:

They have been very helpful, just imagine if they had asked us to pay for all the two weeks we were there, where would we have gotten the money from, so I appreciate their support. The nurses are so nice to us and very professional ***(P007).***

Some participants expressed joy about the fact that they received support both in cash and in-kind throughout their stay in the hospital. These were their comments in their excitement:

*It was very helpful and the support throughout the surgery too, because when you calculate it's about four thousand Ghana cedis for each person's surgery, but we had it free and free feeding and accommodation (**P011).***

"The hospital was very helpful because it was very expensive to do the surgeries at other places and we had it free here, and they even fed us free, so they have been very helpful" ***(P004).***

Other participants commended the professionalism and kindness of the hospital

staff, particularly the nurses. These statements collectively reflect the positive impact of the hospital's services on the participants' well-being and highlight the importance of accessible and compassionate healthcare. They narrated their views with a grateful heart as follows.

"The people in this hospital(staff) have done very well. All the support from all the nurses and doctors and the information they gave was very helpful" ***(P001).***

*"The nurses are so nice to us and very professional. I have never met such nurses like that except in this hospital and I recommend them" (**P007).***

Staff Counselling and Education

Fistula had a negative psychological impact on the mothers. All participants acknowledged that they were educated and counselled by the nursing staff after the surgery which was very helpful. They shared that the counselling session raised their hopes for a better future.

*A counsellor came to also talk to us and told us that we are healed now so we should forget the past days when we were sad and thinking of suicidal things and encouraged us to be positive about for the future because we are healed, we should take those things out of our head (**P001).***

Another participant also shared her story:

*I was encouraged not to give up on my life and relationship because this condition destroyed my life, so I don't think I will ever marry. But they counselled me, but I am praying for strength to take care of my son (**P008).***

Participants reported that the best part of their recovery was the encouragement they received from the counsellors.

*"…a woman came to talk to us and encouraged us to forget about all that we went through, and it helped me a lot…" (**P005).***

*They showed us pictures of how the fistula came about, how to maintain our hygiene, and how to keep ourselves during our menses, they encouraged us so well, but we didn't experience such encouragement at home, so were happy at the hospital and didn't want to go home, everything was free. Their care was very helpful (**P013).***

The nurses provided information on how participants should care for themselves. They received education in the various areas they needed to pay attention to, to aid in wound healing. Some participants recall receiving education on their diet and personal hygiene. These were their comments:

*"…The nurses at the hospital told us how to maintain our hygiene so that our wounds will heal faster …" (**P006).***

*They showed us pictures of how the fistula came about, how to maintain our hygiene, and how to keep ourselves during our menses. The nurses told us to eat very well and take our medicines so that our wounds will heal well (**P013).***

*"…They also told us to eat plenty of fruits and eat well so that the wound will heal well…" (**P010).***

Other participants remember the education they received about when to resume sexual activity; three participants shared their statements as follows;

*"…The nurses at the hospital told us when to resume sex, they said after six months…" (**P006).***

*"…They told us to keep ourselves well and to resume sex after six months..." (**P004).***

*"…They also told us when to resume sex, they said we should wait till six months before…" (**P007).***

Whilst some participants were grateful for the education given one participant had concerns following discharge education, according to her, she did not receive any education from the nurses but had information from other clients.

We were not given any education they didn't tell us anything like how to take care of ourselves or when to resume sex, it was one lady who told us about the sex part during the conversation. but we were given review dates ***(P009).***

Community Post-Repair Programs

There are policies and programs laid down to help women reintegrate back into their communities, but there are implementation problems. The African Union has also called for the development of policies to address the social and economic impact of obstetric fistula on women, including the provision of psychosocial support and vocational training. However, a lack of political will prevents these policies from being implemented and programs organized for these women to help them reintegrate.

Institutional Policies and Programs

Many women after the repair do not know where to send their concerns and how to bounce back to their normal lives again. They run back to the hospital where they had the repairs and expect them to help them with vocational skills and finances to start up a business or trade. They shared their views as follows.

We don't have anything like that(programs) in the community, after you are discharged you are on your own, no one is even willing to give you a loan to start something, so you rely on family members and friends ***(P001).***

"There is nothing like that, we don't have people supporting us after our repair. we don't have anything like that here" ***(P002).***

"No please after discharge home you have to start your life by yourself, there are no plans for us, no one to talk to for help" ***(P013).***

Other participants recall that some organizations other than the hospital supported them with some cash and used clothes after the repair.

I know the NGOs who are outside the country support people with fistula to have the surgery, and it does that, but apart from them, I haven't heard of any programs like that. Usually after the surgery, they give some used clothes which are donated by people because some people don't even have clothes to wear, and 200gh as transportation back home ***(P012).***

Another participant commented:

"No support like that, it's only the catholic hospital that is currently supporting women who go through fistula with free surgery and after that, you are on your own" ***(P007).***

Three participants also had an idea about some programs from NGOs and the hospital community and how it was beneficial and had this to say.

"The Catholic hospital is the one trying to organize something like that but one year now, I haven't heard anything" ***(P009).***

"What I know is that the queen mother in Mankessim said she will organize some people to come and train us on soap making, slippers, and catering" ***(P010).***

We are now appealing to the government to support us. The Mankessim queen also brings us fruits and water after the surgery as a way to support us, she is even planning to empower us the women who have had the surgery with skills and I hope she can do it ***(P011).***

Media support

The media plays an integral role when it comes to helping mothers get back onto their feet after they have received treatment. Some of the participants stated that they received tremendous support from the media to enable them to start life all over again. These were some of their comments.

…There is nothing like that in my community, but there was a program on Adom TV and I also remember seeing another one on Angel TV discussing how they can help women who have fistula with money to start something with their lives after surgery, so they also supported me with some money, but apart from them nobody does that kind of thing in Ghana… ***(P006).***

Apart from Angel TV who was so supportive financially after the surgery, I heard about another one at Atinka TV but when I went there, the queue was very long so they could not support me there. We are now appealing to the government to support us with more finances. The Mankessim queen also brings us fruits and water after the surgery as a way to support us,

she is even planning to empower us the women who have had the surgery with skills and I hope she can do it ***(P011).***

Cultural Beliefs and Practices

Some of the participants come from a cultural background where spiritual beliefs play a significant role in explaining and addressing health issues. When health problems arise, consulting a spiritualist is the initial response, and these spiritualists often provide explanations that involve evil-minded intentions from relatives. In response to perceived spiritual threats or health issues, there is a reliance on traditional remedies and concoctions, suggesting a preference for non-conventional healing methods within these cultural contexts.

Traditional Beliefs

Traditions play a role in our day-to-day lives; women are not able to reintegrate well because there are spiritual beliefs that are attached to the condition of obstetric fistula. Participants reported that fistula is associated with spirituality and the traditional bodies must be consulted to find the cause, however, after realising it is a medical condition that can be treated with surgery, they refused to continue with the traditional concoctions.

Where I come from when the problem came, they went to ask a spiritualist and he said it was from some relative who wanted to kill me, so they asked spiritually and we were doing concoctions, but after the surgery, I haven't gone back to my hometown, and I have stopped taking the medicines they gave me ***(P0012).***

Some participants believed they had been placed under a curse since they didn't see the condition as normal. Having a successful surgery was an eye-opener for them, they decided to put the past behind them and move on with their lives.

So, after the condition, my husband stopped coming to me, so I thought my mother-in-law had cursed me, but after I went to the hospital and was healed, I decided to move on with my life, after all my husband stopped coming to me and I now know better that the condition [obstetric fistula] is not from a curse ***(P003).***

Other participants did not face cultural obstacles or stigma after undergoing obstetric fistula repair. They suggested that such issues were not prevalent in their communities. Their statements collectively provide insights into the varying cultural perceptions and awareness levels related to obstetric fistula and its repair within different communities. These were their statements.

"…I didn't have any problems with my community, and growing up I didn't hear of anything like that so we did not attach any spirituality to the condition.…" ***(P004).***

For me, because we are living in our own homes, and not mingling in the community, I don't think there is something like that [cultural stigma], and even if it is there it did not affect me in any way ***(P007).***

Community Perspective

Women after obstetric fistula repair are the subject of discussion in some communities. People still don't believe they are no more suffering from the condition. The participants of the study gave varied expressions of their experience.

… Also, the way some people treated me made me feel very bad so even though I have had the surgery, I can't still go out often. The way some people look at me sometimes makes me feel very bad. so, I am taking it step by step… ***(P008).***

However, P006's statement highlights that some misconceptions related to fertility and the past condition may still exist.

"…Even though I had the surgery, and I am healed, people still think the condition [obstetric fistula] I had is the reason why I am not able to get pregnant …" ***(P006).***

Challenges after Repair

Although living with fistula came with a lot of challenges for mothers who experienced it, going for the surgery was supposed to relieve these mothers of the challenges. Life after fistula repair also came with some challenges such as fertility issues, issues with intimacy, financial difficulties, and post-surgery complications.

Infertility

Some participants mentioned experiencing multiple miscarriages after developing obstetric fistula and hoped to sustain pregnancy till term after the surgery but have not yet gotten pregnant. Two participants shared similar experiences:

*And you know I told you I had three miscarriages after the fistula and after the surgery, I thought I would be able to get pregnant and have another baby, but after 2years I am still not pregnant again (**P010).***

*"... I want to concentrate and have children because I lost another pregnancy after the fistula surgery…" (**P006).***

Other participants who hoped to get pregnant after the repair reported that, her menstruation seized after the surgery and advanced age which has prevented them from getting pregnant.

*"My menses stopped coming after the surgery, so I am having difficulties having children, so I am thinking of adoption due to my age now" **(P012).***

*"... I don't think I can ever get pregnant again, because no husband and my age now, no child too" **(P002).***

Fear and apprehension about the potential for pain or discomfort can hinder sexual intimacy.

(P013) mentioned being afraid to engage in sexual activity after the repair due to concerns about what might happen.

*"I have not tried sex because I am afraid of what will happen, because if I had not had sex, I wouldn't have gotten pregnant and gotten myself into this problem" **(P013).***

Some participants also had intimacy problems, the first time they tried, but currently are enjoying their sex life without any problems.

*When I resumed sex, it was a little uncomfortable, and my vagina was very sensitive now especially if I put my fingers there but now, I don't have any problem, I am enjoying sex with my husband **(P006).***

Post-surgery Complications

Even after successful repair some participants still had problems physically and psychologically which made it difficult to reintegrate well.

Physical

Even after successful repair some of the clients developed some conditions which affected their daily lives. Some were sexual, and others were medical issues. Several participants mentioned experiencing pain or discomfort during sex after their fistula repair. This physical discomfort can lead to emotional distress and can create difficulties in maintaining a healthy sexual relationship. These were their comments:

*They told us to have sex after six months, so I tried but there was bleeding, so I gave myself some one week and later I tried again and was still bleeding so since then I have stopped having sex, also when I urinate, I was in pain after the surgery, but currently I don't experience those problems **(P009).***

A similar experience was shared by another participant;

*I have pain after sex, I even cried during sex and if a man is sleeping with you and you are complaining that you are in pain, he will always have problems with you, so I stopped having sex with my husband and he packed out to stay with my rival **(P011).***

Other participants were faced with medical challenges, and they had this to say:

"I had constipation initially, so they gave me medicine and I was able to pass stools, they advised me to eat well so that I don't have constipation" ***(P010).***

Another participant recounted;

*When I scream or cough hard at times some of the urine comes into my panty, but it is small and I feel pain when defecating there is blood in my stools when I constipate, so I am careful, and always make sure I don't keep urine for a long time. I also take in lots of fruits and water so that I don't get constipation (****P007).***

Psychosocial

The experiences shared by these participants after the repair of the obstetric fistula revolve around anxiety and lingering negative thoughts. These accounts emphasize the long-lasting psychological effects and challenges that individuals may face even after their fistula repair; these were their painful experiences in the following narration.

*When I went home initially, I was anxious, I was afraid the problem would come back in case I did anything hard, so I was very careful and complied with the advice given to us (other fistula clients) by the nurses (****P001).***

*"I still have the negative thoughts and experiences of what I went through. At times I feel it might come back again, so I am taking it step by step" (****P008).***

One participant discussed the presence of discrimination among women with fistula, where some women with less severe forms of the condition looked down on others which puts more burden on fistula clients even after repair. These were her comments.

*Some people had very severe forms of the fistula, so some of the women felt their type of fistula was better than others and were looking down on some of the women if you don't have the heart and courage you will give up (****P009).***

*Well as I told you a lot of people did not know, but one of my aunties came to visit me unexpectedly, and from how she was nosing around she wanted to be sure I was healed, but I was not bothered at all, because when you give my family a chance, they will destroy your life (****P009).***

Even after successful repair, some people were still stigmatized. Intra-community discrimination can add to the emotional burden experienced by individuals with a fistula and one who had the condition for 18 years had this to say.

*Madam do you know that my in-laws think I have been cursed because of what happened to me, with my pregnancies and condition, so they never reached out and when my husband died what they took me through, but my family didn't allow them, so even though they heard I am healed, they still think it's spiritual and I killed their son and a whole lot of issues, but at times you want to believe them, because madam just look at me and what has happened to me is it not spiritual. (****P002).***

Other participants sadly narrated their stories:

*"I know some people don't believe I am healed because many thought this condition can never be repaired, so once in a while, you can see their attitude is to confirm whether it has come back" (****P010).***

Also, the way some people treated me made me feel very bad so even though I have had surgery, I can't still go out often. The way some people look at me sometimes makes me feel very bad. so, I am taking it step by step ***(P008).***

Financial

The financial challenges faced by these participants after the successful repair of obstetric fistula primarily revolve around the fact that partners or husbands do not support some of these women adequately, making life difficult for them, some too for fear of having the condition recurring do not want to engage in any hard work and tends to depend on people for financial support. These were their comments.

I am looking for someone to give me a loan to start my trading business again. For my

*husband he brings money whenever he likes, at times one month we don't hear from him. It is a sad situation because you went to the hospital to deliver and you didn't plan for this to happen, all your plans have to end because you had the condition and the man who impregnated you doesn't even care, so it makes life very difficult and you don't even know what to do, but once there is the life you move on and hope for the best (**P004).***

Similarly, two (2) other participants also had their experiences to share:

*...financial problems, because I was trading but when the problem happened, I had to stop, so I don't work now and I have to get money for me and my son, so there is hardship, even though my mother has been helping us out, no husband to support us financially (**P013).***

*"...Also, I need money to start up something in case I am not able to go back to school to teach since I don't have a husband..." (**P008).***

One participant who was doing her seamstress business could not go back to do her work due to the fact that she did not want to stress herself after surgery and was dependent on her husband for financial support.

*"...I also had to stop the seamstress work because I did not want to cause any problems, like stressing myself so financially my husband is the one supporting me..." (**P006).***

Another participant also recounted that.

Participants who depended on their husbands for financial support before they had the condition was abandoned and now even after repair are still not working and have financial challenges. One participant in her narration said,

*... now I cannot do difficult jobs again because I don't want to do anything that will affect the surgery, so financially we are suffering, my husband did not allow me to work so I have been a housewife all these years, so I don't even know where to start from, and he is not supporting financially too, I am living on the small donations I get from people...(P**011).***

Some participants were able to pick up the pieces of their lives and started their business to earn a living. Here are the varied responses of the study participants:

*"... but I started selling polythene bags in the market and I am doing my business, earning my small, small money, people are buying, and I don't have to depend on my husband for everything" (**P010).***

*Everything was okay, I was just grateful for healing mercies, and some months later I could resume my waakye business, making my own money and taking care of my children, and by the grace of God people are buying my food (**P005).***

Luckily for some participants, because they were working in the government sector, they were still being paid salaries and were able to cope before and after surgical repair.

*"...luckily, they[employer] were still paying me salary so I could fend for myself and did not have to depend on anybody, so I have been financially stable..." (**P009).***

Suggestions from Women After Repair

All participants after successful repair, had a message for the government and the community. In their opinion people don't know what obstetric fistula is and how it came about, so a lot of community education should be done. Other suggestions from them also implied that there was a need to form support groups and serve as advocates.

Government Initiatives

All participants in this study were of the view that the government needs to support women after successful surgical repair in the form of monetary or skill acquisition. They believe this support can go a long way to help them reintegrate after a successful repair.

Awareness Creation

Lack of education is a major complaint many of the participants mentioned that they had not heard of the condition until they experienced it. They recommend that nurses and healthcare

providers conduct community education and awareness campaigns to ensure that people are informed about the condition and know where to seek help. These are what some participants said:

*"...It was my first time hearing of fistula after I had the condition, so the nurses should be doing education in the community to create awareness so that people can know where to get help…" **(P007).***

*"...There should be avenues that people can know that there are places like this hospital for people who have gone through this situation to come in for help…" **(P004).***

*Education should be done for people to be aware of the fistula, people are having it but don't know where to get help, the nurses should spread the news to churches and schools and add it to their antenatal education, they can print pictures and post them around the hospital **(P009).***

Additionally, they emphasized the importance of educating society about this condition, possibly to reduce stigma and provide information and support.

*"...because the people have not heard about this condition, they feel it is because you have done something bad, so if the people in our community know about it they will not say that…" **(P010).***

Trainings

Participants advocate for government-sponsored training programs. They believe that these programs would empower women who have undergone surgery, by equipping them with skills that could help them earn a living. The emphasis is on post-surgery training to enhance the livelihoods of these women, and these were their suggestions:

*I think the government should bring out training so that we can take part after the surgery and earn a living, and the government should talk to the community about the condition, that it's not spiritual so that they are aware and stop stigmatizing people **(P002).***

*"...There should be training for women to empower them with skills after surgery…" **(P013).***

"…**I hope that they can organize the training for us so that we can add it to what we are doing and get money to take care of ourselves because the men are cheating on us…" **(P010).

Peer Support Groups

Participants suggest that individuals who have the condition should come together to provide peer support for each other. They believe that connecting with others who share a similar experience can be beneficial for those dealing with the condition. These were their expressions:

*"...I think if I know people who have those conditions(fistula) we can be peer support for them and educate them on the condition…" **(P005).***

*"...and I want to use myself as an ambassador for fistula, so if I get the opportunity, I can go to radio stations to talk about it **…" (P009).***

Summary of Findings

After being informed of the goals and purpose of the study, thirteen women who underwent successful obstetric fistula repairs gave their permission and were eligible to take part. An in-depth interview guide was used to help with the interview. To analyse the data, and recorded the interview sessions and transcribed them using the thematic content analysis approaches. Four main themes, two emerged themes and thirteen sub-themes emerged from the data. The findings proved that obstetric fistula destroys the lives of women when they are affected and destroys their relationships. But after successful repair one is expected to return to their normal lives, their initial experience after surgery is met with happiness and joy, but this is cut short when they do not get the needed support from their partners, family, and community. Women can reintegrate successfully if they get good support.

The hospital where these women had their repairs were very instrumental in helping these women stay positive and look forward to a bright future, they gave advice and counselled them, but after these women were discharged, some had challenges that did not allow them to reintegrate fully, others also did not get the needed support in the form of skill training, other's wanted capital to start up a business but did not get the needed support and had to depend on relatives for survival. The study findings revealed that some women after repair were able to reintegrate with the needed support, but the majority did not fully reintegrate because they did not get all the support needed.

Discussion

Obstetric fistula can have profound physical, mental, and social outcomes for affected women, making the process of reintegration a critical component of their recovery [24, 25] Majority of the women in this study expressed happiness and a profound sense of relief from the burden of obstetric fistula after successful repair. A study conducted on Ethiopian women stated that women's emotional well-being was improved after surgical repair; these women reported feeling happy as well as a profound sense of relief and gratitude [26]. This is also consistent with findings from other studies in Addis Ababa and Nigeria that also reported that women's response following successful treatment is predictably one of happiness, joy, and relief. [27, 28].

On the contrary, even after successful repair, some women continue to face severe social marginalization and severe emotional pain. They become profoundly aware of their loss of sexual and marital privileges due to the impact of the obstetric fistula [29]. According to a study by [28], while successful repair helps women feel happy and hopeful again, it only addresses a small percentage of the numerous issues these women face. Many of them are still trapped in stigma, severe poverty, and relationship struggles. A comprehensive analysis of ten qualitative studies detailing the reintegration and rehabilitation processes of women in sub-Saharan Africa who had undergone obstetric fistula repair revealed that nearly all the studies had unfavorable outcomes. The negative features of rehabilitation that were most frequently noted were the long-term emotional, financial, and physical repercussions. The majority of the women stated that it traumatized them to be their families' financial burden [6]. Fortunately, the majority of the women in this study had favorable outcomes. This profound sense of relief stemmed from the fact that the specific context and environment played a crucial role in their recovery and well-being, contributing to the positive outcomes.

Some participants in this study, experienced divorce after repair because they did not live up to their husband's expectations sexually, and some other participants separated because their men abandoned them and moved to live with other women even after repair. This finding is consistent with a study conducted in Banadir and Mudug regions, Somalia which concluded that women with obstetric fistula frequently get divorced even after repair. Some husbands divorce their spouses due to the foul urine odours and leaks that come with obstetric fistula, which they find repulsive before repair. Some divorce their spouses because the survivors of fistula cannot please them sexually, and others are divorced because they are unable to conceive and require years to heal after surgical repair [30].

In addition, this study found out that, some husbands choose to stay with their second or third wives rather than their spouses due to fistulas even after successful repair, and these women did not receive the needed support which is in line with a study done in Malawi which revealed that due to polygamy, women with obstetric fistulas do not receive much help from their spouses [7].

Interestingly some participants in this study still had support from their husbands after repair and some even still maintained their marital status even though they could not conceive. This result is similar to other studies conducted in Guinea and Tanzania, in their study nearly half of the participants referred to their husbands as "supportive carers", indicating that their husbands were of great support to them [31, 32].

In this study, most of the women had support from family which made them return to their social and economic activities. A study of Kenyan women who underwent fistula treatment found that partner and family support played a significant role in their reintegration after surgery [33]. Also, further findings in this study established that fistula survivors relied on their partners or family for financial and emotional support which was consistent with a study by [28] who stated that family and friends can assume a basic part in offering social help for women during the reintegration process. This assistance may include psychological support, assistance in daily life, and financial support. For example, relatives may provide support in routine activities such as food preparation and housekeeping, while partners may offer emotional support and companionship.[34].

Findings from this study further illustrate the support women received from their mothers, siblings, and children. Which was very instrumental after repair and helped women to move forward and be hopeful for the future. Similarly, according to [26], women survived after surgery because of family support. Family and relatives were the most dependable source of financial and emotional support for women living with obstetric fistula, even though some of the women faced rejection from their spouses and communities. Family members, particularly parents, siblings, and their children were crucial in providing assistance and support for clothing, food, and water despite the minimal resources available [30, 35]. These statements convey a theme of strong familial support in this study, particularly from mothers and sisters, in times of need. They highlight the valuable contributions of family members in providing care and assistance, which can be vital in various life situations.

Social support is an important part of reintegration. Social support can come from friends, family, and the community. The type and amount of social support required will vary depending on the individual needs of each woman [36].

Despite the significance of social support in the reintegration cycle, numerous women with obstetric fistula face critical boundaries in accessing the support they need even after repair [37] Most women in this study said that their fistulas damaged their relationships with friends and family and reduced their communal activities. Nonetheless, the majority of our study population found it easy to reintegrate and fortify these relationships following repair and were able to carry on with their regular activities, such as attending funerals and markets after repair even though they suffered with relationships when they had the condition. This was in line with a qualitative study of 20 Malawian women who were interviewed and in their responses these women were received warmly upon returning to their homes, and most soon after, they started taking part in programs again [38].

Despite other studies stating that some women were not accepted back into their communities after fistula repair [39], the majority of the participants in this study did not report facing challenges returning to the community. The findings in this study reflect previous research by [40] which indicated that following obstetric fistula repair, reintegration was relatively easy for Malawian women [40]. The fact that most women in this study did not face stigma or social obstacles during their reintegration is a good result of fistula repair surgery.

A few women in this study however continued to experience stigma and are still struggling to be accepted by people in the community even after repair. Similar reports are seen in Kenya and Ethiopia [27, 39, 24]. Moreover, the reintegration process for women may be greatly influenced by their prior experience of living with a fistula before undergoing treatment. The extent of their isolation and stigmatization during the time living with obstetric fistula could significantly impact their status even after successful repair, regardless of whether these women were no longer experiencing symptoms.

Healthcare providers also play an important role in supporting the reintegration process. Healthcare providers can provide medical treatment, counseling, and rehabilitation services to help women regain their physical and psychological health [21, 10]. The participants in this study expressed sincere gratitude for the assistance provided by the hospital staff. Their statements emphasize the hospital's financial support, which made necessary medical procedures accessible to them.

After the repair of the obstetric fistula, women require a scope of healthcare services, including follow-up care, rehabilitation, and family planning services. Follow-up care is basic to monitor the woman and recognize any potential complications that might emerge. The women appreciated the information provided before discharge, suggesting the importance of patient education. Additionally, they commend the professionalism and kindness of the hospital staff, particularly the nurses. These statements collectively reflect the positive impact of the hospital's services on the participants' well-being and highlight the importance of accessible and compassionate healthcare.

On the contrary, even though the majority of the clients were appreciative of the information given, some complained about not getting adequate and needed information. Family planning services are likewise fundamental, as numerous women who have developed obstetric fistula are at a higher risk of developing complications during pregnancy and childbirth, interestingly none of the participants in this study mentioned family planning or the use of contraception as part of the topics of health education required during discharge and their future fertility goals. This is consistent with findings from a study by [7] which stated that one of the more difficult aspects of the discharge process is preventing women from having sex for six months following fistula repair, to allow the vaginal tissue to heal properly. These women who are discouraged from having sex may be less likely to ask about the availability and options for contraception, which could result in unwanted pregnancies among women who have had fistula repairs [7]. Therefore, this study suggests that women after repair at fistula repair centers would benefit from a more comprehensive discharge process. This includes contraceptive education and a discussion of future fertility goals. As supported by [7], health workers should include this in their discharge process [7].

This study provides additional evidence of the importance of counselling, and education considering the psychological effects that the illness has on women and the stigma attached to it. This is in line with a study by Khisa on Kenyan women and in her discussion, she stated that women may benefit from counselling that focuses on dealing with reproductive issues, infertility, and return to normal lives. Information, education, and communication about exercise, hygiene, adequate hydration, and nutrition may come during the counselling sessions [33]. The findings in this study support evidence that some of the women who received some counselling from healthcare workers were able to reintegrate well after discharge home even though it was not from a trained professional counselor.

The World Health Organization (WHO) recommends Reintegration as a crucial element of the guiding concept for the care of women who have obstetric fistulas. On the other hand, not much is known about the best practices for reintegration programs, what it means for women to reintegrate, and what kind of assistance they require to live their pre-illness regular lives again. Many of the women interviewed had no idea of any reintegration programs for them after surgery.

The study findings indicate that there are currently no reintegration programmes at the fistula centre of the Mercy Women's catholic hospital in Ghana. There are no activities or programs organized for clients when WHO clearly has outlined reintegration steps for clients after repair. Formal reintegration programmes are not available. A few clients who had skill training organized by the queen mother of Mankessim in collaboration with UNFPA did not have the finances to continue and had skill training abandoned causing financial problems for them.

The data collectively underscores the significant absence of support programs, activities, or policies for women recovering from obstetric fistula repair in these participants' communities. This gap in support highlights a potential issue in ensuring holistic care and recovery for women affected by obstetric fistula. It also suggests a need for increased awareness, advocacy, and potential policy changes to address this issue and provide better post-repair support for affected women.

In Ghana there is no comprehensive approach to the management of obstetric fistula before and after repair, therefore government must collaborate with some institutions and bring out such initiatives to help women fully reintegrate after obstetric fistula repair like in countries with well-established fistula centers.

The media played as a good support system by allowing some of the clients to share their stories for free and even gave some women support financially, they also helped in creating awareness on the plight of women with fistula even after surgery.

Cultural beliefs contribute to the difficulty that clients have in reintegrating because, some cultures believe that obstetric fistula is spiritual, which makes it difficult for some clients to be accepted back into their communities even after a successful repair. Some of the participants come from a cultural background where spiritual beliefs play a significant role in explaining and addressing health issues and some beliefs that the woman was a witch or promiscuous during pregnancy make it difficult for them to be reintegrated after repair. When health problems arise, consulting a spiritualist is the initial response, and these spiritualists often provide explanations that involve malevolent intentions from relatives. In response to perceived spiritual threats or health issues, there is a reliance on traditional remedies and concoctions, suggesting a preference for non-conventional healing methods within these cultural contexts.

An encouraging finding from our study is that most of the respondents confirmed that there is no cultural taboo that affected them when they returned back to their communities. According to the respondents, socio-cultural beliefs did not hinder their reintegration process. They had the freedom to socialize with others and fulfil their responsibilities within the community after surgery. The majority of participants did not report facing cultural obstacles or stigma after undergoing obstetric fistula repair. They suggest that such issues were not prevalent in their communities. Their statements collectively provide insights into the varying cultural perceptions and awareness levels related to obstetric fistula and its repair within different communities. Other studies in Nigeria highlight that sociocultural beliefs do not impede these women's integration process. They are free to socialize and carry out their routine responsibilities within the community [28]. The observation that many of the studies reported that women were hiding and reluctant

to be seen or interviewed due to past fistulas seemed contradictory [28].

A study done by Jarvis in the Northern Region of Ghana however reported that it was difficult for many women in the Northern part who had undergone surgery to reintegrate and this was made difficult by cultural and societal, limitations for women [10]. Interpreting this data underscores, the importance of cultural sensitivity and understanding when addressing healthcare disparities and practices within diverse communities.

Fertility concerns, changes in physical abilities, and financial struggles significantly impacted some participant's lives. Fertility complications were one of the complaints by participants, which reflects previous research that listed fertility as one complication after fistula repair [39]. In addition, the present study found that some women experienced infertility due to the absence of menstruation, and difficulty in conceiving and subfertility which was also reported by other studies that some women perceived difficulties becoming pregnant due to subfertility, absences of menstruation and outright attacks on their capacity to be a wife and mother [11, 38].

The present study reported some of the challenges which some participants encountered even after successful surgical repair, some clients reported they had stress incontinence, dyspareunia, and vaginal dryness. Many women continued to experience sexual dissatisfaction and difficulties during sexual activity even after undergoing surgical repair. Women also linked difficulties in relationships to similar issues related to sexual activity which reflects previous findings by Drew who conducted a qualitative study on 20 Malawian women and reported similar difficulties experienced by these women including pain during sexual activity, and some reported being anxious that their sexual encounter would trigger a recurrence of the fistula [38]. In addition, several studies in Ethiopia, Uganda and Tanzania have recorded challenges, such as ongoing symptoms associated with fistula repairs, such as discomfort and fatigue, stress incontinence, dry vagina, secondary infertility, sexual dysfunction, or pain [26].

A study in Tanzanian and Ghana on women's psychological expectations after fistula treatment reported some women in their response stated that they would never want to have close friends again due to mistrust and lack of support during critical times.[35] In this present study, few of the participants indicated that they were still stigmatized and still isolated themselves after repair and therefore failed to fully reintegrate.

All the respondents interviewed in this study felt they required financial assistance to alleviate their misery. Providing women with a source of income is crucial for their successful reintegration. Given that they have previously undergone a great deal of agony from poverty, shame, and neglect before surgery, releasing them back into the community to continue living in poverty amounts to initiating a new cycle of suffering that may result in another fistula. A Kenyan study found that providing income-generating activities, skill acquisition training and government support can help women reintegrate into society [33, 28].

In this study, women faced financial difficulties. These women lost their jobs or were unable to do jobs that provided them with an income as a result of fistula repair, causing them to experience financial difficulties that hampered their reintegration. There is evidence to suggest that women who have good financial support will be able to resume their usual lives. These accounts highlight the complex and multifaceted challenges that women may face after obstetric fistula repair. Participants underscore the idea that financial support can be a means of empowering them after they have undergone treatment. They hold the view that financial assistance can contribute to their ability to rebuild their lives, possibly by engaging in income-generating activities.

Participants in this study emphasized the importance of educating people about this condition, possibly to reduce stigma and provide information and support. Many of the participants mentioned that they had not heard of the condition until they experienced it. They recommend that Government, nurses, and healthcare providers conduct community education and awareness campaigns to ensure that people are informed about the condition and know where to seek help.

Women in this study stated that the Government should bring out training programmes on income-generating activities to help them get the needed skills and be able to return to their normal lives again. Participants in other studies reveal a variety of post-repair rehabilitative interventions available to women in Sub-Saharan Africa, including income-generating skills (embroidery), clothing and soap gifts, paid transportation for follow-up visits, small monetary stipends, and basic literacy training. This will help them to have more positive reintegration experiences following fistula repair, health education and counselling for women and their communities, among other treatments, should be provided [6].

In this study, some of the women advocated for the need for support groups to meet and share information and also support people who are yet to do their surgeries, which is consistent with findings by Yeakey in which participants suggest that affected women who underwent successful fistula repair desired to work as advocates to help other women who were going through such challenges [40]. They believe that connecting with others who share a similar experience can be beneficial for those suffering from the condition. This was in line with the study conducted in Malawi which stated that a significant number of women were great advocates of fistula repair, and many were also teaching and supporting those who required repair [38, 9].

Overall, these statements underscore the need for awareness, education, and support for women dealing with challenges during the reintegration process. The participants are advocating for a multi-faceted approach involving peer support, financial assistance, community education, healthcare access, and personal advocacy to address this health issue effectively.

Conclusion

Women with obstetric fistula face challenges, surgical repair is the only treatment option for obstetric fistula management. Social reintegration of obstetric fistula has not been given the attention it deserves, just like its treatment. This study has shown that women reintegrated fully or partially depending on the support received from partners, family, community, and health workers. It has also brought attention to the plight of women who experience problems with reproduction and sex after surgery, which has a detrimental impact on their relationships and marriages. It also brought attention to the fact that further studies need to be done on the advantages of post-repair reintegration programmes from the viewpoint of women and ways to support them.

Consequently, more studies on post-repair women's experiences in the community may help address concerns related to sexual and reproductive health, enhancing care accessibility, and addressing the obstacles that women confront. These results show, there is a need for better and higher-quality care for women post-surgical repair, and they can also be used to inform policy development.

Recommendations

Based on the findings of this study, the following recommendations are made to the Ministry of Health, Ghana Health Service, Nursing and Midwifery Council, Fistula centres, and other interest groups.

1. The Ministry of Health and Ghana Health Service should partner with non-

governmental agencies and develop a comprehensive program for women undergoing obstetric fistula therapy at the fistula centres.

2. Ministry of Health and Ghana Health Service should formulate policies with an emphasis on reintegration implementation and make sure all fistula centres adhere to it.
3. Ministry of Health and Ghana Health Service should collaborate and design a discharge protocol for all fistula centres. The researcher recommends that women in fistula repair centers would benefit from a more thorough discharge process that includes contraceptive education and a discussion of future fertility objectives since none of the clients talked about family planning in this study. Also, the discharge process should involve psychological counselling which deals with positive ways of dealing with challenges when they arise after discharge home.
4. Also, Ministry of Health and Ghana Health Service can empower health workers so that they can ascertain whether these women have been fully reintegrated by following up with them at the community level. Also, there should be professional counsellors at the fistula site to give professional counselling to these clients before discharge.
5. A more comprehensive program can be organized by Ministry of Health and Ghana Health Service at the various fistula centres where reintegration services like vocational training, small scale enterprises would be established, and these women can be enrolled into it before they are released into their communities. To guarantee complete recovery, the women must receive social support and be reintegrated economically when they return home following a successful repair.
6. Ministry of Health, the Ministry of Information, and Ghana Health Service, in collaboration with community leaders, should actively promote extensive awareness regarding obstetric fistula. This awareness campaign should emphasize the importance of reintegration for affected individuals. Notably, despite surgical repair, obstetric fistula continues to carry a significant stigma, which necessitates targeted efforts to address it. Furthermore, it is crucial to advocate for counseling programs that specifically target spouses, family members, and the general public. These programs can play a vital role in supporting affected women and fostering understanding within the community.
7. Nurses and Midwifery Council should integrate obstetric fistula, its management, and reintegration aspects into the curriculum for the training of midwives in the training colleges and universities.
8. The council should also organize continuous professional development on obstetric fistula, its management, and reintegration services for practicing midwives, with relevant CPD points.

Recommendations for Future Research

1. Future research into the reintegration experiences of women after unsuccessful obstetric fistula repair should be done due to diverse perspectives arising from their experiences.
2. Additionally, quantitative study, encompassing a larger participant pool, is essential. Such research would provide a more comprehensive understanding of the topic.
3. Furthermore, it is crucial to conduct a distinct study specifically in the central region and other regions of Ghana. This research would enable the collection of ample data and facilitate an assessment of the applicability of the study's findings in these specific contexts.

Conflict of Interest

There is no conflict of interest.

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Assessing ICT as a Catalyst for Evidence-Based Decision Making: A Theoretical Literature Review

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Abstract

This theoretical literature review examines the pivotal role of Information Communication Technology (ICT) as a driving force in evidence-based decision-making within educational administration. It highlights ICT's transformative potential to enhance teaching methodologies, streamline administrative operations, and foster data-driven cultures. By analyzing scholarly sources, the paper underscores the significance of ICT competence among education administrators, which encompasses the technical and analytical skills needed to interpret complex data sets and implement effective strategies. Furthermore, it emphasizes how ICT facilitates access to real-time data, promotes transparency, and improves student outcomes through personalized instruction. The review identifies critical factors influencing ICT integration and its effectiveness, including infrastructure, user capacity, and organizational culture. The paper concludes with recommendations for strengthening ICT's role in enhancing Evidence-Based Decision-Making (EBDM) in education.

Keywords: *Data Analysis, Data-Driven, Digital Tools, Educational Administration, Evidence-Based Decision Making, ICT.*

Introduction

In the ever-evolving landscape of educational administration, the integration of ICT stands as a pivotal force, reshaping decision-making processes and heralding a new era of evidence-based practices. ICT encompasses a broad spectrum of technological tools and resources, including computer hardware, software applications, digital communication networks, and the internet, all of which can be strategically leveraged to enhance the efficiency and effectiveness of educational administration. It serves as a catalyst for sustainable development by strengthening global interconnection facilities, accelerating progress through productive economic activities, and bridging the digital divide through the development of a knowledge-based society [26]. This paper explores the multifaceted role of ICT in empowering education administrators to make well-informed decisions grounded in empirical evidence, ultimately fostering improvements in educational outcomes and institutional effectiveness.

Conceptual Framework

According to Marsh & Farrell, Evidence-Based Decision Making refers to the systematic use of empirical data to guide decisions in education [22]. Information and Communication Technology encompasses a broad range of tools and systems used to collect, store, and analyze data, including Management Information Systems, Learning Management Systems, and data analytics platforms [12]. ICT competence refers to the knowledge, skills, and attitudes required for

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effective use of ICT in decision-making processes. It involves not only technical proficiency but also the ability to critically evaluate and interpret data to make well-informed decisions.

This conceptual framework posits that ICT serves as a critical enabler for evidence-based decision-making in educational administration. Effective implementation of ICT tools and the cultivation of ICT competence among education administrators are essential for harnessing the full potential of data-driven decision-making. The integration of ICT can help streamline administrative processes, automate routine tasks, and provide real-time access to comprehensive data, allowing administrators to make more informed and strategic decisions. Furthermore, the ability to analyze and interpret complex data sets can lead to the identification of trends, patterns, and insights that can inform policy development and resource allocation [11]. By fostering ICT competence among education administrators, institutions can cultivate a culture of data-driven decision-making, where policies and practices are grounded in robust evidence and a commitment to continuous improvement.

ICT and Data Availability

ICT significantly enhances data availability by streamlining data collection and storage. Platforms like School Management Information Systems facilitate real-time data entry and retrieval, which are crucial for responsive decision making [10]. Studies also highlight the value of ICT in consolidating disparate data sources for comprehensive analysis [19]. The application of big data analytics and data mining techniques enables administrators to identify patterns, trends, and anomalies that would otherwise remain hidden within the data deluge. The integration of ICT into educational administration streamlines administrative processes by automating tasks such as student enrolment, attendance tracking, and grade management, thereby freeing up administrators' time to focus on strategic decision-making and policy development.

The use of ICT tools in educational institutions enables them to manage vast amounts of student and staff information, including records of student accounts, performance, progression, staff mobility, and performance [28]. This information can cover a wide range of data, such as demographics, enrolment, discipline, learning data like assessment and achievement data, teacher evaluations, and curriculum effectiveness data. Consolidating and managing this data through ICT systems provides a more comprehensive view of the educational system's inputs, resources, governance, operations, and results.

Effective utilization of ICT tools can greatly improve the efficiency and accuracy of data collection processes, ensuring that decision-makers have access to reliable and up-to-date information to support their decision-making [20]. The availability of real-time data and the ability to analyse complex data sets can empower education administrators to make more informed and strategic decisions that drive continuous improvement in educational outcomes. Furthermore, data mining techniques can be employed to extract useful information and trends from existing data, which can be used to inform the decision-making process.

ICT Competence and Decision-Making Synergies

A critical element in harnessing the power of ICT for evidence-based decision-making lies in ensuring that education administrators possess the requisite ICT competence. Administrators need to be adept at utilizing a variety of digital tools and platforms to collect, analyze, and interpret data relevant to their decision-making responsibilities [34]. The convergence of technology and pedagogy is paramount to teachers' beliefs about teaching and learning with ICT. Access to resources, software and hardware quality, ease of use, change incentives, support and collegiality in schools,

school and national policies, commitment to professional learning, and formal computer training backgrounds all influence teachers' decisions to use ICT in the classroom [27].

Furthermore, ICT competence extends beyond mere technical proficiency; it encompasses the ability to critically evaluate the quality and reliability of digital information sources. This involves discerning credible research findings from unsubstantiated claims, identifying potential biases in data sets, and applying appropriate statistical techniques to extract meaningful insights. In addition, digital competencies involve the proficient and discerning use of electronic media for professional, recreational, and communicative purposes and the aptitude to do a task with proficiency and effectiveness [7]. Effective integration of technology hinges upon teachers' attitudes, beliefs, knowledge, and skills concerning ICT. Administrators must therefore be well-equipped to conduct comprehensive evaluations of ICT interventions, meticulously assessing their impact on student learning outcomes through rigorous data analysis and statistical modeling. By nurturing ICT competence among education administrators, institutions can cultivate a culture of data-driven decision-making, where policies and practices are informed by robust evidence and a commitment to continuous improvement [27].

Leveraging ICT for Smarter School Leadership

The advent of ICT has ushered in an era of unprecedented access to educational data, presenting both opportunities and challenges for education administrators. Specifically, ICT implementation allows educational environments to be transformed into spaces where students develop diverse skills through research and problem-solving using technology-based resources. Data-driven decision-making involves the systematic collection, analysis, and interpretation of data to inform strategic decisions related to curriculum development, resource allocation, and performance management [9]. However, the mere availability of data does not guarantee effective decision-making. It is crucial that administrators possess the necessary skills and knowledge to extract meaningful insights from complex data sets and translate them into actionable strategies [24].

Fortunately, digital teaching introduces more data management capabilities, potentially fostering greater transparency and better decision-making processes for teaching and academic improvement [14]. Data visualization techniques, such as dashboards and infographics, can play a pivotal role in presenting complex information in an accessible and intuitive format, enabling administrators to quickly identify trends, patterns, and anomalies that may warrant further investigation. Moreover, administrators must be vigilant in addressing potential biases and limitations in the data, ensuring that decisions are based on a comprehensive and unbiased understanding of the educational landscape [35]. Data-driven decision-making has a substantial positive impact on student outcomes, with a synthesized effect size of 1.17 [3]. Data empowers administrators and educators to tailor instruction to meet the specific needs of individual students, resulting in significant gains in academic performance and overall student achievement [22].

ICT-supported formative evaluation offers decision-makers indispensable insights for iterative program enhancement, enabling precise diagnostic assessments and facilitating continuous performance oversight through the utilization of real-time data analytics. By analyzing data on student performance and teacher effectiveness, leaders can identify effective instructional strategies and areas where additional support may be needed [11]. Data-driven approaches promote transparency and engagement with teachers, parents, and the wider community, creating opportunities for collaboration and collective problem-solving

[11]. It is essential for educational establishments to employ diverse data sources, including standardized evaluations, attendance records, and surveys, to gain insight into student needs and institutional effectiveness [3].

Digital Pathways to Smarter Decisions

The literature consistently underscores the transformative role of information and ICT and evidence-based information in enhancing educational decision-making. ICT enables education administrators to monitor and evaluate learning outcomes more effectively, providing key insights into what is learned, how it is learned, and where and when learning occurs [25]. When properly harnessed, ICT-supported tools offer standardized methods for collecting and analyzing data, thereby supporting more informed decisions and stronger accountability [30]. The use of data to inform decision-making has become a central component of educational improvement initiatives across the globe [13].

ICT also improves management systems, particularly in schools with established data-gathering procedures [34] Educators' ability to use technology effectively in pedagogy is becoming a cornerstone of modern teaching methodologies, reshaping the learning experience [28].

The Infrastructure of Influence—Leadership and Systems

Educational systems and leadership structures play a pivotal role in supporting data-informed decision-making. Farrell's study of six secondary schools revealed how contextual factors—such as financial resources, organizational structures, and regulatory environments—either enable or hinder data-use efforts in schools [22]. However, many school systems remain focused on data collection and entry rather than meaningful analysis and application [4].

Similarly, Sutherland's four-year study in Title I schools [31] emphasized the importance of cultivating a culture of data use. Sutherland found that successful reform relies on collaboration between schools, districts, and state entities, as well as strong internal motivation to use data for continuous improvement.

To fully realize the potential of ICT and evidence-based information, educational leaders must prioritize professional development initiatives that equip administrators with the necessary data literacy skills. Educational leaders must champion a shift towards a data-driven culture, where evidence is valued and used to inform decision-making at all levels of the organization.

Building a Data-Driven Culture in Schools

Educational leaders are being urged to adopt data-driven instructional models that include stages such as data reflection, program design, formative feedback, and instructional alignment [17, 18]. However, despite the growing emphasis on data use, practical implementation remains inconsistent.

Jimerson's work identifies eight major challenges to using data in education, emphasizing that even when data is available, schools struggle with turning it into actionable insights [31, 15] adds that the promise of data use comes hand-in-hand with complexity, requiring thoughtful integration into school culture and routines.

The presence of ICT alone does not guarantee its effective use. A culture that supports data use is critical. Professional development and leadership support are key to fostering this culture [15]. Educators must also possess the requisite skills and confidence to engage with data meaningfully [21]. To foster data-informed educational districts, it is essential to address several organizational factors: cultivating shared understandings of data interpretation and application, providing

professional learning opportunities focused on effective data utilization, and strategically implementing robust computer data systems.

The Human Element - Training, Beliefs and Barriers

One consistent theme across the literature is the need for professional development. Research by Abrams et al. shows that targeted training programs can enhance teachers' data literacy, collaborative practices, and efficacy [1]. However, many programs lack clarity and focus, diminishing their impact.

Freitas & Spangenberg [13], applying the Technological Pedagogical Content Knowledge (TPACK) framework, found that while teachers often have strong content and pedagogical knowledge, their technology-related expertise lags behind. Barriers such as time constraints, inadequate infrastructure, ineffective training, and leadership weaknesses were identified as significant obstacles to ICT integration. These issues are examined through a review of research in the past decade, emphasizing that teachers' beliefs about and capacity for data use are often not connected within the literature or in practice, but they are the heart of the connection between data and instructional change [8]. Teachers' capacity to use data and their beliefs about data use are shaped within their professional communities, in training sessions, and in their interactions with coaches, consultants, and principals.

Leading the Digital Charge -The Role of Principals and Policy

Leadership commitment is frequently cited as a determining factor in successful ICT integration. Mingaine's study in Kenya highlights that school leaders who actively support ICT adoption—through budgeting, advocacy, and integration into daily management—significantly improve implementation outcomes [23]. It is imperative that principals are prepared to support and promote technology adoption among teachers and students. Principals also play a pivotal role in shaping a data-driven culture within their schools.

Effective leadership is essential in fostering a collaborative environment where data-driven decision-making is prioritized, rather than resisted. Principals need to champion the use of evidence to make strategic decisions regarding school improvement, resource allocation, and instructional practices [18].

Policy also has a critical role in shaping ICT integration in education. Policies must focus on incentivizing evidence-based practices and creating accountability measures that genuinely reflect educational outcomes [29]. Educational leaders and policymakers are encouraged to implement comprehensive training programs that focus on applied statistics, data interpretation, and the ethical implications of data use.

The findings urge leaders to stop relying solely on external aid and to take ownership by prioritizing ICT initiatives within their institutions. This includes not only infrastructure but also ongoing professional development and digital policy support. It's increasingly clear that technology leadership is not just about providing tools but about fostering a culture of innovation and continuous improvement.

Tools of the Trade – ICT for Monitoring and Management

ICT systems such as student management software, digital surveys, and online assessments powered by ICT technologies are reshaping how schools collect and use data [6, 33]. Data analytics platforms allow educators to identify patterns and gaps in student outcomes, helping them tailor instruction and policy more effectively to meet individual learner needs [33].

The Malaysian government has implemented numerous initiatives to boost ICT adoption in education, requiring schools to integrate technology into administrative tasks,

teaching, and learning [32]. This signifies the growing recognition of the potential for ICT to transform educational management and decision-making.

School Management Information Systems can also support school managers in handling complex tasks like resource allocation, strategic planning, and monitoring. Through the comprehensive analysis of information from these integrated MIS systems, administrators can gain actionable insights, thereby enhancing their decision-making capabilities. The use of ICT systems has been shown to improve communication, streamline administrative processes, and enhance overall organisational effectiveness, ultimately leading to improved educational outcomes [28].

Roadblocks on the Digital Highway

One of the primary barriers to effective ICT integration in evidence-based decision making is insufficient infrastructure. Many educational institutions, particularly in rural or under-resourced areas, lack reliable access to the internet, modern devices, and stable electricity. This digital divide creates unequal opportunities for leveraging ICT tools for data-driven practices [16]. Without the foundational infrastructure, the implementation of data collection systems, cloud-based analytics, or real-time monitoring tools becomes impractical, thereby limiting the use of technology for informed decision-making.

Another major challenge is limited digital literacy among educators and administrators. While technology may be available, many stakeholders do not possess the necessary skills to use ICT tools effectively. This skills gap inhibits the interpretation of data, utilization of management information systems, and engagement with analytics platforms. As Abrams et al. noted [1], capacity building is essential for fostering confidence and competence in data use. Training programs are often sporadic, inadequately tailored, or inaccessible, leading to underutilization of available technology and poor decision outcomes.

Resistance to change and organizational culture also represent formidable roadblocks. Introducing ICT systems often requires changes to established workflows and hierarchies, which can provoke uncertainty and skepticism among staff. Cultural norms that prioritize intuition or tradition over data can hinder the acceptance of evidence-based approaches [16]. In such environments, ICT tools are either resisted or used in a superficial manner, preventing them from becoming integral components of decision-making processes.

Moreover, data interoperability and integration issues continue to obstruct seamless ICT-enabled decision making. Educational institutions frequently use disparate systems that do not communicate well with one another, making it difficult to consolidate and analyze data holistically [9]. The lack of standardized data formats and protocols means that crucial information remains siloed, diminishing the potential insights that could be gained from a unified dataset. This fragmentation reduces the timeliness and accuracy of decisions made based on available data.

Finally, policy and governance limitations can stall progress on the digital highway. In many regions, policies around data privacy, ICT procurement, and digital innovation are outdated or inconsistently applied. As Avila et al. point out [5], the absence of clear frameworks and accountability mechanisms can lead to ad hoc implementation of ICT initiatives, undermining sustainability and scalability.

Without a supportive policy environment, even the most sophisticated technological tools may fail to translate into meaningful educational improvement.

Toward a Data-Empowered Future

The available literature paints a clear picture. ICT is not merely a tool, but rather a catalyst for change in educational leadership and

management. The integration of digital technologies enables smarter decision-making, fosters accountability, and supports a more adaptive and responsive educational system. Administrators can drive meaningful improvements in teaching, learning, and overall school effectiveness by strategically leveraging ICT and prioritizing evidence-based information. This, however, requires strong leadership, supportive policies, and an unwavering commitment to building a data-driven culture within educational institutions [28, 32].

School Management Information Systems have now become pivotal in modern education, streamlining administrative tasks, enhancing communication, and supporting data-driven decision-making [12]. These systems facilitate efficient data processing, leading to quicker and more informed decisions, thus strengthening the connection between effective information management and educational advancement. The future of educational administration lies in embracing and mastering the transformative potential of ICT and data analytics.

However, achieving these outcomes requires more than just infrastructure—it calls for a shift in mindset, leadership prioritization, strategic investment in teacher training, and a culture that values data as a tool for growth and equity.

Conclusion

ICT plays a vital role in transforming educational administration through evidence-based decision-making. By equipping administrators and educators with digital competencies and fostering a data-driven culture, schools can improve student outcomes and enhance institutional effectiveness. While barriers remain, effective leadership, robust infrastructure, and tailored professional development can drive successful ICT integration.

To fully leverage ICT in education, key recommendations include investing in infrastructure to ensure access to up-to-date digital tools and reliable internet connectivity; providing targeted professional development training in data literacy, ICT competence, and TPACK for educators and administrators; developing policies that encourage data use, transparency, and accountability; garnering leadership support to empower school leaders to prioritize and champion ICT adoption and conducting research initiatives to investigate the impact of ICT on student outcomes and develop contextually relevant strategies for integration.

The future of education administration lies in its capacity to harness technology to make informed decisions, promote continuous improvement, and ensure that every student has the opportunity to succeed in the digital age. Educational institutions that embrace this transformation will be best positioned to meet the evolving needs of students and prepare them for the challenges and opportunities of the 21st century.

Conflict of Interest

The author declares that there was no conflict of interest in the process of conducting and publishing this research work.

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Factors of Unemployment of Graduates in Butembo, DRC

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Abstract

In this study on the factors of unemployment among graduates in Butembo in the DRC, we wanted to identify the type of the first employment opportunities that graduates seek and educational factors of unemployment among graduates and to find skills and strategies to develop employability for graduates. We questioned 74 from secondary school and 48 from tertiary education. The results obtained with chi-square at the 1% or 5% threshold showed that they all have the same obstacles, the lack of necessary employability skills. We found that graduates apply for higher-paying professions such as humanitarian work and commercial companies without taking into account their study specialty. There are many factors contributing to unemployment. They are mainly educational, namely: a) Field of study which is not in demanded on the job market or is very popular or is still unclear for an employment perspective; b) Poor learning of employability skills, lack of computer skills, lack of local environment knowledge, lack langue mastery, lack of motivation to work; c) Outdated and truncated learning content; d) Poor learning conditions, lack of laboratory, insufficient teaching materials, and e) Theoretical and collective learning approach with an insufficient internships period. To solve these challenges, it is necessary to focus learning on computer skills practices, values, local environment concepts, local language, English and French, job search technique by updating and professionalizing learning with workplace learning and inverted classroom learning approaches and internships sufficient period.

Keywords*: Employability, Factor, Graduate, Unemployment.*

Introduction

The school as a social organization provides learners with various teachings in order to train and transform them so that they have employment and become capable of solving the problems of individual and collective life. "Work is a vector of personal development and preserves our intellectual capacities." [1]. The "Work also allows us to have an identity and autonomy. In addition, it helps us overcome the existential angst specific to every human being." [2]. Any job requires a qualification. And it is the school that guarantees this requirement. The school "is attributed two major complementary missions: instruction and socialization. The school participates in the development of knowledge and the mastery of social rules, that is to say, academic knowledge, but also "know-how" and the learning of a common culture. It also participates in the training of the citizen, and through the certificate, it is a key to integration into the world of work. Today, the certificate has become essential to access a stable job." [3]. In DRC, "in 2021, a survey conducted by the UNICEF established that 78% of the young people surveyed did not have a job and that 25% had no job opportunities in their field of study. In Kinshasa, youth employment remains a major challenge, as they find themselves unemployed despite their qualifications."[4]. According to the UNDP [5], "the living conditions of households in North Kivu are quite poor with poverty affecting seven out of ten households. The unemployment rate is higher than the national average." Indeed,

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"nearly 80% of Congolese people aged between 15 and 35 are unemployed in Goma (North Kivu) and Bukavu (South Kivu), according to estimates by specialists. In this part of the country, thousands of graduates find themselves unemployed after their studies." [6]. This phenomenon of unemployment is due to factors that require a study to identify and then resolve them. Based on data from the empirical literature covering the period 2001-2020 in the DRC, L. Balemba [7] found that "the variables education, inflation, foreign direct investment, population significantly explain the level of youth unemployment at the 1% and 5% threshold." After collecting data from graduates in Kisangani, Adrien Mutunzi [1], Jean-Pierre Kiza[2] and Joseph Tsipanga[3] [8], found that unemployment among young graduates is mainly due to "a low level of available jobs, the mismatch between demand on the labor market and supply, recruitment mechanisms in institutions or the type of job sought by young graduates". Using Google forms, Florent Kambasu Kasula [9], sent an online questionnaire to all former finalists of the Catholic University of Graben in Butembo. According to the opinions of the former graduates, "the unemployment of young graduates is due to: "a) a strong growth of the student population but less competitive; b) a lack of initiation to entrepreneurship among young graduates; c) a labor market more favorable to less qualified or uneducated workers; and d) an absence of a general national policy for job creation." Considering the two of the factors mentioned above, namely: - *a strong growth of the student population but less competitive* and - *a labor market more favorable to less qualified or uneducated workers*, one can ask the question of why we study. Yet, no job is possible without qualification. Those who have studied would have a better chance of having a job than those who have studied less or less. Then we think that the problem lies more in the training received. And this has raised a number of questions for this study as follows:

- What are the types of jobs that graduates seek the first time?
- What are the educational factors of unemployment among graduates?
- What are the employability skills and strategies to develop at school to better prepare learners for employment

Hypotheses

- Young graduates in Butembo would seek more employment with NGOs and commercial companies than in other sectors of activity.
- The educational factors that contribute to unemployment among young graduates in Butembo abound. The most important would be related to:
  - *The field of study*: study in low demand on the job market, very popular field of study, field of study that is not very specific from an employment perspective, less diversification of fields of study, etc.
  - *The state of preparation*: incomplete file, lack of skills in the requested job, lack of mastery of computer skills, incapacity with regard to the job, lack of motivation, lack of mastery of French, English and local language, local environment, etc.
  - *And the learning conditions and approach*: theoretical learning approach, insufficient internships period, lack of laboratory, insufficient teaching materials,
- Concerning employability skills and strategies to develop at school, it is necessary to focus learning on computer skills practices, values, local environment concepts, local language, English and French, job search technique by updating and professionalizing learning with workplace learning and inverted classroom learning approaches and internships sufficient period to motivate learners and

make them more active in their learning and autonomous.

Objectives

- Identify the first job opportunities that unemployed graduates seek.
- Identify educational factors of unemployment among graduates.
- Find the employability skills and strategies that school must use to develop employability for graduates.

Methodology

With a comparative approach, this study was conducted on a population composed of people meeting the following characteristics: being a secondary or university graduate but unemployed without a job located in the city of Butembo. This population being large and infinite, we occasionally drew a sample of 122 unemployed graduates who wanted to participate in our survey by actively answering our questionnaire. We have used the survey method, which is used to "collect the personal views of individuals concerning their knowledge, attitudes or behavior" [10], was used in our study. It is proved useful because it enables "primary data to be collected from a questionnaire administered to a sample drawn from a target population. It is a scientific research method designed to collect information systematically in order to describe, explain and compare individual and social objectives and phenomena." [11]. Using this method, we resorted to the questionnaire technique, which is "a self-reporting instrument used to gather information about variables of interest to the researcher" [10]. The questionnaire is "a technique for collecting quantifiable data in the form of a series of questions asked in a precise order. It can be used to gather a large number of testimonies or opinions" [12]. The data we obtained were presented in tables to facilitate analysis on the basis of frequencies and percentages. We used the Chi-square comparison test [13] according to this formula,

$$Q^2 = \sum \frac{N_{ij} - \frac{(L_i \times C_2)^2}{n}}{\frac{L_i \times C_2}{n}}$$

and fractile values for the distribution of Chi-square test [14] to determine if the data we obtained are consistent with our expectations, that is to verify whether unemployed secondary school graduates are different from tertiary education graduates concerning the job search and the type of job sought, the preparation of graduates to employment, the learning content and the learning conditions with the null hypothesis (Ho) which states that there is no significant difference between secondary school graduates and tertiary education graduates and the alternative hypothesis (Ha) which states that there is significant difference between secondary school graduates and tertiary education graduates.

Our sample is presented as follows: Ladies are 54 or 44.26% and gentlemen are 64 or 55.73%. Among them 74 or 60.65% are secondary school graduates and 48 or 39.35% are tertiary education graduates. The fields of study for secondary school graduates in our sample are: Mechanical, Latin-Philo, Electricity, Printing, Biochemistry, Literary, Social technique, Secretarial, Account, Industrial, Chemistry, Agronomic, Building, Pedagogy, Nutritional, Veterinary. And the fields of study for the tertiary education graduates in our samples are: Architecture, Veterinary, Economic, Business and Management, Human Resources Management, Multimedia Information Sciences, Development, Sciences and Techniques, Law, Education, Health and Community Development, Medicine, Psychology, Philosophy, Political and Administrative Science, Applied Sciences, Environment, Geology, Project Management and Organization, Civil Engineering, International Relations, Public Health and Epidemiology, Agriculture.

Results

The results we obtained are as follows.

Job Readiness

Job Search and the type of Job Sought

Table 1. Responses to the Question of Job Application, Companies Approached, and for Others, Reasons of not trying to Look for a Job

Part I						**Part II**						
Response	**High school Unemployed graduates**		**Tertiary Unemployed graduates**		**Total line Li**	**Requested Company**	**High school Unemployed graduates**		**Tertiary Unemployed graduates**		**F**	**%**
	of	**tf**	**of**	**tf**			**F**	**%**	**f**	**%**		
Yes	65	87,837	47	97,91	112	Education	9	13,43	8	17,02	17	14,91
						Business	36	53,73	8	17,02	44	38,59
						NGO	9	13,43	23	48,93	32	28,07
						Hotel	3	4,47	1	2,12	4	3,50
						Hospital	1	1,49	4	8,51	5	4,38
						Farming	1	1,49	0	0	1	0,87
						Technological	2	2,98	0	0	2	1,75
						Public secretariat	1	1,49	0	0	1	0,87
						Building	4	5,97	0	0	4	3,50
						Public administration	1	1,49	3	6,38	4	3,50
						Sub-total	***67***	***100***	***47***	***100***	***114***	***100***
No	9	12,162	1	2,083	10	**Reason**	**F**	**%**	**f**	**%**	**F**	**%**
						You didn't find yourself able.	4	44.44	1	0	5	50
						You do not master some of the skills that the job requires.	3	33.33	0	0	3	30
						You don't have someone to find you a job.	2	22,22	0	0	2	20
Column total Cj	**74**	**100**	**48**	**100**	**n= 122**	***Sub –total***	**9**	**100**	**1**	**100**	**10**	**100**
$Q^2obs = 3.91$						**TOTAL**						

Source: *Our Survey*

The critical Q^2 at the 1% significance level and the degree of freedom of 1 is 3.84.

Decision : as critical Q^2 , 6.63 > Q^2 obs, 3.91 we keep the null hypothesis.

Comment: This table indicates that the secondary and tertiary graduates who seek employment applied in the commercial field by 38.59%; humanitarian field by 28.07% and teaching field by 14.01% than in other fields. Those who didn't apply for job were by 50%

unable to work; by 30%, they lacked skills required, and by 20%, they expect someone to find them a job.

Direct Factors of Graduate Unemployment

Table 2. Responses to the Question of the Reasons for the Lack of Hiring

Part I	**Part II**						
Factor	**indication**	**Secondary school Unemployed graduates**		**Tertiary Unemployed graduates**		**F**	**%**
		F	%	f	%		
Poor job preparation	Your file was not complete	12	16,21	15	31,25	27	22,13
	Your file was not in the field of study that the employer wanted.	30	40,54	11	22,91	41	33,60
	You did not master a computer skill or other skill required by the employer.	9	12,16	11	22,91	20	16,39
	You were unable to work and you failed the test.	16	21.61	9	18,75	25	20.48
	There were fewer offers than demands.	7	9,45	2	4.16	9	7.36
TOTAL		**74**	**100**	**48**	**100**	**122**	**100**

Source: *Our Survey*

Comment: From this table, we see that graduates are poorly prepared for employment. In 33.60% their files are not in the field in which they are applying for employment; in 22.13% their files are incomplete; in 20.48% they fail the test and they were unable to work, and in 16.39% they do not master computer skills and others.

Field of Study as a Factor of Unemployment

Table 3. Responses to the Question of Whether there are Reasons for Unemployment Related to the Field of Study

Part I						**Part II**							
Response	**secondary school Unemployed graduates**		**Tertiary Unemployed graduates**		**Total line Li**	**Indication**	**secondary school Unemployed graduates**		**Tertiary Unemployed graduates**		**F**	**%**
	of	**Tf**	**of**	**tf**			**F**	**%**	**f**	**%**		
Yes	73	98,64	47	97,91	120	Your field of study is in low demand on the job market.	22	29.71	21	38.17	43	33.33
						You are many in the same field of study on the job market.	37	50	13	23,63	50	38,75
						Your field of study is unclear from an	15	20.26	21	38.17	36	27.90

						employment perspective.						
No	1	1,35	1	1,083	2	***Sub-total***	***74***	***100***	***55***	***100***	***129***	***100***
Column totalCj	**74**	**100**	**48**	**100**	**n= 122**							
$Q^2\ obs = 0{,}12$						**TOTAL**						

Source: *Our Survey*

Q^2 Critical at the significance level of 5% and the degree of freedom of 1 is 3.84.

Decision: as critical Q^2 , 3.84 > Q^2 obs, 0.12 we keep the null hypothesis.

Comment: In this table we find that the unemployed, in 38.75%, are from the same field of study on the job market; in 33.33% their fields of study are not demanded on the job market; in 27.90% their fields of study are not very precise from an employment perspective.

Training Content as a Factor of Unemployment

Table 4. Responses to the Question Whether Unemployment is Linked to Training Content

Part I						**Part II**						
Response	**Secondary school Unemployed graduates**		**Tertiary Unemployed graduates**		**Total line Li**	**Indication**	**Secondary school Unemployed graduates**		**Tertiary Unemployed graduates**		**F**	**%**
	Of	**Tf**	**of**	**tf**			**f**	**%**	**f**	**%**		
Yes	71	95,94	46	95,83	117	Your curriculum is old and misses some concepts required.	50	59.52	12	33.32	62	51.66
						Your learning develops less computer skills.	11	13,09	9	25	20	16,66
						Your studies develop more foreign knowledge than local.	23	27.37	15	41.66	38	31.66
No	3	4,054	2	4,166	5	***Sub-total***	***84***	***100***	***36***	***100***	***120***	***100***
Column total Cj	**74**	**100**	**48**	**100**	**n= 122**							
$Q^2\ obs = 0{,}82$						**TOTAL**						

Source: *Our Survey*

Q^2 Critical at the significance level of 5% and the degree of freedom of 1, is 3.84.

Decision: as critical Q^2 , 3.84 > Q^2 obs, 0.82 we keep the null hypothesis.

Comment: Here, we see that the curriculum is one of the contributors to the lack of jobs for graduates. Indeed, the respondents express in 51.66%, that the curriculum is old, lacks concepts that the work requires; in 31.66% that the program develops more foreign knowledge than local; in 16.66% that the curriculum develops less computer skills.

Teaching Approach as a Factor of Unemployment

Table 5. Responses to the Question Whether Unemployment is Related to the Teaching Approach

Part I						**Part II**						
Response	**Secondary school Unemployed graduates**		**Tertiary Unemployed graduates**		**Total line Li**	**Indication**	**Secondary school Unemployed graduates**		**Tertiary Unemployed graduates**		**F**	**%**
	Of	**Tf**	**of**	**Tf**			**F**	**%**	**f**	**%**		
Yes	71	95,945	47	97,916	118	Your internship period was insufficient to get experience.	27	30,33	10	16,12	37	24,5
						You hadn't a lab in your school.	28	31.45	31	49.99	59	38.81
						You had few teaching materials for practical exercises.	6	6,74	2	3,22	8	5,26
						Your training was more theoretical than practical	28	31,45	19	30.64	47	31.21
No	3	4,054	1	2,083	4	***Sub-total***	***89***	***100***	***62***	***100***	***151***	***100***
Column total Cj	**74**	**100**	**48**	**100**	**n= 122**							
$Q^2\ obs = 0{,}34$						**TOTAL**						

Source: *Our Survey*

Q^2 Critical at the significance level of 5% and the degree of freedom of 1, is 3.84.

Decision: as critical Q^2 , 3.84 > Q^2 obs, 0.34 we keep the null hypothesis.

Comment: It turns out that the theoretical learning approach also contributes to the lack of employment of graduates. Through this table, the respondents affirm in 38.81% that their schools do not have a laboratory for practical learning; in 31.21% their training was more theoretical than practical; in 24.5% that their internship period is very short and insufficient to acquire good experience.

Employer Criticism of Training Curriculum

Table 6. Responses to the Question of Knowing the Shortcomings of School Training in Relation to Employment according to Employers

Part I						**Part II**						
Response	**Secondary school Unemployed graduates**		**Tertiary Unemployed graduates**		**Total line Li**	**Criticisms**	**Secondry school Unemployed graduates**		**Tertiary Unemployed graduates**		**F**	**%**
	Of	**tf**	**of**	**tf**			**F**	**%**	**f**	**%**		
Yes	72	97,29	48	100	120	Outdated theoretical training.	18	22.5	17	34.69	35	27.12

						Lack of sufficient skills and experience including of computer, french,…	50	66.25	23	46.92	76	58.88
						Limited knowledge and lack of initiative	9	11.25	9	18.36	18	13.94
No	2	2,702	0	0	2	***Sub-total***	***80***	***100***	***49***	***100***	***129***	***100***
Column total Cj	**74**	**100**	**48**	**100**	**n= 122**							
$Q^2\ obs = 0{,}53$						**TOTAL**						

Source: *Our Survey*

Q^2 critical at the significance threshold of 5% and the degree of freedom of 1, is 3.84.

Decision: as critical Q^2 , 3.84 > Q^2 obs, 0.53 we keep the null hypothesis.

Comment: According to employers' criticisms, the learning curriculum contributes to the lack of hiring of graduates. Considering all the criticisms ranging from the obsolescence of the contents to the minimization of studies, let us remember that the critics express in 58.88% that the graduates lack sufficient skills and experience for the job including computer and french; in 27.12% that the training is theoretical and outdated and in 13.94% their level is low compared to the requirements of the job.

Learning Concepts to be Focused into the Learning Curriculum to Better Prepare for Employment

Table 7. Responses to the Question of which Concepts to Focus on to Better Prepare for Employment

Part I						**Part II**						
Response	**Secondary school Unemployed graduates**		**Tertiary Unemployed graduates**		**Total line Li**	**Indication**	**Secondary school Unemployed graduates**		**Tertiary Unemployed graduates**		**F**	**%**
	of	**Tf**	**of**	**tf**			**f**	**%**	**f**	**%**		
Yes	73	98,648	48	100	121	Intense practice on computer skills	14	18,18	18	36	32	25,19
						Learning of values, local environment, local language and English	9	11.68	17	14	16	12.59
						Learning on job application techniques	12	15,58	12	24	24	18,89
						Updating and professionalizing learning with sufficient internships period	39	50.64	13	26	52	40.93
						Learning entrepreneurship	3	3,89	0	0	3	2,36
No	1	1,351	0	0	1	***Sub-total***	***77***	***100***	***50***	***100***	***12 7***	***100***

Column total Cj	**74**	**100**	**48**	**100**	**n= 122**							
$Q^2\ obs = 0{,}26$						**TOTAL**						

Source: *Our Survey*

Q^2 Critical at the 5% significance level and the degree of freedom of 1 is 3.84.

Decision: as critical Q^2 , 3.84 > Q^2 obs, 0.26 we keep the null hypothesis.

Comment: There are many employability skills and learning strategies to focus on. Among these, 40.93% suggest updating and professionalizing learning with sufficient internships period; 25.19%, regular and intense practices on computer science skills; 18.89%, the concepts on job search; 12.59%, learning of values, local environment, local language and English.

Discussion

The results of the Chi-square statistical test at the 1% and 5% threshold support that there is no significant difference between unemployed secondary school and tertiary education graduates. They have all the same problems, lack of employability skills. This justifies what Florent Kambasu Kasula [9] found: "labor market is more favorable to less qualified or uneducated workers". Because what is the point of employing an incapable tertiary education graduate if he does not differ significantly from a non-qualified who costs less than a tertiary graduate? Considering the results presented in table 6, according to employers, the contents and the learning approach contribute to the unemployment of graduates considering the obsolescence of the learning contents, theoretical learning approach, the lack of sufficient knowledge and experience in computer, French, English, the low professional level compared to the requirements of the job. It means, learning contents and learning conditions are poor and cannot prepare correctly graduates to employment as we can see with the results in Table 5. Schools do not have laboratories for practical learning, courses are taught theoretically, and the internship period is very short and insufficient to acquire good experience. Yet, as envisaged by the strategy of the World Bank [15], girls and boys who come to school to learn must "acquire real knowledge and can enter the workforce with the skills needed to become productive and successful citizens". This supports the need of diversification of the learning approaches focusing on workplace learning approach because workplace learning "is the process of acquiring knowledge, skills, and attitudes through experience in the workplace. Workplace learning is an ongoing process that brings together people to learn and grow. Workplace learning means more than just attending workshops or webinars; it's about sharing ideas, collaborating on projects, and working through challenges together" [16], and inverted classroom learning approaches. "This learning framework focuses on active and intentional learning, which is proven to result in a higher level of emotional investment in the training, especially when compared to the traditional classroom. Also, collaborating and sharing feedback with peers helps improve knowledge retention, especially in the long run. At the end of the day, flipped learning will contribute to increased productivity and employee performance, as people can directly apply the knowledge gained in their daily work". [17]. Also, learning is unsuitable for the local environment as we see it with the results in Table 4. Learning develops foreign concepts different from those useful to the local environment. According to the results in Table 3, graduates are unemployed because the fields of study are not very precise as to the specificity of the job to be performed and their fields of study are not in demand on the job market. This is why many of them apply for the same job.

According to the results in Table 1, graduates are not ready for employment. They do not master some of the skills that the job requires, they feel incapable, and they are not motivated to apply for job. The above results confirm our second hypothesis that the educational factors that contribute to unemployment among young graduates in Butembo are numerous. The most important ones relate to the field of study, the state of preparation for the job, the contents of training, the learning conditions and approaches.

The results in the same Table 1 show that graduates apply for the best paying or well available jobs without taking into account their fields of study and their qualification. They apply more in the humanitarian, commercial domain. This confirms our first hypothesis according to which young graduates from Butembo would seek employment more with NGOs and commercial companies than in other sectors of activity. And this leads us to say that young people choose fields of study out of complacency. The results in the table 2 support that graduates are incapable, are not ready for work, do not master certain notions that the job requires, which confirms once again the second hypothesis.

The results in Table 7 support that to better prepare graduates for employment, it is necessary to focus on intense practices on computer science skills and language skills especially English because "basic computer skills are essential for employability and efficiency in today's digital age. Many job positions require basic computer skills like email, Microsoft Office, and internet navigation. These skills can increase job prospects and opportunities. Additionally, they allow individuals to complete tasks more efficiently, saving time and increasing productivity". [18]. Also "people who speak one or more foreign languages are better at solving problems, and they are more creative and empathetic. Problem-solving, creativity and empathy are invaluable soft skills that any employer would appreciate in a candidate. It is also argued that bilingual and multilingual people are more open to accepting other people's points of view and better at establishing interpersonal connections, which are also great skills, especially in areas like customer service and business relations" [19] and "Proficiency in English opens doors to a plethora of career opportunities on both a local and global scale. In today's competitive job market, many employers prioritize candidates with strong English language skills, irrespective of their field or specialization".[20] School should focus also on updating and professionalizing learning, internships with considerable duration to acquire sufficient experience, concepts on job search techniques using appropriate learning approaches. These results confirm our third hypothesis according to which the school needs to update, professionalize learning and develop many employability skills and learning approaches in order to help graduates to be ready for employment. This meets the orientation of the ILO [21] which "aims to help key stakeholders better understand the importance of key skills for employability, the means of transmitting them, acquiring them, validating them and integrating them into academic content and professional training".

Conclusion

In this study on the factors of unemployment among graduates in Butembo, our problem is sum up in these questions:

- What are the types of jobs that graduates are looking for the first time?
- What are the educational factors of unemployment among graduates?
- What are the skills and strategies to be developed at school so that learners can easily access employment after their studies?

In this study we pursued the following objectives:

- Identify the first employment opportunities that graduates seek after leaving school.
- Factors of unemployment among graduates and
- Find the employability skills and strategies that the school should use to facilitate access to employment for graduates in the RDC and particularly those in Butembo.

To achieve this, we collected data using a survey method and questionnaire technique. We processed the data by frequency scoring with statistical analysis based on percentages and chi-square.

We found the following:

- Young graduates are more likely to apply for jobs in more lucrative fields such as humanitarian work, sales and available fields such as teaching, without necessarily taking into account their training specialty.
- There are many factors contributing to unemployment among young graduates. They are mainly educational, namely:

1. The field of training that is not in demand on the job market or is very popular or is still not very precise from an employment perspective.
2. Poor preparation for learning skills and lack of motivation to work.
3. Outdated and truncated training content.
4. Poor learning conditions due to the lack of laboratory facilities, insufficient teaching materials, and
5. Theoretical or collective learning approach with an insufficient internship period.

To solve these challenges, it is necessary to focus learning on computer skills practices, values, local environment concepts, local language, English and French, job search technique by updating and professionalizing learning with workplace learning and inverted classroom learning approaches and internships sufficient period to motivate learners and make them more active in their learning and autonomous.

The results obtained during this study therefore confirmed all our hypotheses.

This article presents the educational factors or challenges of unemployment among graduates and the educational solution in terms of employability skills and learning approaches.

Conflict of Interest

There is no conflict of interest.

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Socio-Cultural Determinants of Lassa Fever Transmission in Kailahun and Kenema Districts, Sierra Leone

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Abstract

Lassa fever remains endemic in Sierra Leone, despite efforts to eradicate it. This study examines the socio-cultural determinants of Lassa fever transmission in Sierra Leone. A cross-sectional survey of 1,033 randomly selected participants was conducted in two endemic districts (Kailahun and Kenema) in Sierra Leone. Structured questionnaires were used to gather data from household heads. Data analysis was conducted using SPSS version 28. Findings indicate a high awareness of Lassa fever (90.9%), with health centers (48.9%) being the primary source of information. However, knowledge of specific symptoms such as muscle aches (23.2%) and bleeding (23.2%) remained low. Misconceptions about transmission were evident, with only 54.7% recognizing direct rodent contact as a risk factor, and 3.1% attributed it to mosquito bites. Knowledge of preventive practices were inadequate, with only 12.8% being mentioning proper food storage and 4.3% recognizing personal protective equipment use. A high percentage (91.4%) reported using traps or other rodent control methods; however, 4.9% engaged in hunting and consuming rats. Proper food storage remains a critical issue, with only 56.5% using sealed containers while 18.8% used open containers, exposing food to rodent contamination. These findings highlight a mixed landscape of behavioural change, while some protective measures have been embraced, while other risk-associated cultural practices remain embedded in community life. Analysis revealed that older age groups (AOR = 5.505, p=0.011) had significantly higher odds of experiencing Lassa fever symptoms. Poor hygiene (AOR = 1.555, p=0.008) and improper waste disposal (AOR = 2.968, p=0.046) were also key risk factors. These findings underscore the need for public health interventions to improve knowledge, dispel myths, and promote preventive behaviors to mitigate Lassa fever transmission.

Keywords: *Lassa Fever, Rats, Symptoms, Transmission.*

Introduction

Lassa Fever is an acute viral hemorrhagic illness endemic to parts of West Africa, where it poses a significant public health challenge. Traditionally, much of the research surrounding Lassa Fever has focused on its virology, the development of diagnostic tools, and strategies for medical intervention [1]. However, an emerging body of evidence suggests that sociocultural practices play a critical role in sustaining the transmission of the disease. Social customs, traditional healing practices, community burial rituals, and housing architectures are among several factors that can influence exposure to the Lassa virus [2].

Several studies have underscored the complexity of Lassa Fever transmission dynamics by highlighting how traditional beliefs and practices may inadvertently facilitate viral spread. For example, local

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customs regarding rodent management—the primary reservoir of the virus—combined with cultural perceptions of illness, contribute to prolonged exposure and delayed access to formal healthcare [3]. Moreover, community rituals and familial caregiving practices sometimes counter recommended infection control measures, revealing an important intersection between cultural norms and public health outcomes [4].

Despite these insights, significant gaps remain in the literature with respect to fully characterizing the sociocultural determinants of Lassa Fever transmission. Previous investigations have often been confined to epidemiological frameworks, with limited integration of qualitative analyses that explore community perceptions and practices at a granular level [5]. Additionally, there is an underrepresentation of region-specific case studies that examine how local traditions and beliefs interact with structural determinants such as urbanization and access to healthcare [6]. This paucity of interdisciplinary studies leaves a critical gap in both understanding and addressing the underlying sociocultural factors that fuel Lassa Fever outbreaks.

This study examines how specific cultural practices contribute to the transmission and containment of Lassa Fever in Kailahun and Kenema districts, Sierra Leone. We argue that effective control and prevention strategies require an integrated approach that not only addresses medical and environmental factors but also considers the complexities of cultural practices and beliefs [7].

Methodology

Study Design

This study employs a descriptive and cross-sectional quantitative research design to assess the socio-cultural determinants of Lassa fever transmission in Kailahun and Kenema Districts, Sierra Leone. A descriptive style allows the researcher to describe the population, situation or phenomenon and draw conclusions based on the population variables [8]

Study Area and Population

Kailahun and Kenema, two districts in Eastern Sierra Leone, serve as the study areas for this research. These regions, which share borders with Liberia, are characterized by dense forests and have the country's highest reported cases of Lassa fever [9]. Kenema is home to the only Lassa fever isolation wards, staffed by full-time medical professionals. Kailahun District, located in the Eastern Province, comprises fourteen chiefdoms and shares international borders with Guinea to the north and Liberia to the northeast and south, with the Moa River marking part of its boundary. The district's economy primarily relies on rice, coffee, and cocoa farming and small-scale mining. Its vegetation includes savanna, woodland, and secondary forest growth, receiving 2,001–3,000 mm of rainfall annually [10]. The district has an area of about 2,859sq.m, with Kailahun town as the Chiefdom Headquarter. Kenema District, also in the Eastern Province, is the region's most populous, with 784,571 residents. It consists of sixteen chiefdoms and is bordered by Bo, Tonkolili, Kono, Kailahun, and Pujehun districts, as well as Liberia to the southeast. Its economy is driven by diamond mining, agriculture, and trade. While home to multiple ethnic groups, the Mende people form the majority population [11]. Covering 6,053 km², Kenema is the third-largest city in Sierra Leone after Freetown and Bo, with Tongo as its second-largest town [11]. The study population was heads of households from the Kailahun and Kenema districts, offering a broad scope of perspectives.

Household heads were engaged through structured questionnaires. Additionally, community members were observed during special cultural and social events, enriching the study with a holistic understanding of the region. This multifaceted approach aimed to

capture diverse viewpoints and experiences, maximizing the depth of the research findings.

Study Sampling

The sample was drawn using a multistage sampling technique, involving different strategies in each stage.

In the first stage, chiefdoms were selected. Four chiefdoms were purposively chosen per district based on the incidence of Lassa Fever (two chiefdoms with the two lowest incidence and two with the highest incidence) using data from. Finally, homes were randomly selected during the data collection stage using a systematic random selection technique.

Sample Size Calculation

Using Slovin's Formula:

$$n = \frac{N}{1 + Ne^2}$$

$$N = Total\ Population$$

$$e = error\ at\ 95\%\ confidence\ level$$

$$n = \frac{78700}{1 + 78700(0.05)^2} = 397.97 \approx 398$$

Sample size=398

With a projected confidence interval of 95% and an error margin of 5%, the estimated sample size is 398 persons. However, to cater to the cluster effect, this sample size was doubled to 796, further rounded up to 1033 persons for the quantitative study.

Inclusion and Exclusion Criteria

The inclusion criteria include adults aged 18 years and above who reside in the Kailahun and Kenema Districts. Individuals who had lived in the Kailahun and Kenema Districts for at least six months prior to the study were also included. Individuals willing to provide informed consent for participation were also included. Participants who had not lived in the Kailahun and Kenema Districts for more than six months were excluded from the studies.

Data Collection Procedure

Structured questionnaires were used to collect relevant information about socio-cultural factors influencing the prevention and control of Lassa Fever infection. The questionnaire was pretested in another district with ten people. Where necessary, appropriate corrections were made to the questionnaire after pretesting. It was further subjected to professional scrutiny by two public health experts who did not participate in the studies. The survey questionnaire was administered through in-person interviews, considering the target group's viability and accessibility. The interviews were conducted in the household head's local language. The requirements of the studies were explained to all participants, who were asked to sign or thumbprint an informed consent form depending on their educational level.

A data collection team was recruited and trained on the study methodology and survey tools to ensure precise implementation. Before deployment, rigorous pretesting and review of the survey tools were conducted to enhance their effectiveness. Comprehensive logistic support was provided to the team.

Data Analysis

Data were analyzed using SPSS version 28. Descriptive statistics, including frequencies and percentages, were used to summarize socio-demographic characteristics and socio-cultural factors associated with Lassa fever transmission. Chi-square tests were employed to assess associations between categorical variables, such as cultural practices and household behaviors. Multivariable logistic regression was conducted to identify independent predictors of Lassa fever transmission, with adjusted odds ratios (AOR) and 95% confidence intervals (CI) reported. Statistical significance was set at $p < 0.05$.

Ethical Consideration

Ethical approval was obtained from the Ministry of Health and Sanitation in Sierra Leone to ensure compliance with research standards. Measures were implemented to safeguard participants' privacy, confidentiality, and protection, including the use of coded identifiers. Interviewers explained the study's purpose and obtained written consent from participants before proceeding. Respondents had the right to withdraw at any time, and strict confidentiality was maintained. Ethical protocols were followed to respect participants' dignity and uphold the 'Do-no-Harm' principle. Collaboration with traditional and religious leaders fostered cultural sensitivity and community acceptance, while adherence to community entry protocols ensured proper engagement, with verbal informed consent obtained from all participants.

Results

Socio-demographic Characteristics of Participants

Table 1 illustrates the socio-demographic characteristics of the study participants (N = 1033). The sample was nearly evenly distributed across two regions, with 54.8% from Kailahun and 45.2% from Kenema. Within Kenema, Lower Bambara had the highest representation (53.5%), while Jaluahun was the most represented chiefdom in Kailahun (35.6%). The age distribution showed that the majority of participants (29.6%) were between 30-39 years, followed by 40-48 years (26.8%). More participants were female (58.1%) than male (41.9%). Most participants were married (67.8%), while 14.3% were single, 15.6% widowed, and 2.3% divorced/separated. In terms of occupation, nearly half (48.5%) were farmers, followed by traders (21.8%), and other occupations (23.2%). Household sizes varied, with most participants (49.6%) living in households of 5-8 members. Education levels showed that 48.6% had no formal education, while 33.9% attained secondary education. Religious affiliation was predominantly Islamic (65.4%), followed by Christianity (19.6%) and traditional beliefs (15.0%).

Table 1. Socio-demographic Characteristics of the Participants

Variables	Frequency (N = 1033)	Percentage (%)
Region		
Kenema	467	45.2
Kailahun	566	54.8
Chiefdom in Kenema		
Dodo	51	11.0
Kandu Lekpiama	74	15.8
Small Bo	92	19.7
Lower Bambara	250	53.5
Chiefdom in Kailahun		
Jawei	104	18.4
Mandu	136	24.1
Upper Bambara	124	21.9
Jaluahun	201	35.6
Age		
Under 20 years	30	2.9
20-29 years	187	18.1
30-39 years	306	29.6
40-48 years	277	26.8

50-59 years	155	15.0
60 years and above	78	7.6
Sex		
Male	433	41.9
Female	600	58.1
Marital Status		
Single	148	14.3
Widowed	161	15.6
Divorced/Separated	24	2.3
Married	700	67.8
Occupation		
Miner	5	0.5
Health worker	18	1.7
Teacher	44	4.3
Trader	225	21.8
Farmer	501	48.5
Others	240	23.2
Household Size		
2-4	215	20.8
5-8	512	49.6
9-12	256	24.8
Above 12	50	4.8
Education Level		
Non-formal Education	502	48.6
Primary	90	8.7
Secondary	350	33.9
Higher	91	8.8
Religion		
Traditional	155	15.0
Christianity	202	19.6
Islamic	676	65.4

Knowledge and Awareness of Lassa Fever

Table 2 shows the participants' knowledge and awareness of Lassa fever. A majority (76.4%) reported knowing the common symptoms of Lassa fever. Among specific symptoms, high fever (71.1%) and headache (55.4%) were the most recognized, while bleeding from gums/nose (23.2%) and muscle ache (23.2%) were the least known. Regarding transmission, handling and preparation of rats (55.0%) and direct contact with infected rodents (54.7%) were the most identified routes. However, misconceptions were evident, as 3.1% incorrectly believed mosquito bites could transmit the disease. Awareness of preventive measures was low. Only 11.7% recognized avoiding contact with rats as a preventive measure, and 12.8% acknowledged proper food storage to prevent contamination. The least recognized measures were using

personal protective equipment (4.3%) and vaccination (4.3%)

Table 2. Knowledge and Awareness of Lassa Fever

Variables	Frequency (N = 1033)	Percentage (%)
Do you know the common symptoms of Lassa fever?		
No	244	23.6
Yes	789	76.4
Symptoms associated with Lassa fever: High Fever		
No	299	28.9
Yes	734	71.1
Symptoms associated with Lassa fever: Headache		
No	461	44.6
Yes	572	55.4
Symptoms associated with Lassa fever: Sore Throat		
No	687	66.5
Yes	346	33.5
Symptoms associated with Lassa fever: Weakness		
No	638	61.8
Yes	395	38.2
Symptoms associated with Lassa fever: Muscles Ache		
No	793	76.8
Yes	240	23.2
Symptoms associated with Lassa fever: Nausea and or vomiting		
No	680	65.8
Yes	353	34.2
Symptoms associated with Lassa fever: Bleeding from gums and noses		
No	793	76.8
Yes	240	23.2
How is Lassa fever transmitted: Direct contact with infected rodents (n=931)		
No	422	45.3
Yes	509	54.7
How is Lassa fever transmitted: Handling and preparation of rats		
No	419	45.0
Yes	512	55.0
How is Lassa fever transmitted: Airborne transmission		
No	836	89.8
Yes	95	10.2
How is Lassa fever transmitted: Consumption of contaminated food		
No	480	51.6
Yes	451	48.4
How is Lassa fever transmitted: Mosquito bites		
No	902	96.9
Yes	29	3.1

Preventive measures against Lassa fever you are aware of: Avoiding contact with rats (n=94)		
No	83	88.3
Yes	11	11.7
Preventive measures against Lassa fever you are aware of: De-rating		
No	88	93.6
Yes	6	6.4
Preventive measures against Lassa fever you are aware of: Properly storing food to prevent rodent contamination		
No	82	87.2
Yes	12	12.8
Preventive measures against Lassa fever you are aware of: Using personal protective equipment		
No	90	95.7
Yes	4	4.3
Preventive measures against Lassa fever you are aware of: Getting vaccinated		
No	90	95.7
Yes	4	4.3
Preventive measures against Lassa fever you are aware of: Others		
No	87	92.6
Yes	7	7.4

Figure 1 presents the awareness of Lassa fever among the participants. The majority (90.9%) reported having heard of Lassa fever, while a small proportion (9.1%) were unaware of the disease. This indicates a high level of awareness among the respondents.

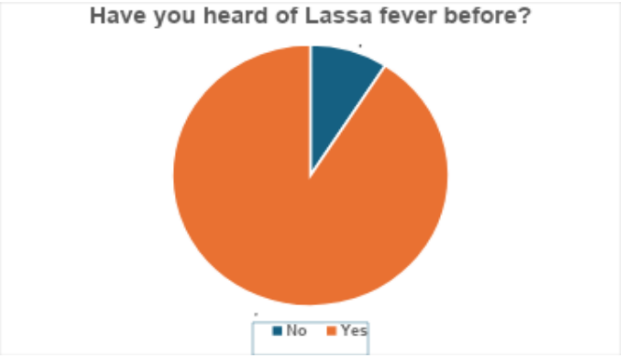

Figure 1. Awareness of Lassa Fever

Source of Information About Lassa Fever

Figure 2 illustrates the sources of information about Lassa fever among participants. The most common source was health centers and health workers (48.9%), followed by radio/TV (25.3%). A smaller percentage (8.0%) received information through community meetings or town hall discussions, while 9.1% reported not knowing their source of information. Other less common sources included markets (1.4%), billboards/campaigns (1.5%), schools/children (1.7%), and unspecified sources (4.2%).

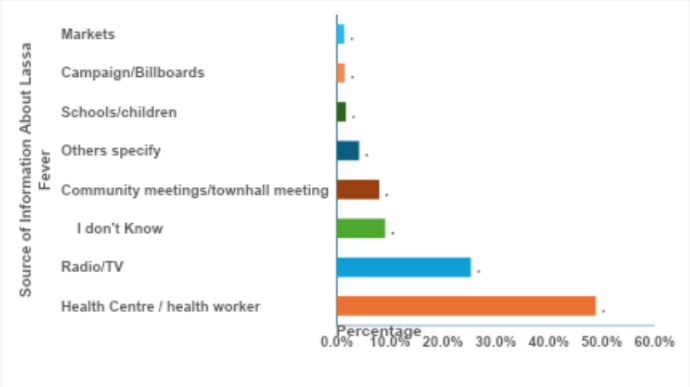

Figure 2. Source of Information About Lassa Fever

Cultural Practices Related to Lassa Fever Prevention and Risk Factors

Table 3 highlights cultural practices related to Lassa fever prevention and risk factors. The majority (91.4%) reported using traps or rodent control methods, while a small proportion (4.9%) engaged in hunting or capturing rats for consumption. Only 6.6% took no specific measures against rats, and 6.9% stated that rats were uncommon in their environment. Regarding food storage, more than half (56.5%) used sealed containers, while 18.8% stored food in open containers, increasing the risk of contamination. Additionally, 36.5% dried grains on the roadside, and 27.8% used the village drying floor, both of which may expose food to rodents. Environmental conditions varied, with 64.0% reporting the presence of open waste bins or dumpsites. A bushy environment was reported by 39.4%, while only 8.5% lived in well-kept, fenced surroundings. Handwashing practices also differed, with nearly 50% washing hands often, while 29.0% did so rarely, and 1.8% never washed hands with soap under running water.

Table 3. Cultural Practices Related to Lassa Fever Prevention and Risk Factors

Variables	Frequency (N = 1033)	Percentage (%)
How do you typically address the presence of rats in or around your living area: Use traps or other rodent control methods		
No	89	8.6
Yes	944	91.4
How do you typically address the presence of rats in or around your living area: Do not take any specific measures		
No	965	93.4
Yes	68	6.6
How do you typically address the presence of rats in or around your living area: Engage in hunting or capturing rats for consumption		
No	982	95.1
Yes	51	4.9
How do you typically address the presence of rats in or around your living area: Rats are not common in my environment		
No	962	93.1
Yes	71	6.9
Food storage methods		
Open containers/sacks	194	18.8

Sealed containers	584	56.5
Do not store grains	244	23.6
Others	11	1.1
Where do you dry grains and other food items: On the roadside		
No	656	63.5
Yes	377	36.5
Where do you dry grains and other food items: On the village drying floor		
No	746	72.2
Yes	287	27.8
Where do you dry grains and other food items:		
No	793	76.8
Yes	240	23.2
Where do you dry grains and other food items: Do not dry grains		
No	708	68.5
Yes	325	31.5
Where do you dry grains and other food items: Others		
No	911	88.2
Yes	122	11.8
Are there open waste bins or dumpsites in your surroundings?		
No	372	36.0
Yes	661	64.0
Condition of your surroundings: Well-kept with fence		
No	945	91.5
Yes	88	8.5
Condition of your surroundings: Littered		
No	911	88.2
Yes	122	11.8
Condition of your surroundings: Bushy		
No	626	60.6
Yes	407	39.4
How often do you wash your hands with soap under running water?		
Never	19	1.8
Rarely	300	29.0
Always	199	19.3
Often	515	49.9

Prevalence of Lassa Fever Symptoms Transmission

Figure 3 illustrates the prevalence of Lassa fever symptoms among the surveyed population. The majority of participants 655 (63.4%) never experienced Lassa fever symptoms, while 378 (36.6%) reported having had Lassa fever symptoms.

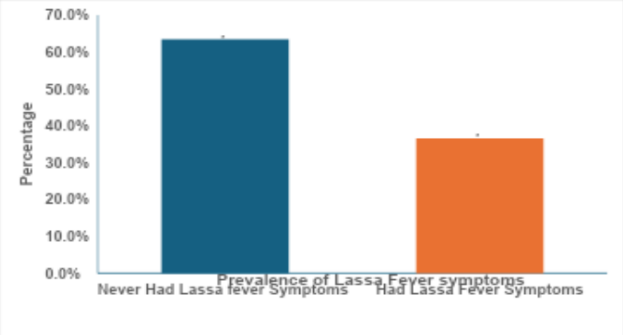

Figure 3. Prevalence of Lassa Fever Symptoms

Socio-Cultural Factors Associated with Lassa Fever Transmission in Sierra Leone

This study revealed significant associations between socio-cultural factors and Lassa fever symptom presentation across different demographic groups. A notable age-gradient effect was observed, with risk increasing substantially in older age groups - individuals aged 60 and above demonstrated the highest risk (AOR: 5.505, p=0.011), being over five times more likely to experience symptoms compared to those under 20. Educational background analysis showed a predominance of non-formal education in both symptomatic (56.1%) and asymptomatic (44.3%) groups, while secondary education suggested a potentially protective effect (AOR: 0.573, p=0.100), though not statistically significant. The religious distribution revealed that Islamic faith was predominant in the study population, with both Christianity (AOR: 1.729, p=0.030) and Islam (AOR: 26.404, p=0.022) showing significantly higher risks compared to traditional beliefs.

These findings have important implications for public health interventions and community-based approaches to Lassa fever prevention and control. The strong age-related gradient suggests the need for targeted interventions for older populations, while the educational patterns highlight the importance of inclusive health education programs across all educational levels. The significant associations with religious affiliation underscore the potential value of engaging religious institutions as partners in health education and prevention strategies. Future research should focus on understanding the mechanisms behind these socio-cultural associations, particularly the strong religious correlation with symptom presentation, while addressing potential confounding factors not captured in the current analysis. These insights can inform the development of more effective, culturally sensitive interventions that consider age, education, and religious factors in their design and implementation. Table 4 presents the study findings from both univariate and multivariate analyses of socio-cultural factors associated with Lassa fever transmission in Sierra Leone.

Table 4. Analysis of Socio-Cultural Factors Associated with Lassa Fever Transmission in Sierra Leone

Variable	Never Had Lassa fever Symptoms n (%)	Had Lassa Fever Symptoms n (%)	COR (95% CI)	P-value	AOR (95% CI)	P-value
Lassa Fever Symptoms Transmission	655 (63.4)	378 (36.6)	-	-	-	-

KPs Group						
Kenema	292 (44.6)	174 (46.0)	Ref	-	-	-
Kailahun	363 (55.4)	204 (54.0)	0.936 [0.726-1.207]	0.610	0.995 [0.735-1.347]	0.973
Age category (Years)						
Under 20	26 (4.0)	4 (1.1)	Ref	-	-	-
20-29	142 (21.7)	45 (11.9)	2.000 [0.662-6.042]	0.219	1.825 [0.575-5.793]	0.307
30-39	202 (30.8)	104 (27.5)	3.347 [1.138-9.844]	0.028*	3.195 [0.955-10.685]	0.050*
40-48	168 (25.6)	109 (28.8)	4.217 [1.432-12.417]	0.009*	3.611 [1.062-12.276]	0.040*
50-59	80 (12.2)	74 (19.6)	6.012 [2.003-18.046	0.001*	4.308 [1.224-15.165]	0.023*
60 and above	37 (5.6)	42 (11.1)	7.378 [2.356-23.109	0.001*	5.505 [1.488-20.369]	0.011*
Sex						
Male	275 (42.0%)	158 (41.8)	Ref	-	-	-
Female	380 (58.0%)	220 (58.2)	1.000 [0.774-1.293]	0.997	0.971 [0.709-1.332]	0.857
Marital Status						
Single	110 (16.8)	38 (10.1)	Ref	-	-	-
Widowed	74 (11.3)	87 (23.0)	3.403 [2.102-5.510]	<0.001*	1.772 [0.879-3.574]	0.110
Divorced/Separate d	18 (2.7)	6 (1.6)	0.965 [0.357-2.609]	0.944	0.491 [0.162-1.492]	0.210
Married	453 (69.2%)	247 (65.3)	1.569 [1.051-2.340]	0.027*	0.896 [0.521-1.538]	0.689
Occupation						
Miner	4 (0.6)	1 (0.3)	Ref	-	-	-
Health worker	13 (2.0)	5 (1.3)	1.538 [0.137-17.334]	0.727	0.58 [0.046-7.471]	0.834
Teacher	29 (4.4)	15 (4.0)	2.069 [0.212-	0.532	0.774 [0.070-	0.817

			20.192]		8.512]	
Trader	160 (24.4)	65 (17.2)	1.625 [0.178-14.816]	0.667	0.765 [0.079-7.438]	0.786
Farmer	291 (44.4)	210 (55.6)	2.863 [0.318-25.800]	0.348	1.369 [0.142-13.237]	0.944
Others	158 (24.1)	82 (21.7)	2.076 [0.228-18.876]	0.517	1.084 [0.112-10.485]	0.834
Household Size						
2-4	138 (21.1)	77 (20.4)	Ref	-	-	-
5-8	347 (53.0)	165 (43.7)	0.438 [0.235-0.818]	0.010*	0.688 [0.47-0.997]	0.048*
9-12	148 (22.6)	108 (28.6)	0.370 [0.206-0.667]	0.001*	0.951 [0.631-1.434]	0.810
Above 12	22 (3.4)	28 (7.4)	0.573 [0.311-1.056]	0.074	1.877 [0.957-3.679]	0.067
Respondent Education Level						
Non-formal Education	290 (44.3)	212 (56.1)	0.919 [0.582-1.453]	0.719	0.742 [0.377-1.461]	0.388
Primary	54 (8.2)	36 (9.5)	0.506 [0.377-0.680]	<0.001*	0.784 [0.359-1.710]	0.540
Secondary	256 (39.1)	94 (24.9)	0.903 [0.572-1.424]	0.660	0.573 [0.295-1.112]	0.100
Higher	55 (8.4)	36 (9.5)	Ref	-	-	-
Religion						
Traditional	113 (17.3)	42 (11.1)	Ref	-	-	-
Christianity	122 (18.6)	80 (21.2)	1.764 [1.122-2.774]	0.014*	1.729 [1.120-2.670]	0.030*
Islamic	420 (64.1)	256 (67.7)	1.630 [1.107-2.399]	0.013*	26.404 [14.987-46.518]	0.022*
Handwashing/Hy giene Practices						
Poor	215 (32.8)	104 (27.5)	Ref	-	-	-
Good	440 (67.2)	274 (72.5)	1.306 [0.988-2.726]	0.049*	1.555 [1.123-2.153	0.008*

Grains and Foods Storage Practices						
Do not store grains	163 (24.9)	81 (21.4)	Ref	-	-	-
Open containers/sacks	127 (19.4)	67 (17.7)	1.038 [0.696-1.546]	0.046*	0.557 [0.333-0.931]	0.025*
Sealed containers	360 (55.0)	224 (59.3)	1.252 [0.914-1.715]	0.161	0.954 [0.640-1.423]	0.817
Others	5 (0.8)	6 (1.6)	2.415 [0.716-8.150]	0.155	2.055 [0.552-7.653]	0.283
Rats Hunting/Consumption						
No	649 (99.1)	366 (96.8)	Ref	-	-	-
Yes	6 (0.9)	12 (3.2)	3.562 [1.326-9.569]	0.012*	0.648 [0.478-0.879]	0.005*
Waste Disposal Practices						
Poor	221 (33.7)	151 (39.9)	Ref	-	-	-
Good	434 (66.3)	227 (60.1)	0.760 [0.585-0.988]	0.040*	2.968 [1.020-8.638]	0.046*

Source: Field Survey *`*Significant at P<0.05*

Discussion

Knowledge and Awareness of Lassa Fever Transmission

The findings indicate a relatively high level of awareness of Lassa fever, with 90.9% of respondents having heard about the disease. This aligns with previous studies conducted in Ibadan, Nigeria, where awareness of Lassa fever in the affected community was 65%, while in the university community, it was 85% (16). However, despite this high awareness, only 76.4% of respondents demonstrated knowledge of the common symptoms, suggesting gaps in comprehensive understanding. The most recognized symptoms were high fever (71.1%), followed by headache (55.4%), while muscle ache (23.2%) and bleeding from gums and nose (23.2%) were the least recognized. This is consistent with findings from studies in Liberia and Africa, which revealed that fever and headaches were frequently acknowledged symptoms [12, 13].

While 54.7% of respondents identified direct contact with infected rodents as a mode of transmission, and 55.0% acknowledged the risk of handling and preparing rats, misconceptions remain. Less than half of the respondents (48.4%) were unaware that consuming contaminated food could lead to infection, and 10.2% believed in airborne transmission, which contradicts established evidence. Notably, 3.1% of respondents wrongly identified mosquito bites as a transmission mode, reinforcing the need for public health education to dispel misconceptions. These findings corroborate studies from endemic regions, indicating that while specific knowledge gaps persist regarding indirect transmission through food contamination, the majority of adults in the studied community knew that consuming food contaminated with rat faeces and urine transmits Lassa fever [14]. Public health

strategies should focus on strengthening knowledge about transmission pathways to improve preventive behaviors.

Preventive Measures Against Lassa Fever

The study found significant deficiencies in knowledge about preventive measures. Only 11.7% were aware of avoiding contact with rats, 6.4% recognized de-rating as a preventive measure, and a mere 12.8% identified proper food storage as essential for preventing rodent contamination. The limited awareness of personal protective equipment (4.3%) and vaccination (4.3%) is concerning, as these are critical in healthcare settings where nosocomial outbreaks have occurred. Comparable studies in Lassa fever-endemic regions, such as Nigeria, have reported similar gaps in preventive knowledge, particularly regarding food storage and hygiene practices [15]. These findings highlight the need for culturally tailored health education programs to promote rodent control and personal hygiene practices.

Cultural Practices and Lassa Fever Risk Factors

A high percentage (91.4%) of respondents reported using traps or other rodent control methods, which is encouraging. However, 4.9% engaged in hunting and consuming rats, which is considered a significant risk factor for Lassa fever transmission [16, 17]. Studies from Nigeria and Guinea have identified rodent consumption as a persistent cultural practice, posing challenges to disease prevention efforts [18].

Proper food storage remains a critical issue, with only 56.5% using sealed containers while 18.8% used open containers, exposing food to rodent contamination. Additionally, 64.0% of respondents reported the presence of open waste bins or dumpsites, which contribute to rodent proliferation. Prior studies in endemic areas suggest that poor waste management and open food storage increase household exposure to the Lassa virus [19]. Community interventions promoting environmental sanitation and rodent-proof storage are necessary to mitigate these risks.

Prevalence of Lassa Fever Symptoms and Risk Factors

The study found that 36.6% of respondents reported experiencing Lassa fever symptoms, highlighting the disease burden in the surveyed regions. This aligns with a study by Oshiokhayamhe et.al. (19), who found that many people who contract Lassa fever do not show any symptoms, but when symptoms appear, they usually include headaches, weakness, and fever. However, our findings were contrary to systematic review research, which revealed a broader spectrum of symptoms of Lassa fever among patients [20].

Multivariate analysis revealed that older individuals had a significantly higher likelihood of experiencing Lassa fever symptoms compared to younger age groups. The age categories 30-39 (AOR = 3.195, $p = 0.050$), 40-48 (AOR = 3.611, $p = 0.040$), 50-59 (AOR = 4.308, $p = 0.023$), and 60+ (AOR = 5.505, $p = 0.011$) all showed significantly elevated risks compared to those under 20 years. This trend aligns with existing literature that suggests older individuals may have prolonged exposure to Lassa fever risk factors, such as occupational hazards or cultural practices related to food storage and rodent control [21].

Household size also emerged as a significant factor influencing the likelihood of Lassa fever symptoms. Individuals in households with 5-8 members had a reduced risk (AOR = 0.688, $p = 0.048$) compared to smaller households, suggesting that larger families may implement more preventive measures such as shared hygiene and rodent control responsibilities. However, this protective association diminished for households with 9-12 members (and those with more than 12 members, possibly due to increased human-rodent

interaction and overcrowding, which has been reported as a risk factor in other studies. Religious affiliation was also a significant predictor of Lassa fever transmission. Both Christianity (AOR = 1.729, p = 0.030) and Islam (AOR = 26.404, p = 0.022) were significantly associated with Lassa fever symptoms compared to traditional religions. This might be linked to variations in cultural practices regarding rodent handling and food storage as well as cultural issues and taboos, as seen in other zoonotic disease studies [22].

Good handwashing and hygiene practices were significantly associated with lower odds of Lassa fever symptoms (AOR = 1.555, p = 0.008). This underscores the importance of basic hygiene in reducing disease transmission, corroborating findings from previous studies emphasizing hand hygiene in Lassa fever prevention [23, 24]. Food storage practices significantly influenced Lassa fever symptoms. Individuals who stored grains in open containers had a lower risk of Lassa fever symptoms (AOR = 0.557, p = 0.025) compared to those who did not store grains at all. This finding may be counterintuitive but could suggest that those not storing grains engage in other risky behaviors, such as frequent market purchases where contamination risks exist.

Consumption of rodents was a significant risk factor for Lassa fever symptoms in this study (AOR = 0.648, p = 0.005). Hunting and handling rodents, a common cultural practice in some regions has been well-documented as a major transmission route for Lassa fever [17, 18]. Public health interventions should emphasize behavioral change regarding rodent consumption. Poor waste disposal was associated with an increased risk of Lassa fever symptoms (AOR = 2.968, p = 0.046). Open waste bins attract rodents, increasing the likelihood of human contact with infected animals. This finding aligns with other studies that emphasize environmental sanitation as a key measure in Lassa fever prevention [25].

Conclusion

This study highlights critical socio-cultural determinants influencing Lassa fever transmission in Sierra Leone. While awareness levels are generally high, significant gaps in knowledge and preventive practices persist. The findings underscore the importance of age, household size, hygiene behaviors, and food storage practices in determining infection risk. Multivariate analysis identified poor hygiene and improper food storage as key predictors of transmission. These studies emphasize the need for targeted public health interventions, including community-based education campaigns, improved sanitation, and stricter food storage practices. Strengthening health promotion strategies and integrating socio-cultural factors into Lassa fever prevention programs will be essential for reducing disease burden and mitigating future outbreaks.

Study Limitation

This study has some methodological limitations. First, its cross-sectional design limits the ability to establish causal relationships between socio-cultural factors and Lassa fever transmission. Second, self-reported data may be subject to recall and social desirability biases, potentially affecting the accuracy of responses. Additionally, while efforts were made to ensure representative sampling, the reliance on household heads may not fully capture diverse community perspectives, particularly those of marginalized groups. Lastly, language and cultural nuances in questionnaire interpretation could influence data consistency, despite pretesting and interviewer training.

Conflict of Interest

There is no conflict of interest.

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Facility-Based Focus Group Exploration of Psychoactive Substance Use

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Abstract

The abuse of psychoactive substances significantly impacts individual behavior and perception, posing a substantial public health challenge, particularly in psychiatric hospitals, and negatively affecting treatment outcomes. This study employs a facility-based, cross-sectional design utilizing focus group discussions to gain insights into attitudes, beliefs, and practices. The study examined subjects' awareness of substance use, its consequences, and the relationship between psychoactive substance use and academic attainment. The results are as follows: N = 55; 76.4% (n = 44) are male and 23.6% (n = 23) are female. The mean age is 30.87 years with a standard deviation of 8.25. The modal age of onset for substance use is 17 years, with a mean of 18.18 and a standard deviation of 7.58. The presence of mental illness resulting from psychoactive substance use was observed in 58.2% (n = 32) of cases. The educational status of subjects was significantly lower than that of their parents, with Pearson $X^2 = 49.8$, df = 24, and p = 0.001 with a 95% confidence interval. The majority of participants indicated that they commenced substance use in schools, and the behavior continued despite awareness of the consequences, as evidenced by 94%. Consequently, educational institutions should implement extensive substance use preventive strategies, such as mandatory drug use screening prior to university admission, regular random drug testing within the university premises, and zero tolerance to substance-indulging behaviors.

Keywords: *Exploration, Facility-Based, Focus-Group, Psychoactive Substance.*

Introduction

Substance use, particularly the misuse and abuse of psychoactive substances, has a profound impact on individual behavior and perception. These substances affect the central nervous system, leading to alterations in cognitive processes and behavioral responses to environmental stimuli. Such changes can result in significant and far-reaching consequences for individuals and society [1, 2]. Understanding these effects is essential for promoting informed decision-making and public health initiatives. Recognizing this influence is crucial in comprehending the challenges individuals encounter and effectively addressing issues related to substance use. Substance use disorder is characterized by a problematic pattern of substance use that results in considerable distress or impairment in daily functioning. Psychoactive substances can elicit substantial changes in behavior, including heightened aggression and violence or, alternately, passivity and reckless behavior. Furthermore, these substances cannot only modify physical strength and sexual performance but can also compel individuals to engage in actions that profoundly contradict their personal values [3].

Understanding these effects is critical for making informed decisions regarding substance use. Acknowledging the emergence of substance use disorder necessitates an awareness of the significant risk and protective factors that influence drug misuse behaviors

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among youth. The complexities surrounding psychoactive substance use and its repercussions require ongoing examination, particularly concerning protective factors that may mitigate associated risk demand ongoing investigation, especially regarding protective factors that may reduce risks [4]. In public health, focus groups are often employed as an efficient and cost-effective method to collect data from specific segments of the target population, thereby meeting program objectives. To gain a deeper understanding of the attitudes, beliefs, practices, and values associated with a particular subject, such as psychoactive substance use, the process involves the meticulous planning and facilitation of a series of group discussions among individuals in similar circumstances. Substance abuse poses a significant public health challenge, particularly in Mental health facilities, it has a negative impact on the treatment outcome. Over 50% of individuals with mental illness present with co-occurring substance use disorder, highlighting the need for thorough screening for substance use in patient evaluations. Substance use frequently coexists with mental illness, where substances may initially function as a self-medication strategy to alleviate symptoms of mental disorders, thereby potentially heightening susceptibility to mental health issues. The interplay between substance use and mental health is influenced by causal relationships, correlation, and overlapping risk factors [5]. Addiction is characterized by a loss of control over drug use, initially thought to stem from disruptions in subcortical reward circuits and the prefrontal cortex. The prefrontal cortex plays a crucial role in modulating behaviors by regulating the limbic system and reward regions and contributing to higher-order executive functions such as self-control, salience attribution, and awareness [6]. Problematic behaviors, such as substance abuse, gambling, aggression, violence, and engagement in high-risk sexual activities, are closely associated with impulsivity. Impulsivity is characterized as "a tendency for swift and spontaneous reactions to internal or external stimuli, frequently occurring without consideration for the potentially adverse consequences that may affect the individual acting impulsively or others".

Research examining impulsive individuals suffering from drug addiction confirm the existence of a correlation between impulsivity and substance abuse. Those who engage in the abuse of multiple substances demonstrate a higher degree of impulsivity in comparison to individuals who abuse only a singular type of drug. Furthermore, individuals with a history of substance use exhibit a propensity for immediate gratification when confronted with various reward options, even if the rewards are minimal [7]. Impulsivity is a comprehensive and complex construct typically characterized in two ways. Impulsive action that is marked by a deficiency in behavioral inhibition, occurring without consideration of potential adverse outcomes. Secondly, impulsive choice that is characterized by a lack of self-control or an inability to postpone gratification [8].

Significance of Study

Nigeria encounters considerable public health challenges attributed to substance abuse, which warrants focused attention on the interplay between substance use and mental health disorders, the vulnerability of adolescents, the imperative for informed policy and interventions, and the enhancement of scientific understanding within this field. The risk and initiation of substance use are markedly elevated among peers in academic environments, particularly during university years. Consequently, targeted interventions are essential to alleviate risks correlated with substance use, particularly during pivotal developmental phases. Furthermore, substance abuse continues to pose a significant challenge despite the implementation of government policies, drug legislation, preventive strategies,

and regulatory measures. Initiatives aimed at combating substance use should focus on adolescents, young adults, students, educational institutions, parents, and religious organizations. The reinforcement of drug policies and legislation, the identification of associated risk factors, and addressing the sources of drug supply represent critical preventive measures [5].

Study Objectives include assessing the socio-demographic profile and clinical metrics of the respondents, to examined subjects' awareness of substance use, risks and its consequences, the relationship between psychoactive substance use and academic achievement, and to evaluate the utilization of psychoactive substance use, and the presence or absence of mental illness.

Methodology

Study Design – This is a cross-sectional, descriptive, facility-based focus group discussion, a method carefully selected for its ability to provide comprehensive insights into the target population's perspectives on psychoactive substance use [9].

Study Location - Research was conducted in Abuja, specifically at the Karu General Hospital of the Federal Capital Territory (FCT), a key public health facility in the North Central Nigeria. This location was chosen for its accessibility and relevance to the study's focus on psychoactive substance use.

Study Population- Subjects are persons in inpatient treatment, 58 Male and female of different background, 5 dropped out due to [specific reasons]-living a total of 55 study sample.

Procedure - Cross sectional FGD with Group Size of 9 participants per group, 5 homogeneous group is set, with 4 groups containing male only participants and a single group of 9 female participants. Each discussion lasted two hours and the study was conducted over a period of three days. The methodology involves organizing and conducting a series of group discussions, and recording this information from focus groups on paper, gathering insights into knowledge, attitudes, and behaviors towards psychoactive substance use through these discussions. Materials: The materials used included pens and notepads for participants, consent forms, a brief socio-demographic questionnaire, and refreshments to ensure comfort and relaxation during the discussions. The sessions began with a 5-minute welcome and introduction period for both the facilitator and participants, alongside a brief explanation of the purpose of the focus group discussion aimed at gathering insights into their knowledge, attitudes, and behaviors concerning psychoactive substance use. Ground rules were established for a respectful and open discussion, emphasizing honesty, orderliness in speaking, and respect for differing viewpoints. The consent form and a brief socio demographic questionnaire were applied to the subjects before discussions. Also, a semi-structured question guide was formulated for the facilitator, containing lists of items for discussion.

Inclusion and exclusion criteria – only those who signed the informed consent were included in the study, subjects are those in patient treatment at the facility. None of the individuals are excluded.

Results

The respondents' (N 55) age ranged from a minimum of 19 years to a maximum of 58 years, with a mean of 30 years and a standard deviation of 8.25. The study revealed that the age at which the respondents first used substances was 17 years, as seen among a more significant percentage, with a mean age of 18 years and a standard deviation of 7.580. These findings, detailed in Table 1 and Figure 1, have important implications for understanding the patterns of substance use initiation. The t-test demonstrated a significant difference between the group's mean age and the age at which psychoactive substance use began. These

findings are statistically significant, with an independent t-test value of 7.887, a p-value of 0.05, and a 95% confidence interval. Refer to Table 2 below.

Table 1. Descriptive Statistics

Age	N	Minimum	Maximum	Mean	Std. Deviation
Present Age	55	19.0	58.0	30.87	8.248
Age of First PAS Use	44	8	55	18.18	7.580

Foot Note; Table representing the Mean age of the subjects and that of their parents.

Table 2. T-Test of Independent Samples

Group	N	Mean	df	t-value	p-value	Remark
Present Age	55	30.873	97	7.887	0.001	Significant
Age of Onset of Substance Use	44	18.159				

Foot Note; Table showing the Significant T-test value of the Two Mean (Subjects and Parents)

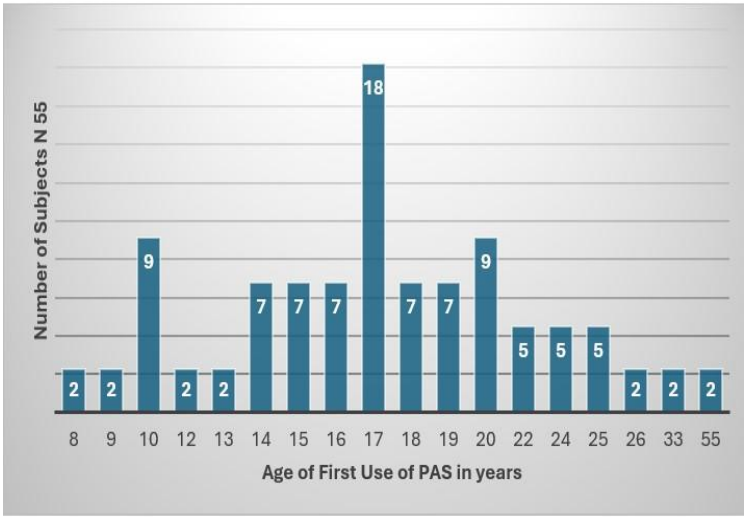

Figure 1. Frequency n (55) of Age of Onset of PAS Use in Years, the Modal Age is 17years.

Gender, Marital, and Employment Status

The gender distribution of the respondents is as follows: 42 (76%) are male, 9 (16%) are female, and 46 (84%) are single or unmarried, while 9 (16%) are married. Most participants are engaged in various jobs, with N31 (56%) employed and N23 (42%) unemployed.

Clinical Correlates: Awareness of psychoactive substance use, associated risks and consequences, and mental health issues

Ninety-four percent (N=52, 94%) are aware of psychoactive substance use and its consequences, and (N=43, 93%) reported knowledge of the significant risks associated with this use. Mental and behavioral disorders related to psychoactive substance use are

present among (N=32, 58%) of those receiving treatment at the time of the research. See Figure 2.

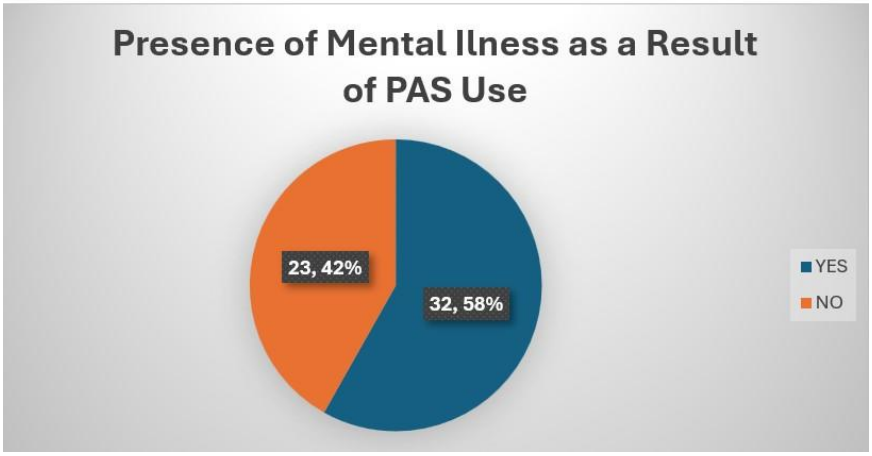

Figure 2. The Presence of Mental Illness due to Psycho Active Substance Use

Many indicated that the availability of substances and peer influence are the main reasons for starting to use substances. Cannabis remains the most commonly used substance, as indicated by (N=18, 32.7%), followed by tobacco use (N=11, 20%) and alcohol (N=9, 16.4%). Most respondents reported their favorite substance as Cannabis (N=14, 25.5%), followed by Crack Cocaine (N=9, 16.4%), Tobacco (N=4, 7.3%), New Psychoactive Substances (NPS-Loud and Arizona) (N=4, 7.3%), and Alcohol (N=2, 3.6%). The substances most difficult to abstain from are cannabis (N=14, 25%) and crack cocaine (N=14, 25%), with 50% of participants reporting challenges, followed by cigarettes (N=5, 9.1%) and alcohol (N=3, 5.5%). Eighty-six percent (N=38, 86.4%) reported having attempted to abstain from using substances in the past without success, while (N=6, 13.6%) have never tried to abstain. See Table 3-8.

Table 3. Reasons for Taking Psychoactive Substances

S/N	Values	Frequency	Percentage
1	For Fun	9	19.1%
2	Influence from friends/Peer Pressure	7	14.9%
3	No specified reason	11	23.4%
4	Death of a loved one	1	2.1%
5	Curiosity	4	8.5%
6	For Relaxation/recreation	9	19.1%
7	For Energy to work harder	2	4.3%
8	Depression	3	6.4%
9	For protection from Pile	1	2.1%
	Total	47	100%

Foot Note: Clinical Correlates of Psychoactive Substance Use FGD N=55

Table 4. Favorite Psycho Active Substance use

S/N	Values	Frequency	Percentage
1	Cannabis/ Marijuana	14	25.5%
2	Cigarettes	4	7.3%
3	Codeine	2	3.6%
4	Crack cocaine	9	16.4%
5	Alcohol	2	3.6%
6	Crystal Meth/molly	2	3.6%
7	NPS Loud &Arizona	4	7.3%
8	None	7	12.7%
9	Rohypnol Refnol	1	1.8%
10	Blunt	1	1.8%
	Total	46	83.6%
	Missing	9	16.3%
	Total	55	100%

Table 5. The Most Challenging Substance to Stop

S/N	Values	Frequency	Percentage
1	Cannabis/Marijuana	14	25.5%
2	Crack cocaine	14	25.5%
3	Crystal meth	2	3.6%
4	Alcohol	3	5.5%
5	Codeine	1	1.8%
6	Cigarettes	5	9.1%
	Total	39	70.9%
	Missing system	16	29.1%
	Total	55	100.0%

Table 6. Risk Factors Associated with Substance Us

S/N	Values	Frequency	Percentage
1	It can cause Dementia	3	5.5%
2	Turns youths to thief	1	1.8%
3	Can bring sickness/health issues	14	25.5%
4	Causes Over dependence	2	3.6%
5	Drugs and substances can damage the brain and cause mental illness	11	20.0%
6	Can lead to Poverty	4	7.3%
7	Lead to arrest by police/NDLEA	2	3.6%
8	Not sure of a risk factor	10	18.2%
9	Endangers the future of youths	7	12.7%
10	One can be poisoned	1	1.8%
	Total	52	100.0%

Foot Note: Clinical Correlates of Psychoactive Substance Use FGD N=55

Table 7. Perceived Consequences from PAS Use

S/N	Values	Frequency	Percentage
1	Mental health issues	29	52.7%
2	Psychosis	3	5.5%
3	Family issues	3	5.5%
4	Health issues	12	21.8%
5	Death	1	1.8%
6	Memory loss	2	3.6%
7	Eating too much	1	1.8%
8	Financial challenges	2	3.6%
9	Regrets/remorse	2	3.6%
	Total	55	100.0

Foot Note: Clinical Correlates of Psychoactive Substance Use FGD N=55

Table 8. Number of Psychoactive Substances Used

S/N	Values	Frequency	Percentage
1	Those taking single (only one) PAS	15	27.3%
2	Those Taking Multiple PAS	28	50.9%
	Total	43	78.2%
	Missing	12	21.8%
	Total	55	100%

The first instance of substance use predominantly occurred during secondary school period as reported by 45% of the respondents. Additionally, 32% indicated that their initial use took place at home or in the home environment, while 10% stated they first used substances at the university. Among the participants, N=25 (45%) have completed tertiary education, while N=12 (22%) dropped out of university due to issues related to substance use. Furthermore, N=6 (10%) holds postgraduate degrees, and N=8 (14%) have completed secondary education. See Table 9 & 10.

Table 9. Subject's Educational Status

S/N	items	Frequency	Percentage
1	Completed University Education	25	45.5%
2	Secondary Education completed	9	16.4%
3	Post-university Education	6	10.9%
4	Dropped out of the University	11	20.0%
5	Islamic Education	1	1.8%
	Total	52	94.5%
	Missing value	3	5.5%
	Total	55	100.0%

Table 10. Parents' Education Status

S/N	items	Frequency	Percentage
1	Completed University Education	24	43.6%
2	Secondary Education completed	8	14.5%
3	Post-university Education	14	25.5%
4	Dropped out of the university	2	3.6%
5	Islamic Education	3	5.5%
6	Primary School completed	1	1.8%
7	Secondary School incomplete	1	1.8%
	Total	53	96.4%
	Missing value	2	3.6%
	Total	55	100.0%

Participants' Educational Status Compared to that of their Parents

Forty-five percent (45%) of the subjects hold a university degree, while 43% of their parents do. Eleven percent (11%) have post-university degrees, compared to 25% of their parents. Additionally, 20% dropped out of university due to substance-related issues, whereas only 3.6% of their parents faced similar problems. Notably, the educational status of the subjects is significantly lower than that of their parents, with Pearson $X^2 = 49.8$, df = 24, and p = 0.001 at a 95% confidence interval.

Discussion

The age of onset of psychoactive substance use is observed to be 17 years of age in most respondents in this study. This data reveals a concerning trend, with most respondents beginning notably early. This fact is significant concerning the adolescent addiction theory; given their ongoing brain development, drug use during adolescence can lead to long-lasting changes in the brain [4, 10]. Table 2 presents the results of a t-test comparing the respondents' mean present age with their mean age at the onset of psychoactive substance use. Since the p-value is less than 0.05, there is a significant difference between the present age and the age at which respondents began using psychoactive substances. Consequently, we reject the null hypothesis in favor of the alternative hypothesis; therefore, there is a notable difference in the mean age of the respondents and their mean age at the onset of psychoactive substance use. There is strong evidence that alcohol, tobacco, and cannabis dependence problems manifest more quickly when drug use begins before adulthood. Several human research studies have examined early-onset difficulties related to drug, alcohol, tobacco, and cannabis use, with strong evidence. This highlights the need for further research to understand this phenomenon fully [1, 11].

Risk-taking, to some degree, is a standard part of teenage development. While the urge to explore new things and gain independence is praiseworthy, it can also lead to drug experimentation. It's crucial to understand that the brain's regions responsible for judgment and decision-making don't fully mature until the early to mid-20s [1, 4]. This means that teenagers may struggle to assess the risks of drug use and are particularly vulnerable to the influence of their peers [1, 12]. Researchers from the National Institute on Drug Abuse's Adolescent Brain Cognitive Development (ABCD) study are using state-of-the-art imaging technology to examine how childhood experiences—including drug use—interact with a child's evolving biology to influence brain development and various outcomes,

including social, behavioral, academic, and health. The study's findings have the potential to significantly influence policy and practice, providing critical new insights into the fundamental elements of adolescence that shape a person's future. Adolescent brain examined by MRI revealed early indications of internalizing and externalizing symptoms that are associated with psychoactive substance use behaviors and mental health difficulties [1, 13].

The knowledge and awareness of the risks and consequences of psychoactive substance use: In this study, 94 % of the subjects are aware of psychoactive substance use along with its risks and consequences. However, drug use persists despite this high level of awareness; this is a pressing issue that requires urgent attention. This can be attributed to theories explaining the concomitant loss of control in addiction. The loss of control over drug use is considered the hallmark of addiction. It is caused by abnormalities in the prefrontal brain, subcortical reward networks, and leads to the iRISA syndrome of impaired response inhibition and salient attribution in substance use. The prefrontal cortex is essential for behavior modification, controlling the limbic system, and rewarding areas involved in higher-order executive processes such as self-control, salience attribution, and awareness. This underscores the importance of self-control in addiction [14]. Similar theories of addiction among digital addicts depict the iRISA syndrome, characterized by severe and chronic effects on neurotransmitter systems, akin to those seen with chronic psychoactive substance use. It disrupts the cellular and molecular mechanisms of the GABAergic and glutamatergic neurotransmitter systems, thereby altering dopamine and serotonin synaptic plasticity. These alterations, crucial for impulse control, memory, and sleep function, show measurable changes. The full spectrum of behavioral symptoms in digital addicts, including eating disorders and withdrawal from outdoor and social activities, highlights the complexity of the issue. Evidence pointing to dysfunctional melatonin and vitamin D metabolism in digital addicts should be taken into account, necessitating a comprehensive approach to treatment [15].

It's concerning that a staggering 86% of respondents have attempted to abstain from substance use, yet without success. This underscores the urgent need for effective intervention strategies. Only 13.6% have never tried to quit. The most difficult substances to abstain from are cannabis and crack cocaine, with 50% of participants reporting challenges, followed by cigarettes (9.1%) and alcohol (5.5%). Studies of the direct effects of drug exposure assessed the effects of stimulant and non-stimulant drugs on the prefrontal cortex activity. The model predicts drug-induced activity enhancements in the prefrontal cortex areas involved in drug-related processes, including emotional responses, automatic behaviors, and higher-order executive involvement. For example, medial Occito Frontal Cortex (mOFC) and ventromedial prefrontal cortex activities in craving, Occito Frontal Cortex OFC in drug expectation, ACC (anterior cingulate cortex) in attention bias, and DLPFC in forming drug-related working memories [14].

Adolescents are more prone to addiction due to factors such as peer pressure, curiosity, experimentation, and the accessibility of drugs [4]. A similar finding is observed in this study: many respondents indicated the availability of the substance and the influence of peers as the main reasons for beginning substance use, underscoring the importance of peer education and support programs. The location of first substance use was reported to be in secondary school by 45% of respondents. Thirty-two percent (32%) reported using it at home, while ten percent (10%) revealed their first use occurred in university, highlighting the significant role of the home environment in initiating substance use. This emphasizes the need for early prevention and education in both

the university environments and in secondary schools.

The age at which individuals begin using psychoactive substances is essential, as it can influence their overall behavior and academic performance. Factors related to substance use, including peer influence and psychological theories of adolescent addiction, play a significant role in this context. Understanding the implications of early substance use, particularly during adolescence, is crucial. It can lead to addiction and may significantly affect academic activities and performance. Addressing these issues involves recognizing the importance of prevention and intervention strategies that target both early use and the factors leading to it [3, 11].

Most respondents identified their favorite substance as Cannabis (N=14, 25.5%), followed by Crack Cocaine (N=9, 16.4%), Tobacco (N=4, 7.3%), New Psychoactive Substances (NPS-Loud and Arizona) (N=4, 7.3%), and Alcohol (N=2, 3.6%). Cannabis remained the first substance of use among the subjects; a similar picture is seen in the UNODC Nigerian study of 2019, where Cannabis is the most commonly used drug [16]. Almost every country in the world grows cannabis. Nigeria harvests cannabis herbs, while Morocco and Afghanistan are major producers and exporters of cannabis resin. The crop contains over 400 chemicals, of which more than 60 are chemically unique and known as cannabinoids. Delta-9 THC tetrahydro cannabinoids cause the most psychoactive effects of cannabis [16].

The substances most difficult to abstain from are cannabis (N=14, 25%) and crack cocaine (N=14, 25%), with 50% of participants reporting challenges. They are followed by cigarettes (N=5, 9.1%) and alcohol (N=3, 5.5%). Eighty-six percent (N=38, 86.4%) reported having attempted to abstain from using substances in the past without success, while 13.6% (N=6) have never tried to abstain. A prevalence of 20–40% was obtained following a systematic search of the literature regarding drug abuse in Nigeria using the PubMed database in 2020.Among students and youths, a 20.9% prevalence was reported, with cannabis as the commonly abused drug. Others include cocaine, amphetamine, heroin, diazepam, codeine, cough syrup, and tramadol [4, 5].

The first instance of substance usage predominantly occurred during secondary school, as reported by 45% of respondents. Additionally, 32% indicated that their initial use took place at home or in a home environment, while 10% stated they first used substances at university. Among the participants, N=25 (45%) have completed tertiary education, whereas N=12 (22%) dropped out of university due to issues related to substance use. Furthermore, N=6 (10%) hold postgraduate degrees, and N=8 (14%) have completed secondary education. Mental and behavioral disorders related to psychoactive substance use are present among 32 (58%) of those receiving treatment during the research. See Figure 2. This situation can be attributed to polysubstance use, observed among 28 (50.9%), while single-substance use is noted in 15 (27.3%). Several studies have linked multiple substance use to a high risk of mental disorders caused by psychoactive substance use [17].

Conclusion

The complexity of psychoactive substance use and its ramifications necessitate continued exploration. Substantial evidence highlights the dangers of adolescent psychoactive substance use, particularly cannabis, which is crucial for mental health advocacy, especially in schools and among university students. Recognizing the onset of substance use disorder requires understanding the significant risk and protective factors influencing drug misuse behaviors among young individuals, particularly the protective factors that can mitigate risks. Effective communication strategies in schools and community-based

interventions will be vital in addressing this health concern.

Recommendation

To address the issue of psychoactive substance use among young people, it is essential to promote early detection and effective interventions. Additionally, increasing awareness among parents and peers regarding the clinical signs and emerging trends of substance use in youth is crucial. Policymakers and healthcare professionals should focus on education, prevention, and interventions that consider individual, family, and environmental factors linked to drug use. Implementing prevention strategies at all levels is vital. This raises the question: What should universities prioritize in this effort?

Public Health Prevention Measures, the primary prevention consists of health promotion, protection, and prevention. Health promotion activities include systemic organizational, political, educational, and regulatory measures that create favorable circumstances for individuals, communities, and groups. Health protection uses laws, rules, and governmental policies to protect the population's health from outside dangers. Disease preventive activities investigate and evaluate health hazards and create and test solutions to lessen harmful exposure, illness initiation, and progression across all life stages, populations, and circumstances [18-20].

School-Based Health Activities: such as those establish thorough health education programs in schools that support substance use, mental health, healthy habits, and access to medical treatment. These initiatives can empower students to make health-related decisions and help establish lifetime healthy habits. School-based health activities, including clubs and anti-drug use social initiatives, aim to inform peers within the university environment.

Prevention Strategies; Quaternary Prevention is implemented to identify patients at risk of overmedicalization, shield them from unnecessary medical procedures, and recommend ethically sound interventions. Tertiary Prevention forms of tertiary prevention are commonly rehabilitation efforts. Secondary Prevention early disease detection targets healthy-appearing individuals with subclinical forms of the disease, for example Urine Drug Test. Primary Prevention, such as tobacco cessation programs implement activities that reduce risk exposure or boost the immunity of at-risk individuals to prevent disease progression. Primordial Prevention involves government policy: Raising taxes on cigarettes, reducing cigarette and alcohol advertisements [21].

In Nigeria, various organizations and policies exist:

1. Comprehensive preventive strategies are implemented, such as the mandatory pre-university entrance drug use screening test and regular random drug use screenings within the university compound and during classes.
2. Health promotion and comprehensive battles against drug abuse programs (WADA War Against Drug Abuse) by the NDLEA, (National Drug Law Enforcement Agency), targeting primary, secondary, and tertiary schools, the Mothers Against Drug Abuse program).
3. Policies such as the zero tolerance for drug use in schools
4. Catch them young: Protect primary and secondary schools from drug use
5. Effective communication strategies and community-based interventions
6. Make adequate use of the impact of faith-based organizations.

Conflict of Interest

Author declares no Conflict of interest in the study.

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Strategic Human Resources Management Practices in the Private Security Industry: Workforce Retention and Professional Development

A Case Study of Securitas Canada

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Abstract

This study researches strategic human resources management (SHRM) practices in Canada's private security industry. It examines the role SHRM plays in workforce retention and staff professional development programs at Securitas Canada. Furthermore, the study investigates how Securitas applied SHRM principles to reduce its high staff turnover rate, and enhance the skill development of its workforce in a labor-intensive and high-risk industry. Using a mixed method of semi-structured approach, which comprises interviews with stakeholders, surveys with 300 employees, and document analysis, the study provides a robust insight into the company's HR strategies. The findings show that competitive compensation packages, targeted recognition programs, and sound professional development initiative have pushed its turnover rate far below the industry average. In addition, technology-driven training and leadership programs put in place by the company has strengthened the HR practices of the organization. The study expands SHRM literature by utilizing the High-Performance Work Systems (HPWS) and Ability Motivation Opportunity (AMO) frameworks to a largely under-researched sector. The study would guide private security firms in improving workforce stability and career growth in high-risk operational occupation and environments.

Keywords: *Human Resources Practices, Professional Development, Private Security Industry, Strategic Human Resource Management, SHRM, Securitas Canada, Workforce Retention.*

Introduction

Background and Context

Canada's private security industry has grown rapidly in recent years, becoming an increasingly important part of both the country's national economy and public safety infrastructure. From 2014 to 2019, the sector grew at an average annual rate of 5.6%, reaching a value of CAD $8.6 billion by the end of that period [2]. Looking ahead, the sector is projected to grow to about CAD$ 9.4 billion by the year 2032, with a compound annual growth rate of 3.84% [16, 21]. Several factors contribute to this trend, the most notable being rising security needs across a range of sectors, including the retail sectors, driven by the financial impact of organized crime and theft. Added to this is the growing concerns over public infrastructure protection [25, 26]. At the regional level, demand has followed a similar upward trajectory: between 2019 and 2023, service patronage in private security companies increased by 8%, while the need for licensed security guards rose 19% since 2017. At the close of year 2023, the industry employed over 150,000 individuals nationwide. Serving both private and public sector clients, the industry now occupies a central position within Canada's broader security landscape, both economically and operationally.

However, this growth is not devoid of some socio-economic challenges, including public reluctance to privatization and the need for

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regulation to guard service quality [7]. High turnover rates in the industry remains a problem as this stands at 18%, whilst the national average for all the other sectors combined is about 10% [38]. High attrition rates in the private security sector are closely tied to low wages and challenging working conditions. The median annual salary sits at CAD 34,444, a figure that reflects the limited financial incentive to remain in the field, particularly given the high stress levels and lack of clear career progression [22].

These issues not only impact worker retention but also threaten the sector's operational effectiveness through persistent skill shortages. In 2023, the industry faced a 15% workforce shortfall—double the rate reported just three years earlier [12]. Vacancy rates reached as high as 25% in some areas, with specialized roles such as cybersecurity positions taking an average of 35 to 60 days to fill [29]. An aging workforce adds further strain to recruitment and retention efforts, while competition from other industries continues to draw potential candidates away from the sector [30].

Strategic human resources management (SHRM) is essential in these realities, given that it is one of the identified strategies of sustaining the sector. Competitive compensation, employee recognition, wellness, and skills development programs are SHRM practices in which human resource policies match organizational objectives, thus stabilizing the workforce and developing staff skills for operations resilience [5, 15, 28].

Securitas Canada was chosen as a case study for this research as the company offers a practical and relatable example of how strategic human resource management (SHRM) can be effectively applied in the private security sector. The company operates approximately 24 branches in Canada, and provides both traditional guarding services and advanced technology-driven solutions [40]. Its integrated service approach includes the use of AI-powered analytics, competitive compensation, and employee wellness initiatives. These measures have contributed to a significant lower turnover rate compared to the industry average. As the threat level of public safety increases, and technological innovation reshapes the nature of security work, SHRM will remain central to developing a skilled, resilient, and sustainable workforce. Companies like Securitas Canada demonstrate that targeted human capital strategies can play a key role in addressing persistent workforce challenges across the sector.

Research Problem

The private security industry suffers from high employee turnover, and this could be detrimental to service quality, operational efficiency, and employee morale [1]. A large number of security guards leave their jobs within their first year owing to key challenges, like not being compensated adequately, lack of clear working schedules, unclear career development opportunities, and poor training programs. These not well-defined professional development pathways for security guards prevents them from advancing to higher-level positions and consequently generates negative long-term commitment in the security industry [34].

Although strategic human resource management (SHRM) practices in the Canadian private security industry have been widely researched in the healthcare and financial services sector, a lack of resources has been observed in the latter area [33]. This paper, therefore, attempts to bridge this gap by examining the effect of SHRM practices on employee retention and professional development, using Securitas Canada's employees as case study.

With this in focus, the core research problem can be stated as follows:

1. How do HRM strategies enhance long-term workforce stability and provide career growth to officers in private security firms?

2. What are the results of SHRM practices on workforce retention in Securitas Canada?
3. How can professional development initiatives and programs help employee retention and job satisfaction in the security industry?

Research Objectives

The primary objectives of this study are:

1. To determine the SHRM strategies utilized by Securitas Canada to enhance workforce retention and professional development.
2. To determine the effectiveness of current HRM policies in reducing employee turnover and improving job satisfaction.
3. To evaluate the availability and impact of professional development programs in the company.
4. To identify the major challenges and potential solutions related to career development for security personnel can contribute to longer-term employment and improved retention in the sector.
5. To Propose HRM strategies that can improve employee engagement, retention, and enhance career advancement in the private security industry.

Research Questions

To achieve the objectives outlined above, the study seeks to answer the following key research questions:

1. Is Securitas Canada utilizing SHRM practices to increase workforce retention?
2. Are these practices effectively decreasing turnover and raising job satisfaction rates?
3. How does Securitas Canada provide development opportunities for security officers?
4. What is the connection between employee commitment and long-term employment in the security industry due to career development?
5. What HRM strategies can be implemented to enhance workforce retention and professional advancement in the private security sector?

Significance of the Study

This study is significant for private security industry leaders, human resources professionals, policymakers, academic researchers, and educational institutions regarding value for various stakeholders. The study provides actionable insights for practitioners on adequately managing human resources to grow workforce resilience, employee engagement, and long-term employee commitment. This approach creates opportunities to enhance quality of work life within the organization, as seen in the implementation of innovative strategies for employee well-being, motivation, and professional growth. It also points to the importance of structured professional development programs for providing advanced skills and leadership capability that will enable security personnel to advance professionally and achieve operational excellence.

The findings can inform policymakers and regulators of the need to formulate labor standards and regulatory frameworks that would facilitate better service conditions and enhance professional standards in the private security sector. The study helps to extend the conceptualization of SHRM into high-risk, labor-intensive industries that are typically neglected in the extant literature. It provides theoretical innovations by merging high-performance work systems (HPWS) and the Ability Motivation Opportunity (AMO) framework in an industry setting.

For educational and training institutions, the study offers suggestions for ways of designing the curricula so these institutions can keep up with technological and operational demands within the private security industry.

Structure of the Paper

This article adopts a case study approach, using Securitas Canada as our case study, in

order to enable a practical and comprehensive examination of strategic human resource management (SHRM) practices within the private security industry. The paper begins with a literature review that synthesizes existing research on SHRM, workforce retention, and professional development in high-turnover and high-risk sectors, main themes central to this study. The methodology section outlines the research design, including interviews, surveys, and document analysis, which allows for the identification of Securitas Canada's human resource practices.

The case study framework adopted in this research, allows for an in-depth analysis of the data, specifically examining how the company implements strategies to enhance employee retention and development. The findings section presents key results, highlights effective practices, and assesses their impact on organizational performance and employee engagement. These findings are then discussed in relation to both practical and theoretical implications for the private security industry and related fields. The conclusion summarizes the study's contributions and outlines recommendations for future research.

Literature Review

This section reviews some important academic works that critique Strategic Human Resource Management (SHRM), define workforce retention and draw out important major development processes they offer, emphasizing their applicability in the private security context. The SHRM frameworks are used theoretically and empirically to analyses Securitas Canada's human resource strategies that address labor instability, skill deficits, and professional growth challenges such as labor instability, skill shortages, and limited career advancement opportunities in a high-risk operational environment.

Strategic Human Resource Management (SHRM): Foundations and Frameworks

Human Resource Management (HRM) is different from traditional personnel management practices as it moves beyond mere administrative responsibilities to become one of the core components embodying the organizational strategy of an enterprise. SHRM started gaining momentum in the 1980s, and this was driven by globalization, technological advancement and the increasing international markets' competitiveness. Operational efficiency alone was no longer sufficient to ensure sustainable success. Organizations realized that strategically developing and aligning human capital had become a critical differentiator.

When both human resources and human resources functions are seen as unique, value-generating activities that could, if treated strategically in creating long-term competitive advantage, be sources of competitive advantage rather than economic costs to be minimized, companies will begin treating employees differently [39]. Foundational theories like the Resource-Based View (RBV) emphasize that competitive advantage depends on resources that are rare, valuable, inimitable, and non-substitutable [24]. Organizations that cultivate such resources are more likely to achieve and sustain a dominant market position. Consequently, the High-Performance Work System (HPWS) model suggests the joint use of mutually reinforcing human resource practices, including selective recruitment, high training content, high performance-based compensation and participative management structures to improve organizational performance systematically [23]. In a complementary manner, the Ability Motivation Opportunity (AMO) framework asserts that employee performance is optimally achieved when abilities are developed through development initiatives, motivation is rewarded through recognition and incentives, and meaningful contribution opportunities are expanded. These

frameworks provide a holistic view of the foundation of SHRM insofar as human capital is a key strategic asset that must be effectively managed to navigate complex and volatile business environments.

Strategic Human Resource Management (SHRM) is relevant, particularly in the private security sector, where operations heavily rely on human judgment and are characterized by high employee turnover and the need for continuous human adaptability. Compared to other industries where automation can partially reduce humans' decision-making, this industry depends more on personnel experience, situational awareness, and resilience. Sound HR practices in high-stakes environments lead to operational effectiveness and organizational resilience to unpredictable threats and changing client expectations. There is strong empirical support for Strategic Human Resource Management (SHRM); firms that implement integrated HR practices report productivity gains of 12–18% and experience turnover rates that are 13–30% lower than competitors with fragmented HR systems [25].

An appropriate example of how organic SHRM is translated into organizational strength is represented by Securitas Canada [27]. Securitas has led by investing systematically in structured professional development programs, wellness initiatives that mitigate occupational stress and leadership cultivation pathways and has successfully hardened the company's workforce's capabilities and commitment [9]. Since these practices are part of the organization's broader strategic human resource development approach, they are not isolated interventions; instead, they represent the organization's ability to respond dynamically to technological innovations, regulatory changes, and complex client security demands. Functioning as both a shield and a lever across volatile sectors such as private security, Strategic Human Resource Management (SHRM) helps maintain organizational integrity while simultaneously enabling growth, innovation, and competitive positioning

Furthermore, the SHRM's strategic integration into the broader organization in the context of Securitas Canada reveals its potential as a force for change to contribute to the establishment of SHRM in high-risk work sectors. Systematic investment in human capital is not only good practice; it is necessary for sustainability under labour shortages, regulatory scrutiny and technological disruption, which are routine challenges in those environments. The development of adaptive workforce competencies by SHRM enables firms to maintain service quality and operational readiness when changing conditions. Furthermore, SHRM contributes to employee engagement and organizational agility. Consequently, SHRM goes beyond short-term tactical adjustments to have a culture of continuous improvement, learning and resilience across the organizational levels.

The second way HR strategies are synchronized with core business objectives is by synchronizing human resource investments with operational priorities, client satisfaction, and long-term organizational viability [20]. If human expertise cannot be replaced and operational demands drive an increase, SHRM is not a theoretical ideal but necessary to realize and maintain organizational excellence. Its systematic application transforms human capital from an enormous liability into a sustainable source of strength for private security firms in terms of facilitating their ability to navigate complexity, drive innovation, and deliver greater outcomes in an unpredictable world.

Workforce Retention in High-Turnover Industries: Drivers and Strategies

Industries such as private security, retail, and hospitality face persistent challenges in maintaining workforce stability. In the Canadian private security sector, turnover rates range from 18% to 20%, nearly double the

national average [40]. This high turnover is driven by a combination of interrelated factors that contribute to an unstable and often high-risk work environment. One of the primary issues is financial insecurity, as the median national income remains significantly higher than the average wages earned by security personnel [40]. This economic disparity is further compounded by irregular and poorly coordinated shift schedules, which disrupt employees' personal lives and contribute to elevated stress and burnout levels [40]. Organizational culture also plays a critical role; factors such as poor communication, lack of recognition, and weak leadership structures foster feelings of alienation among employees and contribute to disengagement and attrition [3]. Global workplace data indicate that high engagement levels significantly reduce turnover intentions, suggesting that targeted engagement programs could mitigate these challenges in the private security sector [14]. Moreover, limited opportunities for career advancement diminish workers' long-term commitment and reduce the incentive to remain with an organization over time.

Professional Development and Organizational Agility

As the landscape of threats—spanning cyber and physical domains—continues to evolve rapidly, continuous professional development has become essential to maintaining competitiveness and resilience in the private security sector. In practice, an organization's capacity to respond swiftly to external disruptions is closely tied to the adaptability and depth of its workforce. Professional development supports this by enhancing technical proficiency, fostering strategic thinking, and strengthening organizational agility—factors that directly influence operational outcomes. Key focus areas include conflict resolution, cybersecurity, and emergency management training, which equip personnel with competencies critical for navigating increasingly complex operational environments [17]. The National Cyber Threat Assessment highlights the growing need for cybersecurity skills to address evolving digital threats, underscoring the importance of such training in private security [6].

Beyond skill acquisition, access to ongoing development opportunities contributes to a greater sense of purpose among employees. This, in turn, enhances organizational commitment and reduces turnover [19]. Organizations that invest in professional learning cultures tend to display greater anticipatory and responsive agility in the face of technological disruptions and shifting market conditions [15].

Effective professional development is multifaceted. It includes practical, on-the-job training that embeds new skills directly into daily tasks; flexible e-learning platforms that accommodate asynchronous schedules [15]; and leadership development programs designed to build strategic decision-making and interpersonal effectiveness [7]. Additionally, industry-recognized certifications—such as first aid or cybersecurity credentials—not only validate skills but also improve employability and upward mobility within the organization [24]. Work-integrated learning, such as practical training and certifications, enhances graduate employability, supporting career progression in security roles [18].

Evidence shows that these investments yield measurable returns. Organizations see reduced turnover, enhanced service delivery, and stronger reputational value in the marketplace. For example, Securitas Canada's adoption of virtual reality–based conflict management training and e-learning certification pathways, in partnership with the Security Industry Association [32], has increased employee preparedness by 30%, contributing to both workforce resilience and client satisfaction.

SHRM Challenges and Innovations in the Private Security Sector

The private security industry presents unique challenges for Strategic Human Resource Management (SHRM), requiring tailored and adaptive approaches. Operating in a highly dynamic environment, the sector must align human resource strategies with diverse regulatory frameworks, employee well-being needs, ongoing technological advancement, and public expectations. For firms like Securitas Canada, effectively navigating these complexities is critical to achieving organizational resilience and developing a sustainable, high-performing workforce.

Regulatory Complexities

The Canadian private security sector is both heavily regulated and regionally fragmented. Licensing requirements, compliance obligations, and operational standards vary significantly across provinces [26]. This regulatory diversity poses substantial challenges for companies operating nationally, as human resource policies must be carefully tailored to meet differing regional mandates. Failing to adhere to localized standards can expose firms to legal liability and damage their public reputation—both of which are especially detrimental in a field that relies on public trust [26]. As a result, SHRM in this sector must include mechanisms for regulatory intelligence and agile compliance to support effective operations across jurisdictions. HR departments are increasingly tasked with balancing standardized national procedures and province-specific practices, such as localized onboarding protocols and compliance training. Organizations that manage this complexity effectively can gain a competitive advantage by ensuring consistent service quality while remaining legally compliant in every region of operation.

Occupational Health and Mental Well-being

Another major challenge to SHRM implementation in the private security sector is the high physical and psychological risk inherent in the work. Security personnel regularly face confrontations, threat mitigation, and emergency response duties, all of which contribute to elevated stress levels and exposure to traumatic situations. Research indicates that individuals in private security are 150% more likely to experience mental health conditions such as anxiety, depression, and post-traumatic stress disorder (PTSD) compared to workers in other sectors [10]. These occupational health risks necessitate the integration of robust wellness initiatives into SHRM strategies. Programs such as confidential counseling services, resilience training, mental health awareness campaigns, and stress management workshops not only address immediate health concerns but also help reduce absenteeism and turnover. By investing in employee well-being, firms enhance psychological resilience, strengthen operational readiness, and create healthier, more attractive work environments that support long-term retention.

Technological Disruptions

The accelerating adoption of digital technologies in security operations has reshaped workforce competency requirements and, by extension, the demands placed on SHRM. With AI-driven threat detection, cloud-based surveillance systems, and advanced security protocols becoming standard, traditional physical security skills alone are no longer sufficient. Today's security professionals must possess digital literacy, the ability to troubleshoot technical systems, and a foundational understanding of automated tools. This transformation calls for SHRM strategies that prioritize continuous upskilling and capability development. A forward-looking HR approach ensures that employees are equipped to operate effectively within increasingly technology-driven environments and enables

organizations to remain competitive as the security landscape evolves.

In order to properly manage the rapid pace of technological advancement in the security sector, SHRM practices must prioritize stratified upskilling initiatives tailored to evolving workforce needs. This includes the integration of immersive tools such as Virtual Reality (VR) simulations, which offer scenario-based training environments that enhance decision-making, threat assessment, and overall operational preparedness. In parallel, modern SHRM approaches must embrace flexible, accessible, and personalized learning models. Adaptive e-learning platforms—driven by AI—enable employees to follow modular, self-paced training paths that address individual skill gaps and foster continuous development [36]. Operating within digitally enhanced security infrastructures requires more than just technical competence; it demands adaptability, resilience, and a culture of lifelong learning.

Therefore, advanced training methods should not be considered optional enhancements, but rather strategic imperatives. Embedding continuous learning and digital fluency into organizational culture is essential for maintaining competitive relevance. Companies that fail to implement such practices risk falling behind competitors that can deliver agile, technologically advanced security solutions. As such, capability development must become a core function of every human resource strategy, with ongoing digital training institutionalized as a standard organizational responsibility.

By establishing technological proficiency as an expected baseline, firms can cultivate a workforce that embraces innovation, adapts to disruption, and sustains operational effectiveness in a constantly evolving environment. Ultimately, future-proofing the organization against technological disruption depends on viewing human capital as a durable competitive advantage one that SHRM is uniquely positioned to protect and advance.

Public Perception and Workforce Recruitment

Public perception presents a significant and often underestimated challenge to strategic human resource management (SHRM) in the private security sector. Although private security personnel play a vital role in maintaining public safety, they frequently face societal stigma and are often perceived as less legitimate or professional than law enforcement officers. This misperception has tangible consequences for workforce recruitment, as it discourages highly skilled candidates from pursuing careers in private security. To counteract this, SHRM strategies must include targeted initiatives aimed at reshaping public narratives and attracting top talent.

Innovative approaches to recruitment and retention can help elevate the industry's image while addressing workforce instability. For example, diversity and inclusion programs—such as Securitas Canada's Indigenous youth training initiatives [32] serve dual purposes: they broaden workforce representation and contribute to long-term sector stability by reaching underrepresented populations. In addition, community outreach efforts, public education campaigns, and branding strategies that emphasize the professionalism, technological sophistication, and social impact of private security firms can gradually shift public perceptions in a more positive direction [11].

Building a strong employer brand has become an essential SHRM function. A well-developed brand not only enhances organizational appeal but also contributes to long-term workforce sustainability. To remain competitive and resilient, SHRM in private security must proactively address multiple interrelated areas: regulatory compliance, employee well-being, technological readiness, and public perception. Each of these domains requires tailored, innovative, and integrated strategies embedded within a comprehensive human resource framework.

Organizations that successfully adapt by institutionalizing compliance, investing in employee wellness, fostering continuous digital skills development, and actively managing their public image will be better positioned to cultivate a resilient, engaged, and high-performing workforce. In an era of escalating security demands and rapidly advancing operational technologies, SHRM is not merely a supportive function it is a strategic necessity for long-term sustainability and sectoral advancement.

Theoretical Framework: Integrating HPWS and AMO for Workforce Excellence

The integration of the High-Performance Work Systems (HPWS) and Ability-Motivation-Opportunity (AMO) frameworks offers a robust theoretical lens for examining how strategic human resource management (SHRM) can enhance workforce effectiveness and organizational adaptability, particularly in complex, high-turnover industries such as private security. HPWS is a group of HR practices, it includes careful hiring, regular training, pay based on performance, and involving employees in decisions. It is intended that practices work together to improve work results. With coherent implementation, those systems raise how well employees do and how involved they are. This occurs by matching what employees can do with what the organization wants to achieve.

The Ability–Motivation–Opportunity (AMO) framework (Fig.1) suggests that employee performance is influenced by three interrelated components: the development of skills that enable effective performance, incentives and recognition that foster motivation, and structured opportunities for participation that facilitate performance outcomes [3]. Integrating the AMO framework with broader strategic models allows organizations to adopt a more cohesive and intentional Human Resource Management (HRM) approach. This alignment not only addresses immediate operational requirements but also strengthens workforce resilience and enhances long-term organizational sustainability.



Figure 1. AMO Model's Basic Framework: This diagram illustrates how High-Performance Work Systems—through ability, motivation, and opportunity—drive discretionary effort, enhancing organizational performance. It aligns with the study's focus on workforce resilience in private securit**y.**

Adapted from: Appelbaum, E., et al., (2000). [1]

Securitas Canada shows that private security can include high-performance work systems, ability, motivation, and Opportunity. Human resource practices at Securitas Canada are guided by deliberate and structured systems designed to address key industry challenges. Among these challenges are high employee attrition, skill shortages, and limited opportunities for career advancement. In response, the company's recruitment strategies focus on attracting candidates who demonstrate adaptability and the potential to integrate

effectively into the organizational culture. These targeted efforts aim to build a more stable and capable workforce aligned with the company's long-term goals. Training programs incorporate virtual reality and simulated scenarios to enhance experiential learning and improve operational preparedness. Leadership development, crucial for strategic decision-making in high-risk settings, is bolstered by HR practices that foster resilience and adaptability during crises [7, 13].

These provide workers with technical skills and the ability to think. The learning systems complete the "ability" part of Ability, Motivation, and Opportunity. They meet the High Performance Work Systems concept, which requires excellent quality training. Employee motivation also improves through deliberate acknowledgement, chances to improve to more desirable positions, and wellness plans. These initiatives help reduce employee burnout and foster organizational loyalty, illustrating Securitas Canada's emphasis on the "opportunity" component of the AMO framework. The complementary use of HPWS and AMO becomes particularly significant in high-risk and labor-intensive sectors where operational success depends on both system-level coherence and human capital agility. While HPWS provides structural integration and process discipline, AMO addresses the psychological and behavioral mechanisms that drive individual engagement and retention [4, 25]. The strategy of Securitas Canada, where technology-enhanced learning is associated with motivational and participatory structures, indicates how these models are functional in practice. The company's wellness initiatives that include stress management and psychological support are an extension of the AMO framework to take the concept of employee well-being as the central motivating factor of performance [10].

Similarly, technology readiness developed through training in AI-enabled surveillance and cloud systems shows adaptation of HPWS to contemporary operation requirements [40, 35]. In the end, consolidating these frameworks enables organizations such as Securitas Canada to turn HRM from a human resource management function to a strategic machine through which organizational resilience, employee satisfaction, and long-term sustainability are achieved. This dual-framework perspective indicates the need for work systems that maximize human capital and adjust continuously to regulatory, technological and operational methodologies.

Methodology

Research Design

This study employs a mixed-methods approach, integrating both quantitative and qualitative methods to provide a comprehensive understanding of SHRM practices. This design enables the exploration of phenomena at multiple levels and enhances the validity of findings through methodological triangulation. The qualitative component captures in-depth perspectives from employees and management, while the quantitative element tests hypothesized relationships to improve generalizability.

Qualitative Data Collection and Analysis

The qualitative phase involved semi-structured interviews with 20 key stakeholders, including HR managers, site supervisors, and frontline security officers. This format allowed for both flexibility in probing participant experiences and consistency across interviews. Open-ended questions addressed issues such as workforce retention, training effectiveness, and career development. Interviews were audio-recorded, transcribed verbatim, and analyzed using thematic analysis via NVivo software. Key emerging themes included recognition practices, leadership support, training accessibility, and career progression. A systematized coding process and iterative review ensured the reliability and depth of thematic insights.

Quantitative Data Collection and Analysis

The quantitative component included a structured survey administered to a random sample of 300 employees across Securitas Canada's operational divisions. The survey instrument featured validated Likert-scale items measuring constructs such as job satisfaction, turnover intention, perceived training effectiveness, access to development opportunities, and engagement in wellness initiatives. Items were piloted and assessed for internal consistency using Cronbach's alpha. Data were analyzed using SPSS, employing multiple regression to test causal relationships and Structural Equation Modeling (SEM) to examine pathways between SHRM practices and outcomes like employee engagement and turnover intent—guided by the HPWS and AMO frameworks.

Document Analysis

Document analysis was used to supplement interview and survey data, providing organizational context and validation of reported HR practices. Reviewed materials included HR policies, employee handbooks, training manuals, turnover reports, and wellness program documentation. Publicly available industry reports, internal documents from Securitas Canada, regulatory guidelines, and relevant academic literature were also analyzed. This triangulation of primary and secondary sources enhanced the study's credibility and contextual depth (Table 1).

Findings and Analysis

Retention Strategies

Table 1 summarizes the key retention strategies implemented by Securitas Canada, highlighting their measurable impact on employee engagement and retention.

Table 1. Retention Strategy

Retention Strategy Component	Metric / Score	Notes
Employee Engagement Programs	$\beta = 0.65$ ($p < 0.01$)	Strong positive correlation with retention (from SEM analysis)
Competitive Compensation	88% satisfaction rate among surveyed employees	Based on 300 survey responses
Recognition Programs	75% of employees felt valued through recognition	Includes "Employee of the Month", performance bonuses
Career Progression	20% promoted to supervisory roles in 3 years	Leadership program participants
Flexible Scheduling	Mentioned by 60% of interviewees as retention factor	From qualitative interviews
Supportive Supervisors	Mentioned by 55% of interviewees	Key to work-life balance and motivation

Source: *Statistics Canada. 2023. [36]*

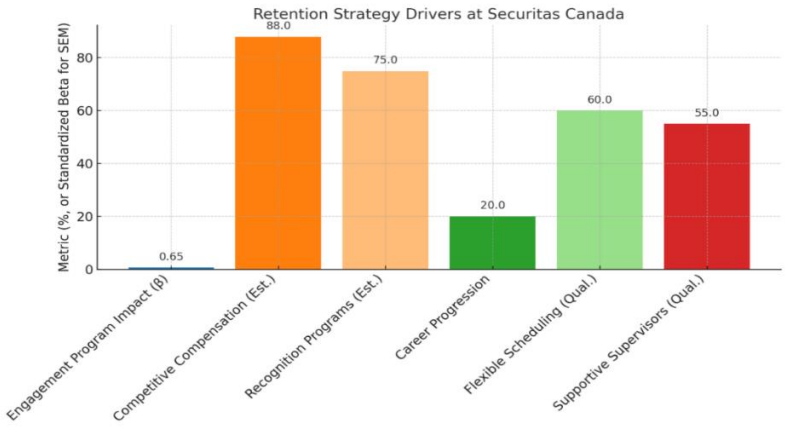

Figure 2. Retention Strategy Drivers at Securitas Canada

Source: *Statistics Canada. 2023. [36]*

Professional Development Impact

Table 2 illustrates the measurable impact of Securitas Canada's professional development programs on employee performance, organizational resilience, and leadership advancement.

Table 2. Professional Development Impact

Impact area	Metric	Reported value
Employee Performance	SEM result: Impact of professional development	$\beta = 0.72$, $p < 0.01$
Organizational Resilience	SEM result: Impact of professional development	$\beta = 0.58$, $p < 0.05$
Leadership Program Outcome	% of employees promoted after training	20% advanced

Source: Statistics Canada. 2023. [36]

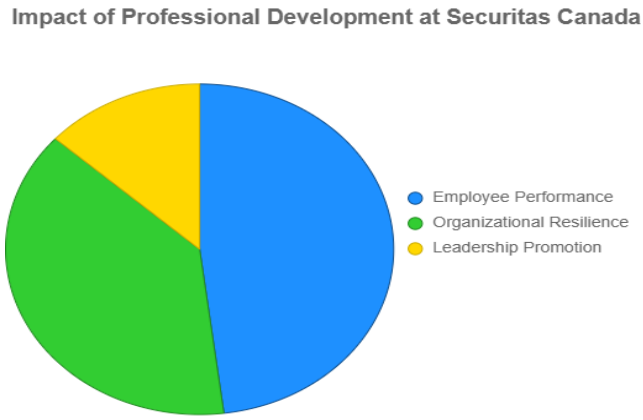

Figure 3. Impact of Training on Performance, Resilience, and Promotion Outcomes

Source: *Statistics Canada. 2023. [36]*

Comparative Analysis

Table 3 compares the turnover rates of leading private security firms in Canada, highlighting Securitas Canada's performance against industry peer.

Table 3. Comparative Analysis

Company	Turnover rate	Notes
Securitas Canada	~18%	As previously stated in the case study.
G4S Canada	5% (2021–2022)	G4S reported a staff turnover rate of just 5% from April 2021 to March 2022, significantly lower than the industry average.
Paladin Security	-	Paladin claims to have one of the highest employee retention rates in the security industry, though specific figures are not publicly disclosed.

Source: *Statistics Canada. 2023. [36]*

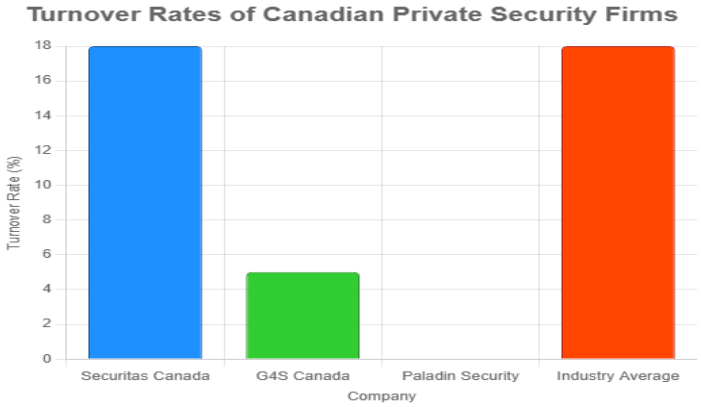

Figure 4. Turnover Rates of Leading Private Security Firms in Canada (vs. Industry Average)

Source: *Statistics Canada. 2023. [36]*

Theoretical Contributions

This study has made several significant contributions to the theory of strategic human resources management (SHRM) in the relatively unexplored private security context. It expands the theoretical map of how SHRM practices can be transposed to labor-intensive, high-risk industries with high turnover, complex regulatory environments, and increasing technological requirements. Central to this analysis is the adaptation and extension of the High-Performance Work Systems (HPWS) framework in conjunction with the Ability Motivation Opportunity (AMO) theory.

The first contribution is the attempt to validate HPWS & AMO frameworks within

the particular domain of the private security industry, and an area that escapes mainstream SHRM research. Previous studies have centered on the effects of HR practices in stable environments such as healthcare. This work has shown that processing HR practices in a systematic bundle (selective recruitment, extensive training, performance-based recognition, participative decision making) can be as effective even within a high turnover and discontinuities setting. Even under operational stress, these combined strategies demonstrated improved retention and job satisfaction levels and improved organizational resilience.

Secondly, this study expands the AMO framework by explicating how wellness projects and technology-enabled training affect the cornerstone AMO factors. This research adds two new dimensions to the glorified sphere of skill enhancement, rewards, and participation [3]: psychological resilience and technological adaptability. For instance, virtual

reality (VR) training and confidential wellness programs (e.g., EAPS) demonstrate improvements in employees' preparedness to operate in high-risk environments. This conceptual expansion is well placed in defining well-being and tech-readiness as strategic enablers of workforce effectiveness.

Third, the analysis reinvents employee wellness as a critical part of HPWS. While recruitment, training, compensation, and engagement remain the traditional focal points of High-Performance Work Systems (HPWS), this study discovered that organized wellness programs significantly impact employee engagement, resilience, and turnover. This finding aligns with the emerging convergence between human capital theory and occupational health, which underscores the strategic role of employee well-being in sustaining a productive and stable workforce.

Additionally, the research fills a gap in the SHRM literature by discovering technological agility as a mediating variable between HR practices and organizational performance. As information security is becoming an integral part of the security business, technological literacy becomes a foundational competency as private security turns tech-oriented to surveil, detect threats and operate. The findings show that further upskilling is valuable and essential to adaptability and competitive advantage.

Finally, this study calls for the disparity of HR strategies across different settings by highlighting the importance of contextual adaptability. In the private security industry, which is characterized by regulators' fragmentation, public stigma, and occupational risk, effective adoption of SHRM needs sector-specific tuning. This recognition introduces a more flexible and responsive SHRM model that can respond to distinctive operational requirements.

In summary, this research:

1. Validates the applicability of the HPWS and AMO frameworks within high-risk, labor-intensive organizational contexts.
2. Conceptually expands SHRM theory to include wellness and technological competencies.
3. Highlights the strategic role of sector-specific adaptation; and
4. Provides a foundation for future research into SHRM in dynamic, high-stakes industries.

These contributions refine existing models and propose a more holistic, adaptive view of SHRM that is better suited to the realities of contemporary security work.

Challenges

Even though Securitas Canada has shown success in implementing Strategic Human Resource Management (SHRM) practices to retain and professionally develop its workforce, this success has not come without challenges that continue to hold back the full-scale implementation of these innovations. These obstacles stem largely from the operational and structural complexities inherent in the private security sector and highlight the difficulty of supporting a stable, skilled workforce in a demanding, labor-intensive environment.

Resistance to Technological Change Among Veteran Employees

One of the most pressing challenges is resistance to change among long-serving employees. Many veteran officers use traditional training techniques, including in-person workshops, manual reporting and experiential field learning. Implementing digital tools like VR simulation, cloud-based reporting systems, and e-learning platforms is a radical departure from their well-established routine, even though VR-based training improves preparation, decisions, and situational preparation [31], doubts remain. This resistance typically arises from concerns that new systems will become obsolete owing to new technologies and that new systems may lead to new systems becoming less valuable. In

contrast, experiential competencies identify employees' professional identities.

Such a proclivity has more profound and broader implications than a simple individual one. Cohesion and standardization risks are exposed to the organization. The uneven adoption of training tools across operational sites is likely to result in inconsistent skill levels and fragmented preparedness, ultimately undermining the cohesion necessary for effective coordination. In addition, generational gaps may widen as younger recruits, who are more adept with technology, increasingly favor technologically driven approaches over the more traditional methods preferred by their older counterparts. Such divisions will breed mistrust among individuals, and sharing knowledge and compromising operational efficiency are important in volatile situations where cohesion in the team is the main priority.

Organizations need to adopt a careful change management strategy to overcome these challenges. Technological adoption should instead be positioned as an addition to the former, not a substitute for traditional skills. Practically, no-pressure workshops help the veteran employees gain confidence in their digital tools, while a mentorship plan allows veteran officers and recruits to learn from each other. This approach maintains institutional knowledge but inspires an ability to change. Modelled as an add-on to existing expertise, rather than a replacement, the positioning of technology might allay the fear of displacement.

Leadership is a very important player in overcoming resistance. For them to be strategic, vice presidents have to not only promote but also actually involve themselves in digital training initiatives. Veterans' involvement in the design and rollout of training programs could likewise inculcate a sense of ownership and decrease the amount of imposed change. This inclusive approach can take the engagement from reluctant compliance to active engagement. Organizations like Securitas Canada can break generational gaps, empower the adoption of technologies, and enhance employee cohesion by empowering technological confidence and valuing traditional knowledge and leadership commitment. Such steps are pivotal for successfully applying such specialized SHRM strategies and for raising the parameters of the level of operational resilience in the modern security environment, which is becoming increasingly complicated.

Financial Constraints on Technology-Driven Training Initiatives

Financial constraints present a significant challenge to Securitas Canada's initiative to transition from on-site training to technology-enhanced training programs across its operations. The application of VR/AR simulations demonstrates the most significant potential for improving skills, situational awareness, and operational readiness in the workforce. However, the initial financial cost of equipment acquisition, software development, and infrastructure improvements has been prohibitively high. These challenges are especially acute in smaller or rural branches, where limits to the operational budget and capital investment availability are more common.

In addition to costs related to initial hardware and software (VR headsets, simulation platform, IT infrastructure), organizations also face ongoing costs. These are system maintenance, software upgrades, technical support, and staff training on the new tools. The speed at which technological obsolescence occurs will place further cost pressure, forcing continual reinvestments that allow systems to remain current and effective.

E-learning platforms have become popular as cheap substitutes. However, their success relies greatly on stable internet connectivity and basic digital literacy, which differ significantly across geographic ranges, especially in remote areas. As such, security firms such as Securitas

Canada have conflicting financial priorities: While spending on cutting-edge training technology, allocating to the needs of the workers, the most basic of which are competitive compensation and retention. Organizations require adaptive strategies for innovating in a financially sustainable manner in order to reduce these financial challenges. One of the responses involves partnerships with government agencies, industry associations or technology vendors to co-fund training and development initiatives through platforms or subsidized programs. However, these collaborations have not fully developed in the Canadian part of fragmented private security, where there are differences in regulation and a lack of coordinated efforts among industry stakeholders that restrain scalability.

Securitas Canada may benefit in the short run from phased implementation strategies. Incremental deployment of sophisticated training tools based on branch readiness, budget capacity, and workforce needs will enable cost spreading over time and eliminate immediate financial strain. Likewise, emphasis on modular e-learning options with low physical requirements provides a pragmatic interim rendition for branches limited in digital capacity. In the end, it becomes less of a challenge for private security firms to cope with financial risks when training technology and general public labor development activities are aligned in terms of investment. Through an innovative, pragmatic, staged approach, organizations can produce digitally competent employees who are plug-able strategically to wars, but the organization remains operationally and financially stable.

Regional Disparities in SHRM Implementation

One of the significant challenges in implementing SHRM practice across Securitas Canada's operational environment, based on the urban-rural divide, is the stringent similarity between the two. Urban sites enjoy a bigger talent pool, superior technological infrastructure, and operating budgets. Such benefits enable the implementation of groundbreaking HR ventures such as VR training, e-learning systems, and any other type of holistic employee wellness program. Urban branches are much more efficient in luring talented candidates and providing various incentives for career enhancement than rural branches, which suffers from structural limitations that are not dynamic.

Limited recruitment pools hinder access to skills-qualified candidates, whereas a poor technological framework limits the utilization of digital training solutions. With limited operating budgets, investment in progressive HR strategies becomes even more constricted and many rural sites depend on the old, less effective approaches to development. In turn, employees in these locations experience less satisfaction regarding training access, career advancement, and support services, especially regarding mental health and wellness [22]. These regional imbalances create higher turnover rates, reduced engagement, and a comprehensive drag on overall goal-setting across the organization.

To navigate these inequalities, SHRM strategies need to be flexible and contextual in themselves. Portable mobile training units, Wi-Fi-enabled portable VR systems, and modular e-learning tools can bring professional development to faraway sites. Creating low–bandwidth digital platforms targeted at regions with limited connectivity can help provide equal opportunities for training. Adapted wellness programs that consider the mental health needs of employees out in isolated environments are also important in helping to retain and build resilience. Moreover, leadership must demonstrate equitable commitment to HR investment across regions. Budgetary limitations should not justify neglect of strategic initiatives in rural areas.

Strengthening partnerships with local educational institutions and community-based

organizations can enhance recruitment pipelines and improve employer branding in underrepresented regions. By adopting regionally responsive SHRM approaches, Securitas Canada can reduce operational disparities, improve cohesion, and elevate the standard of employee experience and performance across its entire workforce.

Sustaining Workforce Engagement Amid High Turnover Rates

While the success of SHRM initiatives in improving workforce outcomes is responsible, high turnover remains a defining problem in Canada's private security business. The industry's attrition rate is 30% or higher annually [8]. Securitas Canada has controlled its turnover rate to 18% using structured recognition programs (peer and management), leadership development pathways and improved employee support services. However, sustaining these gains occurs because of the sector's structural realities. Irregular job timings, high-risk exposure, and few opportunities for career progression usually characterize security jobs. Many jobs are viewed as transitional rather than permanent, contributing to apathy and a lack of continuity. Employees typically migrate to industries that promise them more stability and better pay with defined careers. These are compounded by shifts in workforce demands, relief from high mental well-being, work-life balance, and access to continuous learning. [37]. Emerging workforce challenges, such as demands for flexibility and well-being, necessitate adaptive SHRM strategies to sustain engagement [37]

To manage these continuous pressures, a proactive and adaptive "way of working" mindset is critical to workforce engagement. Organizations should utilize standard feedback mechanisms of employees, like climate surveys, focus groups and exit interviews, to recognize changing needs and priorities. Lessons learned from these tools can guide specific initiatives such as flexible time scheduling, a well-defined career-runs-uphill planning, mental wellbeing support and exposure to various skill areas. Such actions enhance job satisfaction and improve organizational commitment. Fostering supportive organizational cultures is essential. Inclusive leadership, cohesive communication, and visible probation for employee development invoke a sense of purpose and belonging. Vocational institutions and industry associations could enter into strategic partnerships to professionalize the workforce, channel development in measurable directions, and sell the sector as a serious long-term job option. Strategic workforce planning, supported by predictive analytics and labor market trend analysis, can help anticipate turnover risks and inform recruitment and development strategies, enabling organizations to address potential workforce instability before it arises. Finally, engagement cannot be maintained solely through HR interventions. Financial and cultural constraints, regional physical dissimilarities, and competition from external labor markets put pressure on even the most developed SHRM systems.

To maintain resilience, private security firms must develop dynamic, workforce-oriented HRM approaches that are adaptable, forward-looking, and responsive to change. Securitas Canada's experience confirms that operational excellence in high-risk environments is not solely a function of innovation in technology or procedures but requires a consistent strategic investment in learning and developing the workforce itself.

Discussion

Practical Implications

This study identifies several critical practical implications for advancing Strategic Human Resource Management (SHRM) in the private security sector, a field marked by workforce instability, operational complexity, and rapid technological disruption.

Embedding Technology-Enhanced Learning Ecosystems

To remain competitive, private security firms must shift digital training tools beyond ad hoc (or pilot stage) into technology-enhanced learning systems as a core component of workforce development plans. These should also support integrated approaches of scenario-based training, mobile micro learning and AI-adaptive learning platforms. This diversity reflects the existence of students with different learning styles and accommodates the inclusion of older employees who may be reluctant to learn technology.

Firms can also minimize development costs by co-creating sector-specific content via co-owners of intellectual property agreements with technology providers. Using internal teams that focus on learning and development and are experts in digital pedagogy ensures local and strategic alignment of training plans with business goals. Technological leasing models and consortia-based access to VR infrastructure represent workable ways of democratizing innovation and bringing high-end training tools into the hands of most firms, if they were for smaller firms or if the latter are portfolio-limited.

Redefining Employee Well-being as a Strategic Imperative

The hazardous and poorly paid private security areas require an expanded definition of wellness beyond standard workforce engagement and retention programs. Confidential counselling and flexible hours are still lovely, but companies need to revisit their basic HR strategies to consider financial wellness, resilience coaching and burnout prevention. The practical interventions are financial literacy workshops, debt management workshops, and support for retirement planning that targets the economic stress or pressure creating the exit. Besides that, programs that build psychological safety, such as mindfulness training, emotional intelligence training, and trauma-informed leadership practices, are critical in high-pressure areas.

Firms should also explore the development of Wellness Advisory Councils, which comprise employees from across roles to co-design wellness programs that reflect real workforce requirements. The predictive analytics tools can show initial signs of stress, absenteeism and burnout, providing an opportunity for preventive actions. Health can also be conceptualized as a strategic asset for a firm once it gains prominence as a key performance indicator (KPI) in the form of executive scorecards, indicating a specific organizational commitment paired with a sense of responsibility given to leadership to shape outcomes related to health, reorienting health as an investment rather than a discretionary reward.

Developing Integrated Talent Management Systems

To achieve maximum efficiency from SHRM's talent management systems, they can no longer be a separate function but must link closely with organizational and industry direction. This includes, but is not limited to, the development of skills forecasting frameworks to facilitate readiness to respond to emerging cybersecurity and drone surveillance challenges and the design of pipelines for such future positions. Succession planning should have its roots in transparent career mapping from frontline to leading roles, which supports visible career movement and challenges stagnation connotations. Performance management systems should also move away from evaluation based on tenures towards evidence-based assessments that integrate client feedback, technological responsiveness, and leadership potential. Internal talent marketplaces may represent another gain for firms, where employees can find themselves in project-based jobs, stretch assignments, or cross-functional experiences, while enhancing

internal mobility and professional development, carefree of formal job changes.

Finally, sustained investment in employer branding is necessary to reshape public perceptions of private security work. This involves public storytelling campaigns that highlight success stories, community impact, diversity achievements, and technological innovation—positioning the sector as a viable, socially meaningful, and future-oriented career path. In summary, aligning SHRM practices with adaptive learning strategies, holistic wellness frameworks, and dynamic talent management systems will allow private security firms not only to survive but lead amid evolving operational pressures and shifting employee expectations.

Theoretical Implications

This study makes a substantial theoretical contribution to the field of Strategic Human Resource Management (SHRM) by validating and extending established models within the distinct, high-risk context of the private security sector. It demonstrates the applicability of the High-Performance Work Systems (HPWS) and Ability-Motivation-Opportunity (AMO) frameworks in environments marked by workforce instability, complex regulation, and rapid technological change. While these models have traditionally been tested in stable sectors such as healthcare, manufacturing, and corporate services, this research confirms their relevance in volatile, labor-intensive settings where employees regularly encounter operational stressors that challenge their engagement and adaptability. A key theoretical advancement lies in the study's expansion of the AMO model. It introduces psychological resilience and technological agility as vital dimensions of employee ability and motivation—attributes increasingly necessary in high-risk environments. The findings suggest that traditional technical training is no longer sufficient; employees must also be emotionally adaptable and digitally competent. Interventions such as VR-based conflict management training and comprehensive wellness programs modestly, yet meaningfully, support the development of these traits. This broader interpretation of AMO creates space for future research that explores emotional and technological competencies as core elements of workforce effectiveness.

Similarly, the HPWS framework is reinterpreted to include employee wellness as a strategic driver of performance, retention, and commitment. Whereas earlier applications of HPWS focused primarily on recruitment, training, incentives, and participatory structures [23], this study argues that psychological health must be embedded within these systems for them to be truly high-performing. By integrating wellness and digital readiness into SHRM theory, this research offers a more comprehensive model suited to the demands of contemporary, high-pressure work environments. Moreover, the study underscores the need for sector-specific adaptations of SHRM models. It challenges the assumption that certain HR practices are universally applicable and instead calls for frameworks that account for sectoral characteristics such as regulatory fragmentation, reputational risk, and occupational hazards. These contextual dynamics often distort the efficacy of generic HR strategies. The findings advocate for more responsive, flexible SHRM models that are aligned with operational realities. This call for contextualization not only enhances the explanatory power of SHRM theories but also improves their practical utility.

Finally, the study lays the groundwork for interdisciplinary integration within SHRM theory. By drawing connections between human resource development, occupational health, and digital transformation, it invites future research to bridge SHRM with organizational psychology, health sciences, and technology studies. In doing so, it strengthens the theoretical foundations of SHRM and

ensures its relevance amid ongoing changes in work, risk, and workforce expectations.

Policy Implications

The findings of this study also carry important policy implications for both private-sector leadership and public regulatory bodies. As private security firms increasingly assume critical roles within the broader public safety infrastructure, systemic inconsistencies in training standards, compensation, and professional development threaten workforce stability and service quality. There is an urgent need for industry-wide standards covering core areas such as conflict management, cybersecurity readiness, and wellness programs. Establishing consistent training and development requirements across firms would not only professionalize the workforce but also enhance public trust in the private security sector. Securitas Canada's success in reducing turnover and improving engagement through structured SHRM investments provides a model for broader institutional adoption.

Moreover, standardizing compensation frameworks and benefit structures is essential. Given the high-risk nature of security work, minimum pay thresholds and standardized benefits aligned with job demands should be mandated. This would help mitigate turnover, enhance workforce morale, and position security roles as viable long-term careers rather than transitional employment. Equally important is the harmonization of regulatory standards across provinces. Fragmented regulations currently limit workforce mobility and increase administrative burden. A unified national policy framework would streamline compliance, improve operational efficiency, and create clearer career pathways through the establishment of national certification programs. To address resource gaps—especially for smaller or rural firms—government support is crucial. Public funding for technology-enhanced training, wellness initiatives, and diversity programs can help ensure equitable access to innovation across the industry. Financial incentives for R&D in emerging security technologies, workforce resilience, and digital transformation will encourage firms to adopt forward-thinking HR strategies.

Finally, a coordinated public-private partnership model should be promoted. Closer collaboration between public agencies and private firms can improve emergency preparedness, information sharing, and integrated training initiatives. Embedding private security more deeply into public safety frameworks will ensure a more responsive, resilient, and trusted security ecosystem. In sum, a proactive and collaborative policy agenda—backed by regulatory harmonization, financial support, and strategic partnerships—can transform the private security industry into a stable, professional, and socially valued sector capable of meeting the evolving challenges of modern public safety.

Conclusion

This study has critically examined strategically related human resource management (SHRM) practices in Securitas Canada, addressing workforce retention and professional development in the private security sector. As an often-high turnover, high skill shortage and volatile operating environment, Securitas Canada offers an appropriate example of how targeted and innovative HR practices can generate a resilient and motivated workforce. For example, introducing technology-driven training initiatives such as VR simulation and e-learning modules has been instrumental in integrating it with structured wellness programs to prepare employees and improve satisfaction at work and organizational stability. Besides these, these initiatives help employees develop the required technical skills to respond to accelerating security demands and foster psychological resilience and professional engagement. The study also points out the

strategic edge of merging HR functions with corporate objectives, particularly operational excellence, client satisfaction and competitive positioning.

Also, Securitas Canada shows HRM as being incorporated into the standard organizational strategies rather than as isolated administrative functions. The theoretical contribution of the research expands the applicability of the High-Performance Work Systems (HPWS) framework and the Ability Motivation Opportunity (AMO) framework to environments associated with high-risk and labor-intensive processes. The present study suggests some important refinements in the traditional SHRM theory by including psychological well-being and technological agility as essential components of employee development in the changing environment. In addition, they delineate the need for the design of SHRM practices tailored to the idiosyncrasies of both the franchise and full-service aspects of the private security sector, and importantly, for extending strategic HRM theory towards more general and increasingly disparate industry contexts where it will likely be practically relevant.

The practical and policy implications of the findings are considerable beyond the individual organizational initiatives. Private security firms are strongly encouraged to be more handsome in an investment, which would see them looking into scalable technology based on operational training and digital competencies among their personnel. The integral strategic integration of employee wellness initiatives as critical drivers of workforce resilience and organizational performance and not simply as ancillary benefits is equally important. At the same time, one should pay individual attention to HR practice, which must be in parallel with organizational goals, and employee development must be directed at the operational effectiveness and relations with clients. At the policy level, it is necessary to have standards set at the industry level or across multiple industries for employee training, worker professionalism and compensation. Subsidies for the initiatives would also increase the sustainability and legitimacy of private security services through governmental support and harmonizing regulations to the provincial jurisdictions.

To better understand the long-term implications of technology-based HR strategy on the stability of the workforce, career trajectory and organizational adaptability, there is an urgent need to undertake a longitudinal study. Comparative studies over different regulatory environments and cultural contexts can provide fascinating insights into how to further evolve human resource practices according to changing industrial landscapes. This study confirms that strategic human resource management is essential for achieving operational resilience, workforce capability, and professional excellence in high-risk service industries. Adopting flexible, creative, and employee-friendly approaches in HR will not only help private security firms gain a competitive edge in a constantly changing and competitive protection environment but also assure organizational success while preserving greater social security results.

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Conflict of Interest

The author declares no conflict of interest related to this research.

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The Use of Spectrum Refarming to Enhance 4G Capacity and Quality of Service in Mobile Telephony

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Abstract

The fast growth and demand for mobile broad band service has driven Telecom network operators to adopt an innovative approached to improve network capacity and enhance Quality of service in Mobile Telephony. The high demand of mobile broadband to pave way for Spectrum refarming which involves reallocating underutilized frequency bands (e.g., 2G/3G) to more advanced networks like 4G LTE. The research focus and objectives was to investigate the impact of spectrum refarming on 4G capacity and QoS improvement and examines the technical, economic, social and regulatory challenges associated with spectrum refarming. The study will follow a quantitave and comparative approach and data collection was conducted through structured questionnaires and distributed to Telecom engineers, IT specialist with hands-on experience in Telecom, regulatory authorities, supporting staff outside IT and Telecom space. The findings indicate that spectrum refarming can significantly enhance the 4G network capacity, improve quality of service and user experience though its implementation is often limited by technical and regulatory challenges and per the results received from the survey, (88.6%) of respondents acknowledged spectrum refarming will significantly improve 4G coverage and capacity, (6.85 %) believed it is not possible and (4.5%) were uncertain. The study also contributes to the field that provide actionable recommendation for telecom operators and policymakers to improve the spectrum management practices. Additionally, (81.8%) of the respondents reported spectrum sharing policy should be introduced to facilitate refarming ,11.4% didn't support the idea of spectrum sharing ,6.8% of respondents not sure and total Reponses were 40.

Keywords: *4G LTE, Network Capacity, Quality of Service, Spectrum Refarming, Underutilized Frequency.*

Introduction

The rapid increase of mobile telecommunications has steered to an exponential increase in demand for high-speed internet and seamless connectivity. With the rise of data-intensive applications such as video streaming, cloud computing, and IoT services, mobile network operators face challenges in ensuring sufficient capacity and maintaining high-quality service [1]. The most effective strategies to address these challenges is spectrum refarming, which involves reallocating frequency bands from legacy technologies (e.g., 2G and 3G) to more advanced networks like 4G LTE [15]. By optimizing existing spectrum resources, spectrum refarming enhances network capacity, improves spectral efficiency, and provides a better quality of service.

The growing demand for 4G services has placed enormous pressure on the mobile networks, particularly in urban areas where spectrum scarcity is a major concern. The traditional spectrum allocation procedures, which dedicate fixed frequency bands to specific technologies, are becoming inefficient as older technologies become obsolete while the demand for newer generations increases [7].

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Spectrum refarming enables mobile operators to repurpose underutilized spectrum from legacy networks, thereby reducing congestion, improving data speeds, and enhancing overall network performance [9].

Additionally, regulatory bodies play a major role in facilitating spectrum refarming by setting policies that ensure a smooth transition while minimizing service disruptions. As mobile networks prepare for the eventual shift to 5G, the spectrum refarming continues to be a vital mechanism in ensuring the sustainability and efficiency of 4G networks [17]. This study discovers the role of spectrum refarming in enhancing 4G network capacity and quality of service, examining the technical, regulatory, and operational aspects that contribute to its effectiveness.

Limitations and Challenges

Regulatory Constraints in Spectrum Refarming

Regulatory constraints in spectrum refarming involve a combination of technical, financial and administrative measures aimed at reallocating frequency bands to more efficient technologies or new services. This process requires changing the apportionment of spectrum bands, which are limited and valuable resources, and often necessitates regulatory approvals to guarantee effective spectrum utilization and rational competition among operators [6].

Policy and Licensing Frameworks

The implementation of technology-neutral licensing regimes is a significant regulatory approach to facilitate spectrum refarming. Such regimes enhance competition by allowing license holders to evolve the technology deployed and the services delivered as markets develop. However, challenges such as artificially created scarcity of spectrum can hinder optimal usage, necessitating policy and regulatory interventions [27].

Spectrum Sharing and Efficiency

The Spectrum Management addresses methods of how spectrum can be used by operators and regulatory agencies efficiently. The deployment becomes smooth when network vendors have a strong engagement with regulators, which benefits them to increase and expand their coverage as a result of spectrum resource allocation by making use of existing frequency to deploy higher [17].

Achievements of Spectrum Refarming in 5G

1. **Cost Efficiency:** By repurposing existing spectrum, operators can reduce capital expenditures associated with acquiring new spectrum licenses. This approach allows for a more efficient use of current resources, leading to significant cost savings [3].
2. **Cost-Effectiveness:** Operators can increase capacity for newer technologies like LTE without the need to acquire additional spectrum through auctions, making refarming a cost-effective strategy [26].
3. **Accelerated 5G Deployment:** Refarming facilitates quicker 5G rollouts by reallocating spectrum from outdated technologies, enabling operators to meet growing demand more swiftly [28].
4. **Optimized Spectrum Utilization:** Dynamic spectrum refarming allows for the reallocation of spectrum from underutilized bands to more heavily used ones, ensuring that networks operate at peak efficiency and reducing operational costs [28].
5. **Improved Coverage and Capacity:** By reallocating spectrum from outdated technologies, operators can enhance both coverage and capacity of 5G networks, leading to better service quality [19].
6. **Better Quality of Service:** Users experience fewer call drops, increased

internet speeds, and improved overall connectivity [12].

Purpose of the Study

The objective of this study is to examine the role of spectrum refarming in enhancing 4G network (QoS). As mobile telecommunications evolve, demand for high-speed internet and reliable connectivity necessitates efficient spectrum utilization. With legacy networks such as 2G and 3G becoming obsolete, reallocating their spectrum resources to 4G LTE has emerged as a viable strategy to address spectrum scarcity and improve network performance [20]. The objective of the study aims to analyze the technical, regulatory, and operational aspects of spectrum refarming, identifying best practices and challenges associated with its implementation [15].

Specifically, the study tries to find:

Assess the Effect of Spectrum Refarming on 4G Network Capacity – By reallocating spectrum from legacy technologies, operators can enhance bandwidth availability and accommodate more users, thereby reducing congestion and improving data speeds [9].

Evaluate the Influence of Spectrum Refarming on Quality of Service – This involves examining improvements in key performance indicators such as download speeds, latency, and call drop rates following spectrum repurposing [12].

Identify the Regulatory and Policy Considerations – Spectrum refarming requires government and regulatory intervention to ensure a smooth transition and minimize disruptions to existing services. This study will explore frameworks and policies that facilitate efficient spectrum reallocation [15].

Examine Case Studies of Successful Spectrum Refarming Initiatives – Analyzing real-world implementations will provide insights into best practices, potential challenges, and lessons learned from mobile operators that have effectively adopted spectrum refarming [23].

By addressing these objectives, this research intends to provide a broad understanding of spectrum refarming and approach to improving 4G network performance while laying the groundwork for future 5G deployments. The outcomes of this survey will be valuable for network operators, policymakers, and telecommunications researchers in making knowledgeable decisions regarding spectrum management and optimization.

Problem to be Resolved

The increase growth of mobile broadband usage, driven by data-intensive applications, cloud computing, and IoT services, has led to increased network congestion and spectrum scarcity, particularly in urban areas. As a result, mobile network operators struggle to satisfy the rising demand for high-speed and reliable connectivity, leading to performance degradation, slower data speeds, higher latency, and deteriorating (QoS) [10].

A significant challenge in addressing these issues is the scarcity of spectrum resources, as many frequency bands remain allocated to legacy technologies such as 2G and 3G, which have seen declining usage [20]. While mobile Telecom operators continue to inject capital in network expansion, acquiring new spectrum is costly and subject to strict regulatory policies, making efficient spectrum management a necessity [15].

Spectrum refarming has developed as a potential solution to these challenges, allowing operators to reallocate underutilized spectrum from legacy networks to more advanced technologies like 4G LTE. However, several obstacles hinder the full implementation and effectiveness of spectrum refarming.

The novelty of this research lies in its unique approach to leveraging spectrum refarming as a strategic solution for enhancing 4G network capacity and (QoS) while ensuring a seamless transition to 5G. Unlike previous studies that focus on spectrum management in isolation, this research provides an integrated analysis of

refarming strategies, technological innovations, regulatory frameworks, and future implications for 5G networks. The key novel contributions include:

Integration of Dynamic Spectrum Sharing, (DSS) for 4G Enhancement

Unlike traditional spectrum refarming that involves complete frequency band reallocation, this study incorporates DSS, to allow multiple mobile generations (2G, 3G, 4G) to coexist within the same spectrum. This enables a gradual transition to 5G while maximizing 4G performance [23].

AI-Driven Spectrum Refarming Optimization

This research explores how Artificial Intelligence and Algorithms for machine learning can optimize spectrum allocation by analyzing real-time network traffic, device compatibility, and frequency interference. AI-driven spectrum optimization is a recent advancement that improves spectrum efficiency and reduces QoS degradation [9].

Comparative Analysis of Global Spectrum Refarming Policies

Unlike conventional studies focusing on a single regulatory environment, this research conducts a comparative analysis of spectrum refarming policies across different regions (e.g., the FCC in the U.S., Ofcom in the UK, and TRAI in India) to determine the best regulatory practices for optimizing 4G networks [16].

Impact Assessment on 4G QoS and Network Performance

The research introduces an empirical evaluation framework that measures the real-world impact of refarming on 4G network throughput, latency, coverage, and user experience. Unlike prior research, this study provides quantifiable benchmarks to evaluate improvements in QoS metrics [7].

Future-proofing Refarmed Spectrum for 5G Expansion

Most studies treat 4G and 5G as separate network transitions, but this research highlights how refarmed spectrum can work as a tie between LTE-Advanced Pro (4G) and 5G. It evaluates strategies for co-existence between Long Term Evolution and with the 5G New Radio in refarmed bands [14.

This research offers a novel contribution by integrating spectrum refarming with AI, DSS, regulatory benchmarking, and QoS analytics to maximize 4G network capacity and service quality. It also gives the opportunity for a smoother shift to 5G, ensuring efficient utilization of limited spectrum resources.

Materials and Methods

Research Design

The study adopts a qualitative research design on spectrum refarming to enhance 4G capacity for the improvement of QoS using online open-ended questionnaires. The quantitative approach was considered appropriate for capturing diverse view of major key stakeholders which allows a thorough exploration of technical, policy, social and economic issues [8].

Participants

The target population consist of direct and indirect experts with professionals such as telecom engineers, network engineers, IT specialist, regulatory authorities, supporting staff in the telecom space. The participants were selected using purposive sampling to ensure the people in right skills of specialization in relation with subject matter area with the requisite professional experience in the respective domains are chosen.

Research Instruments

Online questionnaire was used as primary research instrument for data collection. The questionnaires were designed for close-ended question and multiple questions which allow

participants and professionals in the telecommunication sector, including telecom engineers, regulators and IT professionals, regarding their perception on spectrum refarming and its impact on 4G network performance in relation to capacity, coverage and QoS.

The key questions that were focused on:

1. The concept of spectrum refarming?
2. The level of understanding of spectrum refarming?
3. Whether spectrum refarming can significantly improve 4G network coverage and capacity?
4. Telecom operator's priority of spectrum refarming over acquiring new spectrum bands?
5. How the spectrum sharing policies should be introduced to facilitate refarming?
6. The role government should play in supporting spectrum refarming?
7. The challenges face by operators when implementing spectrum refarming?
8. The biggest economic barrier to spectrum refarming?
9. What improvements would you like to see in your 4G service after spectrum refarming
10. Do you think spectrum refarming will pave way for a smooth transition to 5G?

Table 1. Summary of Key Relevance Questions

Question	**Purpose & Relevance**
How familiar are you with the concept of spectrum refarming?	Accessing the baseline knowledge and professionalism engagement in the subject
What is your level of understanding of spectrum refarming?	Respondents to have conceptual understanding and how it is related to capacity, coverage and QoS.
Do you think spectrum refarming can significantly improve 4G network capacity and coverage?	To explore the effectiveness of refarming as a strategy to improve coverage and QoS.
Should mobile operators prioritize refarming over acquiring new spectrum?	The spectrum resources are limited, expensive, underutilized and refarming addresses the cost benefit and operational expenses faced by operators & regulators.
Do you think spectrum sharing policies should be introduced to facilitate refarming?	To provide a regulatory framework and support dynamic spectrum management by introducing policies that will reduce barriers and encourage collaboration.
What role should government play in supporting spectrum refarming?	Government should develop refarming policies guidelines, transparent, regulatory process and bringing stakeholders together in resolving disputes pertaining to spectrum refarming.
What challenges do you think operators face when implementing spectrum refarming?	To allow respondents to share experiences or insights that may delay or hinder refarming process. This may include resistance from stateholders, intereference management and high transition cost.
What is the biggest economic barrier to spectrum refarming?	To understand economic dimension of refarming & pinpoint barriers such as high

	capital expenditure, lack of financial incentives and regulatory fees.
What improvement would you like to see in your 4G service ?	To capture user feedback on the current states of 4G services and identify service gaps, highlight priority areas for future development and provide insights to customer satisfaction.
Do you think spectrum refarming will prepare the way for a smooth transition to 4G?	To serve as a best method for the transition to 5G technology and evaluate stakeholders confidence as a preparatory step for the future network upgrade

Data Collection Procedure

Data were collected using a semi-structured, close-ended questionnaire designed on Google Forms. The questionnaire included questions that explored respondents' understanding of spectrum refarming, the perceived benefits and challenges, and its impact on 4G network performance capacity, coverage, and QoS. close-ended questions allowed respondents to elaborate freely, which is essential in qualitative inquiry [22].

Participation was voluntary, and respondents were informed about the confidentiality of their responses and the overview of the study. Reminders were sent weekly to enhance the response rate and encourage participation from underrepresented groups.

Basically, research findings should be generalizable to the populace from which the sample is drawn i.e., the sample must accurately represent the population [24].

Google forms was used for data collection and secure storage of responses ensuring ethical compliance by embedding an informal section and ensuring participant anonymity.

Results & Discussion

Q01. Age Category of Respondent

The age group of the respondents exhibits majority of the participants are within the middle age working group. This age category of respondents is considered to be more experienced and professionally active in the telecommunication and IT sectors.

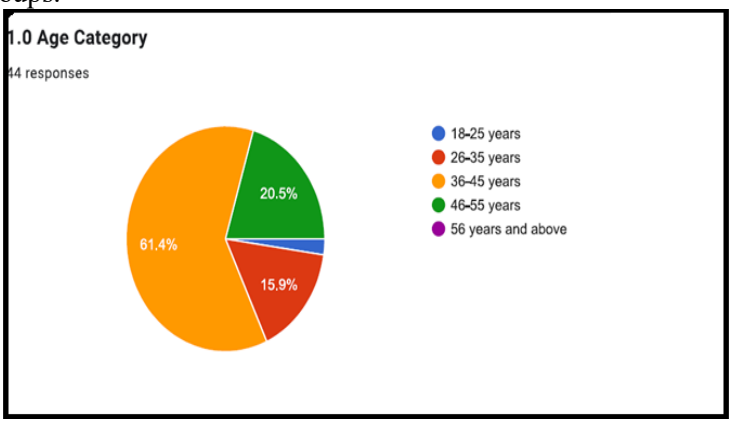

Figure 1. Age Group

The questionnaire garnered 44 responses with 61.4% respondents with age category of 36-45 years gaining the maximum participation as indicated in Figure 1 above.

The 36-45 years was age group representing 61.4% respondents. This shows that a significant portion of participants are in the mi-d level stage having technical, regulatory or managerial skills making their contribution

highly invaluable for the study on spectrum refarming and 4G quality of service.

Age group of 46-55 years' account to 20.5% of the sample and this likely include Mid-level such as senior professionals and decision makers such as policy makers or seasoned engineers with rich experience in the telecom industry and IT space.

The 26-35 years comprising of 15.9% is made of early career professionals who are in technical roles and emerging leadership positions. Their perspective offer insights into operational challenges expectation for future development.

The 18-25 years represents 2.3% of respondents and this category indicating minimal participation from recent graduate trainee and this may reflect the specialized nature of the topic which requires technical & regulatory understanding.

The was no respondents above 56 years and this may due to lack of participation from professionals close to retirements.

Q02. Field of Study

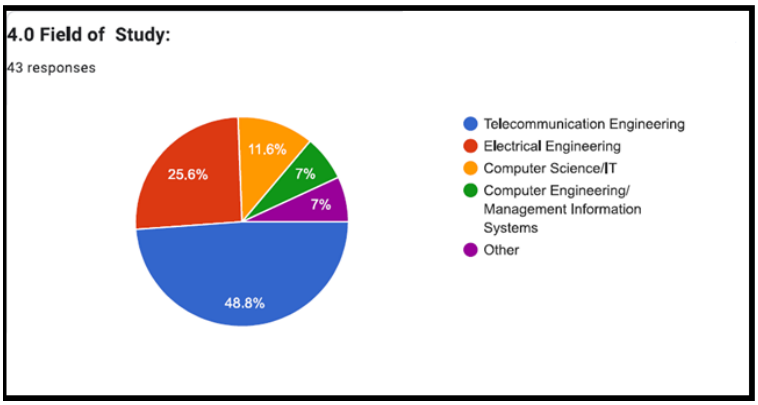

Figure 2. Field of Study

The respondents of this study come from a variety of academics & professionals within the engineering technology disciplines with 43 responses as indicated in figure 2. above.

Telecommunication Engineering (48.8%)

The dominant field of study for this research is the telecom engineers having almost half of the respondents with background align with the core subject of the research with technical expertise in spectrum usage, radio frequency planning and mobile network infrastructure [2].

(Electrical Engineering (25.6%)

A substantial portion of the participants was from electrical engineering space related to the telecommunication industry. These individuals often work in areas in such as signal processing, network systems & infrastructure and making their input relevant to the meaning of spectrum management and network performance [25].

Computer Science /Information Technology (11.6%)

This category of group has professionals in software and digital systems that contribute into how spectrum refarming may impact data services, and backend systems supporting 4G and future 5G services. [7].

Computer Engineering & Management Information Systems(MIS) (7%)

These respondents provide a combination of skilled persons in hardware, software and business systems which can be useful in understanding the operational, data handling and administrative challenges in deploying spectrum refarming and enhanced networking services [4].

Others (7%)

This respondent may come from non-technical areas such as economics, policy

studies, business offer valuable insights into strategic, economic framework and regulatory that impact spectrum policy and industry decisions [18].

Table 2. Summary of Key General Information and Current Network Experience Questions

Question ID	Question text	Response Option-1	Response Option-2	Response Option-3	Response Option-4
Q06	How familiar are you with the concept of spectrum refarming?	Very familiar [69.8%]	Somewhat familiar [30.2%]	Not familiar	
Q07	Which Mobile network operator do you often use?	MTN [65.1%]	Telecel [16.3%]	AT [11.6%]	Other [7%]
Q08	Which type of mobile device do you use?	Smartphone [97.7%]	Other [22.3%]	Basic Phone	Tablet

Table 3. Summary of Key Current Network Experience

Q09	How will you rate the coverage of your 4G Network?	Excellent {22.7%]	Good [54.5%]	Average [20.5%]	Poor [2.3%]
Q10	Do you experience network congestion during peak periods?	Yes [52.3%]	No [20.5%]	Sometimes [27.03%]	
Q11	What is the most common network issue you face?	Slow Internet Speed [68.2%]	Call Drops [9.1%]	Poor Coverage [9.1%]	Other [11.4%]

Q06: A total of 43 responses according to Table 2. above, out of which (69.80%) respondents were fine with the concept of refarming and (30.20%) of respondents are somewhat familiar and (0.00 %) not familiar. The results indicate clearly that respondents are professionals from telecommunication engineering and IT space who have greater knowledge in spectrum refarming.

Q07: The respondents in this category were using MTN network which has (65.1%) of the 43 responses, Telecel (16.3%), AT (11.6%) and Other (7%).However as at end of July 2024 MTN has gained the largest market share of subscriber base which culminated to 75.33%, Telecel Ghana had a 17.7% of the market share and AT with 7.51% of the current subscribers' market share and this was a true representation of the results by the respondent according to Table 2. [21].

Q08: According to Table 2, appreciable number of the respondents used smartphone as mobile device which contribute to 97.7% above average compare to other devices such as Basic Phone (0%.00), Tablet (0.00%) & Other (2. 3%).In a nutshell, Smartphone is the most used device for communication and once spectrum refarming is deployed, it creates opportunity for users to upgrade their mobile devices which in turn will increase the usage of smartphone devices.

With reference to Table 3, many of the participants had good 4G coverage representing 54.5% compared to 22.7% of excellent coverage and this depend on the type of mobile networks the respondents have subscribed to for better services. Moreover,

majority of the respondents admitted they have congestion of (52.3%) at peak period and No congestion represents (20.5%) with sometimes congestion of (27. 3%).Spectrum refarming when implemented by operators will increase capacity and minimize network congestion. In additionally, with respect to Table 3, the greatest network issues faced by respondents was slow internet since majority of them experience issues due to congestion at peak hours which impact slow data due to capacity constraints. Refarming of GSM bands to be deployed to improve 4G coverage and capacity enhancing quality of service.

Key Technical Questions

Q15.0 Which of the following is a major technical challenge faced during spectrum refarming?

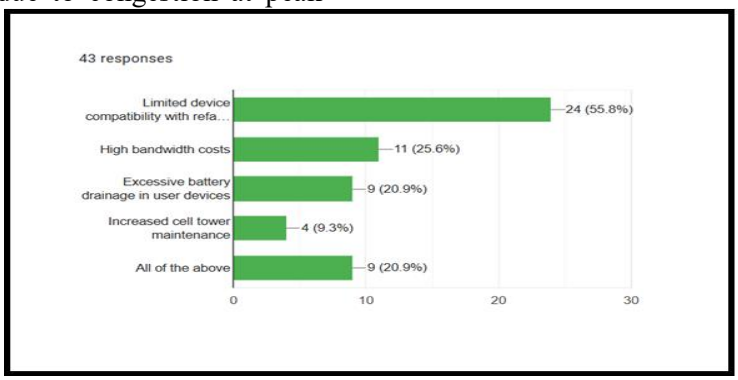

Figure 3. Technical Challenges

Q15: From Figure 3 above, responses from 43 participants were received as the major technical challenges faced during spectrum refarming. The key issue identified represents (55.8%) which is the limited device compatibility with refarming bands. The challenge becomes critical because, following spectrum refarming data traffic volume is likely to improve significantly if device compatibility is considered as priority at early planning stage enabling users to purchase handsets that support the newly deployed frequency bands. Also, high bandwidth cost pose threat to operators in securing required spectrum for deployment.

Q18.0 What type of network optimization strategies should accompany spectrum refarming?

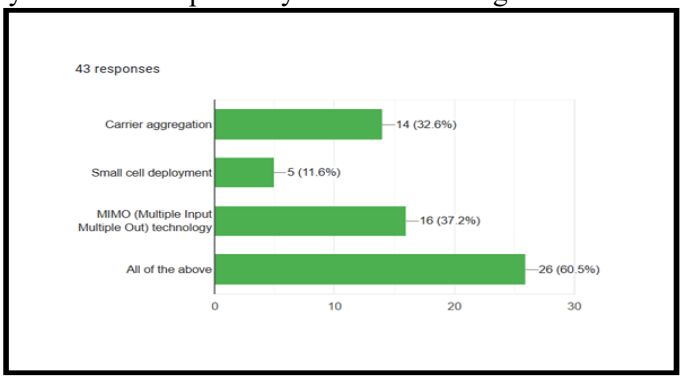

Figure 4. Optimization Strategies

Q18. According to Figure 4 above, the survey results shows that (60.5%) of respondents believe that combination of the strategies including carrier aggregation, small cell deployment and Multiple –Input Multiple-Output should be employed. The (37.2%) of respondents pointed out MIMO as key enabler to increase spectral efficiency and improve signal quality. Meanwhile, (32.6%) favored carrier aggregation since it affords the

operators the opportunity to combine multiple frequency bands to create more channels to boost data throughput and (11.6%) of the respondent emphasized small cell deployment to improve coverage and capacity at high traffic are

Key Regulatory Questions

Q24. What are the key regulatory barriers to implementing spectrum refarming?

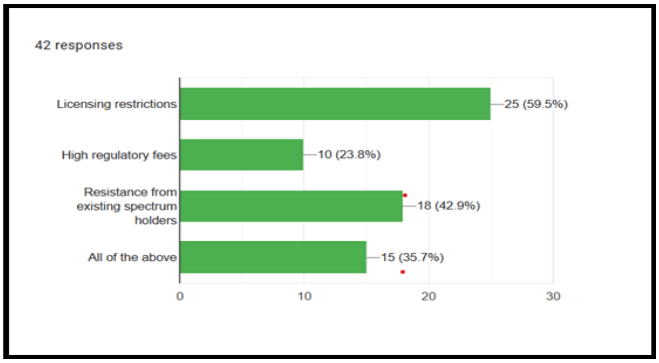

Figure 5. Regulatory Barriers

From the Figure 5 above, the outcome of the study shows significant regulatory to the implementation of spectrum refarming as indicated in the survey results, (59.5%) of respondents identified licensing restrictions as the most critical. Additionally, (42.9%) of the respondents pointed to resistance from incumbent spectrum holders who reluctantly fails to release existing allocation due to vested commercial interest of operational service disruption. (23.9%) cited high regulatory fees which discourage operators from engaging refarming initiates in spite of the gains.

Q27. What role should government play in supporting spectrum refarming?

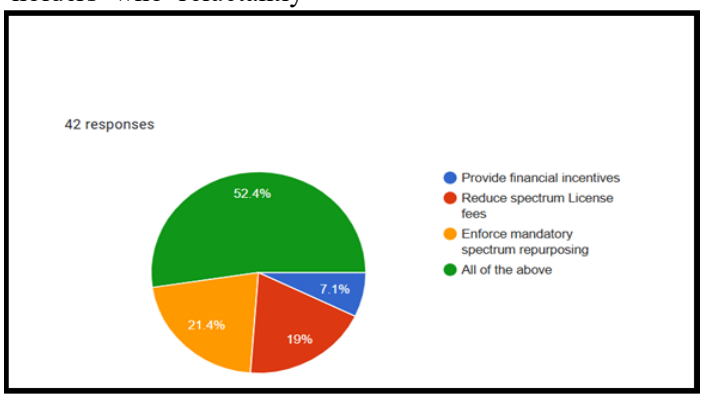

Figure 6. Government Role

From Figure 6 above, survey results indicate that the function of government is considered as pivotal in processing successful spectrum refarming. A (52.4%) of respondents selected All of the above suggesting that, a complex approach involving both regulatory and financial strategies was most effective. Moreover, (21.4%) of the participants suggest the government to enforce mandatory spectrum reallocation policies ensuring the underutilized spectrum band will be reassigned for efficient use of 4G or 5G. (7.1%) point to the significance of financial incentives to encourage infrastructure upgrades and adoption of new technologies.

Key Economic & Social Questions

Q31. Will spectrum refarming lead to increase investment in mobile broadband infrastructure?

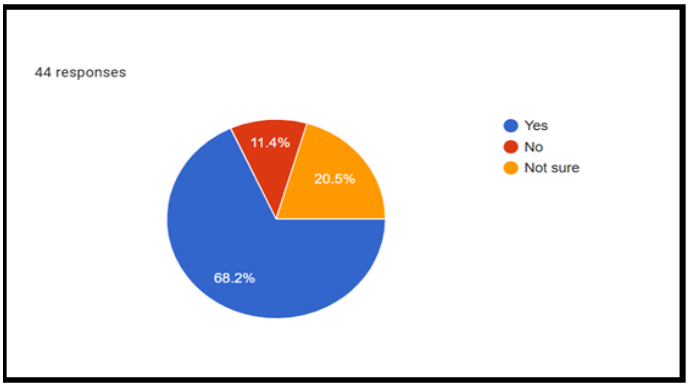

Figure 7. Investment in Broadband

Base on the Figure 7 above, (68.2%) of respondents agreed that refarming would lead to increase investment, while (11.4%) disagreed and (20.5%) was uncertain. Spectrum refarming not only enhances spectrum efficiency but accelerate in improving QoS and digital inclusion.

Q34. How will better 4G coverage impact social and economic activities in your region?

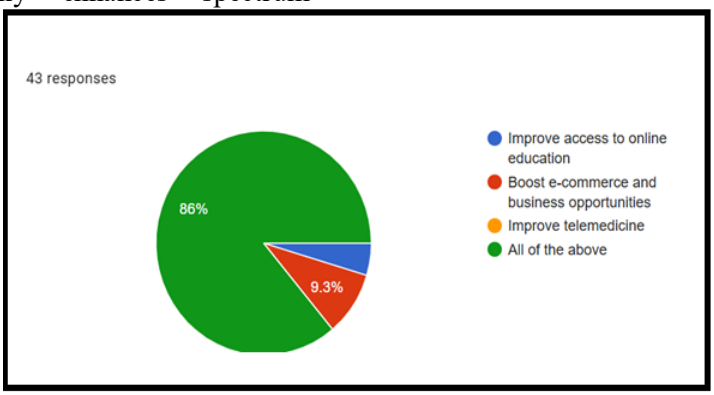

Figure 8. 4G Coverage

According to the survey results from Figure 8 above, (86%) of respondents selected All the above showing a strong census that enhanced broad band to have multiple interlinked benefits. (4.7%) of respondents noted that it will bring access to online education in the remote areas and bridging the educational gaps. (9.3%) of respondents pointed out how 4G coverage will boost e-commerce and business opportunities enabling entrepreneurs to adopt digital financial service and reach out to broader markets.

Conclusion

The study explored stakeholders' perception on the role of spectrum refarming in enhancing 4G network capacity and improving QoS and responses to questionnaires from professionals in telecommunication, IT, Regulatory in addressing the network constraints in spectrum refarming.

Moreover, the responses affirm that spectrum refarming is seen as practical solution to improve 4G performance and would increase investment in mobile broadband infrastructure.

Limited device compatibility, license restriction and high regulatory fees are barriers to implementation of spectrum refarming and requires the intervention of regulators in supporting the process through policy enforcement, cost reduction and financial incentives.

In addition, the results from survey participation indicates that improved 4G coverage will positively affect economic, social sectors with strong support for its impact on

online education, business growth and digital inclusion.

Finally, the spectrum refarming serve as a foundation for a smoother transition to 5G by optimizing existing frequency and reducing the need for entire spectrum acquisition.

Conflict of Interest

I Albert Neequaye Kotey hereby declared that, there is no conflict of interest regarding this research work

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Uptake of Covid-19 Vaccinations in the Aftermath of Covid-19 Pandemic among Adolescents in the Bole District of the Savanna Region

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Abstract

This study examines adolescents' knowledge, attitudes, and uptake of COVID-19 vaccinations in the wake of the pandemic in the Bole district of the Savannah Region. Data was gathered through focus groups, and key informant interviews. Thematic analysis was employed for data analysis. The findings confirmed Rosenstock Health belief theory which discussed some components that may affect the behaviour of people to accept immunization/vaccination. This revealed a moderate level of knowledge among adolescents, with gaps in understanding the broader significance of vaccination. Attitudes were mixed, with positive sentiments attributed to perceived protective benefits and concerns about the necessity of vaccination. Diverse perceptions regarding safety, efficacy, and significance of COVID-19 vaccines were identified. The study recommends targeted educational programs, community engagement, and communication strategies to enhance vaccine-related knowledge and address hesitancy among adolescents. Future research is encouraged to explore broader geographical scopes and diverse populations for a more comprehensive understanding.

Keywords: *Adolescents, COVID-19, Qualitative Study, Vaccination.*

Introduction

The SARS-CoV-2 virus is the infectious agent that causes coronavirus illness (COVID-19) [1]. Respiratory disease is experienced by those who have contracted the virus. Nonetheless, some people get severe illnesses and need medical care. The three most typical signs of COVID-19 are fatigue, dry cough, and fever [2]. Because it is a respiratory condition, an infected person may spread the virus through sneezing, speaking, coughing and poor practices of respiratory etiquettes and hand hygiene. Among the methods to stop the infection from spreading to oneself and others are wearing an appropriately fitting nose mask, washing your hands often, and applying an alcohol-based rub [3].

A major COVID-19 sickness is expected to attack the vulnerable, particularly the aged and other with medical illnesses such as diabetes, cardiovascular disease, cancer, or chronic respiratory ailments. However, the condition could also affect anybody which could become serious [4]. According to Fazel et al. (2021), With the COVID-19 pandemic spreading to several countries and being labelled as a "disease of the young," the focus shifted to preventing the disease's spread among younger people [5]. Due to their developing immune systems and limited ability to defend themselves against infectious diseases,

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adolescents were susceptible to the COVID-19 infection. Thus, in order to meet the immunization targets for public health, it is critical to assess the knowledge and attitudes regarding the uptake of COVID-19 vaccinations in this group [6].

Agyekum et al. (2021), claim that it is one of the deadliest illnesses in living memory [7]. Around the end of 2019, the first case of the novel Corona Virus (COVID-19) SARS-CoV-2 was reported in China [7]. By January 2020, the virus had quickly spread to other countries. The World Health Organization (WHO) declared the epidemic to be a pandemic on March 11, 2020 [1].

The new coronavirus disease (COVID-19) had more than 200 million cases worldwide by August 2021. Over 4 million of those included in this number tragically passed away [8]. At that point, there were approximately 4 million cases and over 100,000 deaths in the African region [8]. On the 18th of July 2022, the global view of Covid-19 stood at 569,194,391 cases and 540,403013 deaths. Africa recorded 12,423000 cases and 256000 deaths in mid July 2022 [2]. At the time of the COVID-19 pandemic, many African nations implemented lockdowns or quarantines to control the blow-out of the virus. However, these actions unintentionally resulted in negative consequences such as worsening non-COVID-19-related health outcomes, increasing mental health problems, and exacerbating economic inequality [2].

Ghana announced its first two COVID-19 cases on March 12, 2020. [9]. Ghana declared a partial lockdown on March 28, 2020, commencing on March 30, 2020, at 1:00 local time, and continuing for 14 days. One hundred and forty-one cases of COVID-19 were confirmed in Ghana when the control measures were implemented [10]. Only basic things like food, medicine, water, paying utility bills, going to the hospital, pharmacies, or banks were allowed for citizens to leave their houses [10]. To handle the COVID-19 pandemic's probable repercussions in Ghana, the government set five main goals. These included (1) limiting and stopping the virus's importation, (2) containing its spread, (3) providing proper treatment for the ill, (4) reducing the virus's negative effects on social and economic life, and (5) boosting domestic output to promote independence [10].

Due to a lack of vaccine availability and the fact that most young people were showing mild signs and symptoms, these groups of people were not prioritized. Young people, however, had infection rates that were comparable to those of other population groups, which means that they could potentially spread infection to more at-risk individuals in their homes, schools, and communities.

Meanwhile, several investigations have demonstrated that COVID-19, especially when the delta variation is present, can be a dangerous illness that even affects children and teenagers, requiring hospitalization due to severe complications [11].

Once more, early data from high-income to low-income nations indicates that children and teenagers younger than 18 may contract and spread SARS-CoV-2 illness [12]. However, information that was accessible globally showed that youth and adolescents were becoming more and more representative of the COVID-19 case load [12]. The insurgence of Covid-19 had dire consequences in all spheres of life affecting every human social and economic activity.

Evidence from a field survey showed that there was low turn-out rate of the people of Bole toward Covid-19 vaccination, and this was attributed to some fears. A report from the Bole District Health Directorate indicated that the district recorded a total 433 suspected cases out of which 93 were confirmed positive cases with 2 deaths from the start of the covid-19 pandemic in 2020 to the first quarter of 2023 in the Bole District [13].

In the Savanna region, out of the 7 districts, the total number of people vaccinated in Bole

as of February 2023 for all doses (1st dose+2nd dose+ 1st booster+ 2nd booster) was 83,810. The entire count of individuals who received a dosage was 35,246 representing (15.6%) of the total population of 120,715, the total adolescent population (persons between the ages 10-19 years) was 27,040, representing 22.4% of the total district population vaccinated. This constituted the lowest age group being vaccinated against the district Covid-19 vaccination target of 58%. According to the Bole District Health Information Officer, "Ghana Health Service has integrated Covid-19 vaccination into its routine vaccination schedule in an effort to contain the pandemic and prevent its resurgence after it was deemed to be a public health concern rather than an emergency". The results are yet to be achieved most especially among the adolescents [13].

Negative attitudes and misconceptions about vaccine safety and effectiveness can lead to reluctance to get vaccinated. Also, peer influence can influence the uptake of the vaccination among adolescents. Additionally, certain perceptions, such as beliefs in conspiracy theories or misinformation, can further hinder the acceptance and uptake of COVID-19 vaccinations among adolescents.

This study is required to fill a research gap concerning the knowledge, attitudes, and ongoing uptake of the COVID-19 immunizations in the aftermath of the pandemic specifically among adolescents in the Bole District. According to Bole District Health Directorate, the total adolescent population (persons between the ages 10-19 years) was 27,040, representing 22.4% of the total district population vaccinated [13]. While there have been studies exploring vaccine acceptance and hesitancy in general populations, there is limited research focusing specifically on adolescents. Prior studies have mostly concentrated on adult populations, which has resulted in a large knowledge vacuum on the variables influencing teenage vaccination uptake in this district. Moreover, a customized study is necessary to pinpoint the obstacles and prospects for enhancing adolescent vaccination uptake in the Bole District due to its distinct features and contextual elements. Therefore, the study's main objective was to evaluate the participants' knowledge, attitudes, and perceptions on the Uptake of COVID-19 Vaccinations among Adolescents in the Bole District. The results of this investigation may help in the development of targeted interventions, educational campaigns, and strategies to increase vaccine uptake among adolescents.

Conspiracy Theories about Covid-19 Vaccines

Since immunization was first proposed and widely accepted, there has been anxiety and suspicion over vaccinations. "Agree" is the response given by respondents to a nationally representative study of Americans when it comes to "doctors and the government still wanting to vaccinate children even though they know these vaccines cause autism and other psychological disorders." For instance, the idea that vaccines can cause autism is unsupported by empirical evidence [14].

State officials promoted conspiracy theories in some nations, such as the US, which recorded the most confirmed COVID-19 cases [15], and a disturbing one-third of US residents appeared to have believed in these beliefs, such as that the virus was intentionally created. Conspiracy theories are explanatory ideas concerning a group of people who work together covertly to achieve evil objectives [15]. Other conspiracies claimed that COVID-19 was purposefully bioengineered, a biological weapon, or a plan to control the populace [16].

Douglas, (2021), asserted that when psychological demands are not being addressed, conspiracy theories are significant, a poll from the Netherlands, Germany, and Italy indicated 92–99% of respondents resorted to various social distancing practices [17]. What then can account for the USA's comparatively

high non-adherence rate? One significant factor may be the widespread acceptance of COVID-19 conspiracy claims. For instance, some literature demonstrates evidence that a hot environment kills viruses, yet COVID-19 is spreading to some hot nations [18].

COVID-19 immunization campaign is facing a "infodemic" in Europe. Europe's reluctance to receive vaccinations is mostly due to "infodemic." Excessive information that spreads quickly, is purposefully or unintentionally deceptive, and prevents the general public from acting appropriately in times of public health emergency is referred to as a "infodemic [19].

The global public health emergency associated with the Covid-19 epidemic has passed. Over the course of more than a year, the population's immunity to infection and vaccination has grown, fatality rates have dropped, and overall strain on health services has lessened, putting an end to the pandemic. Therefore, I fervently hope that I may officially proclaim Covid-19 to be over as a worldwide health emergency. But that does not imply that Covid-19 is no longer a hazard to international health [20].

While there has been substantial progress in COVID-19 vaccine development and distribution, the uptake of vaccines among adolescents remains a critical concern. Understanding the knowledge, attitudes, and perceptions towards COVID-19 vaccinations among adolescents is crucial for designing effective vaccination campaigns tailored to this specific age group. The Bole District, located in Savanna Region of Ghana, represents an important setting for examining the uptake of COVID-19 vaccinations among adolescents due to its unique characteristics, such as the youth dominance of the population of the district.

Theoretical Framework

This study is based on an adopted theoretical framework from (Rosenstock, 1966) on health belief model [21]. The concept discussed some components that may affect the behaviour of people to accept immunization/vaccination. It explains why most people failed to utilize health services such as immunization/vaccination. It also highlights the role of certain beliefs in stimulating preventive health actions. It goes on to say that people's actions linked to their health will change based on how serious they believe the threat to their health to be. It looked at six (6) different methods to this module in its conclusion. Perceived susceptibility or vulnerability refers to an individual's subjective assessment of the likelihood of contracting an illness. A person's perception of the seriousness of getting sick or of not getting treatment for their sickness is known as perceived severity. Perceived benefits refer to an individual's assessment of the efficacy of different interventions aimed at preventing or curing sickness. Perceived barriers are people's perceptions of the difficulties in carrying with advised health actions, Cues to action: the internal or external stimulus required to start the decision-making process to embrace a recommended health action Self-efficacy is the degree to which an individual believes that he can carry out an action successfully [22].

This framework also recognised the need for a study to be carried out before any intervention is designed. This study is therefore in accordance with the framework.

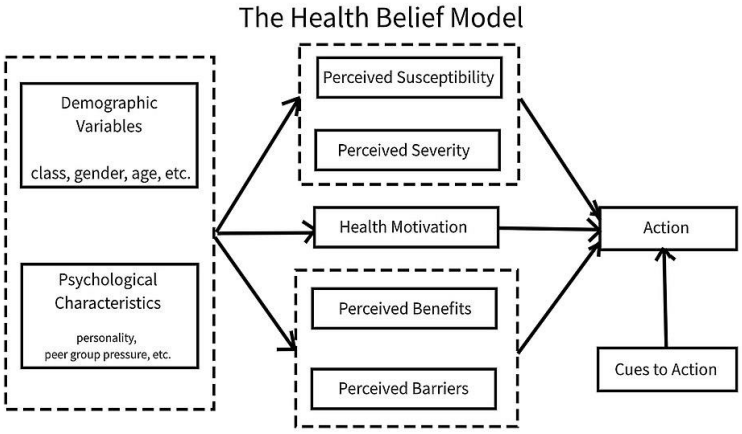

Figure 1. Health Belief Model, Rosenstock, (2015) [21]

Study Area

The study area is Bole District in the Savannah Region of Ghana. The district is situated between latitude 8'10.5 and 09' and longitude 1.50E' and 2.45 W. It is located at the extreme western part of the Savannah region of Ghana. It is also bordered to the north by the Sawla-Tuna-Kalba district, to the west by the Republic of Cote D'ivoire with the Black Volta as the boundary between the two neighbouring countries, to the east by the West Gonja district and to the south by the Kintampo and Wenchi Municipalities in the Bono and Bono East regions [22, 23].

The population of the district is 120,715 projected based on the 2020 population census of 62,719 using 3.6% National Growth Rate and 78,836 using 2.9% Growth Rate of Savannah Region. Ghana Health Service is the main institution that provides health services including CHAG facilities [22, 23].

Adolescents in the Savannah Region and the Bole district participated in the study. Among the sixteen regions of Ghana, the Savannah region occupies around 70,384 square kilometers, or 29% of the country's total land area. As of the 2020 census, 2,336,196 people are estimated to live there. It is split up into seven (7) administrative and political districts, each of which is led by a district chief executive. The districts are further divided into 45 health sub-districts, one of which being Bole district, the site of the study [22, 23].

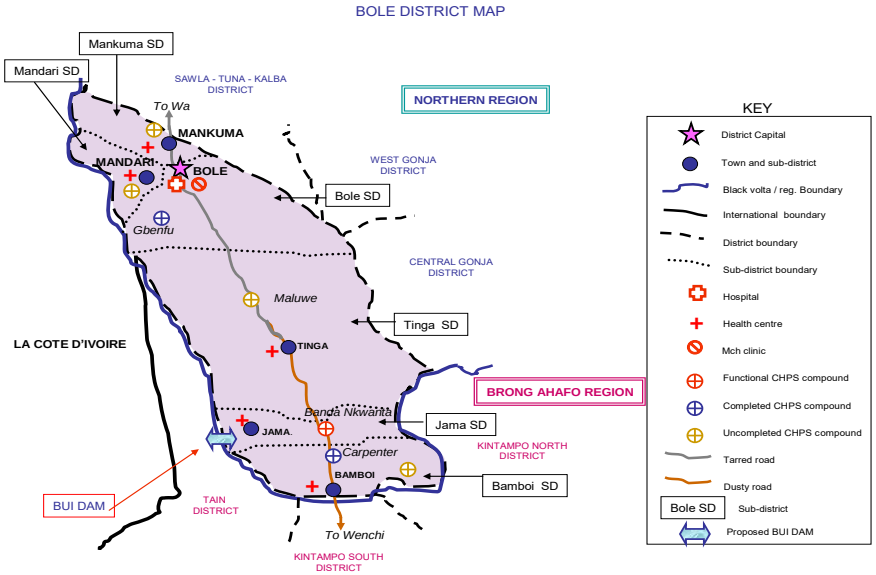

Figure 2. Map of Bole District, Bole District Assembly (2O20), Bole District, (2010) [22, 23]

Health Services Provided

Health services provided at the health institutions include preventive, promotive, curative, palliative and rehabilitation. Specific services are reproductive and child health (RCH) which embodies ANC, Skilled Delivery, PNC, Family Planning services, Expanded Program on Immunization (EPI), Growth promotion, integrated outreach services, community –based health planning and services (CHPS) as well as treatment of clinical cases, minor ailments and screening services. In otherwise preventive, promotive, curative and community base (CHPS) services are provided in the district [13, 25].

The health status of the people of Bole district is among the worst in the Region. Utilization of available health facilities and health services is very low, especially among the adolescents. There is poor health seeking behaviour and many patronize the services of quack doctors, herbalist and rather report very late to the health facilities as a last resort. Family Planning Acceptor Rate is very low 4.3%. This is as a result of socio-cultural and religious beliefs coupled with rumors that need to be addressed [13].

Study Design

A qualitative method was used. a population-based survey and is used to assess the knowledge, attitude, and uptake of Covid-19 vaccines among adolescents at a relatively faster rate.

Study Population

The study population is adolescents between the ages of 10 – 19 years and who has either taken a jab with evidence card or has never taken a jab and who leave in urban and rural communities within the Bole district.

Data Collection Tool

Focus Group Discussion (FGD) was conducted to allow in-depth exploration of different points related to the topic. Focus Group Discussion guide was prepared to guide for study. Also, field notes were taken alongside the use of a tape recorder to complement the written notes. Participants will be with the same characteristic such as socio-economic, age and sex which will create an enabling environment for them to communicate freely. They will be identified in the communities based on their own interest to be part of the discussions. Each group will consist of eight to ten participants. Their opinion will be always respected to enable them actively to contribute to the discussion without fear, and to enable to enable the researcher compare findings. The discussion will be led by a moderator and there will also be a note taker. Each discussion will last between one and one and half hours. For the sake of privacy, the study participants will be isolated from the public for discussion.

Key Informants Interview

Key informant interview was carried out by identifying two adolescent health educators in the communities where the study will be conducted, this will provide a one-on-one conversation to explore the topic in detail. It will also encourage respondents to come up with their opinion about the topic to validate with the focus group discussions. A semi structured interview guide with open-ended questions was prepared to guide the interview. The data collection continued until there was saturation of information and themes, where no new information is generated in the final interview.

Data Management and Analysis

The data collected was analysed using the thematic analysis, and the audio recordings transcribed by putting them into themes and coded. The teams were identified by bringing together the fragments of ideas and experiences from the data collected. It was translated and interpreted. The differences and similarities of the data were compared. The data collection continued until there was saturation of

information and themes, where no new theme was generated in the final interview.

Ethical Clearance

Ethical clearance was obtained from the ethics committee of the University for Development Studies. Participants were counselled and permission was sought before interviews. Confidentiality was assured about the information provided. The anonymity of the participants was guaranteed and Focus Discussion Group made it to agree to keep the discussion confidential. The purpose of the study as well as the general themes was explained to participants to understand what the discussion was about.

Results

Demographic Features of the Respondents

This section presents an overview of the demographic characteristics of the study participants, as illustrated in Table 1, reveals that in terms of age, most respondents are in the 16-18 years bracket, making up 30% of the total. This is followed by the 12-15 years group comprising of 20%, and the 19-21 years group also made of 10%. The gender distribution is evenly balanced, with an equal number of male and female respondents, each representing 50% of the total. From an educational standpoint, many individuals have completed Junior High School (40%), followed by Senior High School (30%), College/University (16%), and Other (14%). Most people live in rural areas when it comes to residential locations (76%).

Table 1. Results on the Demographic Features of the Respondents

Demographic Feature	Option	Frequency	Percentage (%)
Age	12-15 years	100	20
	16-18 years	150	30
	19-21 years	50	10
Gender	Male	250	50
	Female	251	50
Educational Level	Junior High School	200	40
	Senior High School	150	30
	College/University	80	16
	Other	71	14
Residential Location in Bole District	Urban	120	24
	Rural	381	76

Source: Field Data Analysis, (2023)

Focus Group Discussion Responses

The results from the focus group discussions with the participants were presented in Table 2. It revealed several key themes and sub-themes regarding COVID-19 vaccination.

Table 2. Themes and Sub-Theme

	Core themes	Subtheme
Theme 1	Knowledge	1. Awareness About COVID-19 Vaccines
		2. Sources of Information of COVID – 19 Vaccines
		3. Reliable Sources of Information
		4. Barriers or Challenges in Accessing Information
		5. Myths or Misconceptions

		6. Concerns or Doubts
Theme 2	Vaccination	1. Perceived Safety
		2. Efficacy in Protection
		3. Significance of Vaccines
		4. Understanding of Long-term Effects
		5. Belief in Crucial Role of Vaccines

Theme 1: Knowledge

1. **Awareness About COVID-19 Vaccines**

"I know vaccines protect against COVID-19, but specifics like types and effectiveness vary among us." Participant 1 in Group 3

"Learning in school helps, but media updates and discussions with friends add more details." Participant 2 in Group 2

"Some think vaccines cause the virus or alter DNA; clarifying such myths is crucial." Participant 3 in Group 1

2. **Sources of Information of COVID – 19 Vaccines**

"School teachings give basics, but social media and healthcare provider discussions provide real-world context." Participant 4 in Group 2

"Media is quick, but healthcare providers explain better during check-ups or special sessions." Participant 5 in Group 3

"We share information with each other; it's like a mix of school lessons and friend discussions." Participant 6 in Group 1

3. **Reliable Sources of Information**

"Healthcare providers are trustworthy; they give personalized advice, making it more reliable." Participant 3 in Group 2

"Official announcements and news are good, but sometimes they're too general; we prefer detailed discussions." Participant 9 in Group 3

"We rely on fact-checking websites; they help confirm if what we hear elsewhere is accurate." Participant 10 in Group 1

4. **Barriers or Challenges in Accessing Information**

"In rural areas, limited internet access affects getting timely updates; we rely more on community discussions." Participant 1 in Group3

"Misinformation spreads fast, and it's hard to separate fact from fiction; clearer guidance is needed." Participant 4 in Group 3

"Sometimes, healthcare information seems complicated; simplifying it would make it more accessible." Participant 2 in Group 2

5. **Myths or Misconceptions**

"People say vaccines give you COVID-19; it's confusing, and we need more accurate information." Participant 7 in Group 2

"Some think microchips are in vaccines; these ideas spread fast and create unnecessary fears." Participant 8 in Group 1

"Misconceptions about fertility issues need addressing; they affect decisions, especially among girls." Participant 9 in Group 1

6. **Concerns or Doubts**

"Side effects worry some; understanding what's normal and what's would not be reassuring." Participant 3 in Group 3 in Group 1

"Long-term effects are a mystery; more information on that would help clear many doubts." Participant 5 in Group 1

"People are unsure about vaccine safety; building trust in the process is essential." Participant 1 in Group 2

Theme 2: Vaccination

1. Perceived Safety

Participant in Focus Group 1: Observed thus *"I believe the vaccines are safe, especially after observing family members get vaccinated without any major issues."*

Another participant in Focus Group 2 asserted that: *"There's some concern about*

long-term effects, but overall, I trust the science behind the vaccines."

Participant in Focus Group 3: *"Safety is a priority, and I rely on healthcare professionals for accurate information on vaccine safety."*

2. Efficacy in Protection

Participant in Focus Group 1 intimated that: *"I've seen the vaccines work in preventing severe illness, so I'm confident in their effectiveness."*

Participant in Focus Group 2 has it that: *"I'm unsure about how long the protection lasts, but the immediate protection is reassuring."*

Participant in Focus Group 3 equally observed as: *"There's a general belief that the vaccines are effective in reducing the spread of the virus."*

3. Significance of Vaccines

Participant in Focus Group 1 asserted that: *"Vaccines are crucial for protecting vulnerable populations and achieving herd immunity."*

Participant in Focus Group 2 says that: *"I see vaccination as a way to return to normalcy and protect my loved ones."*

Participant in Focus Group 3 observes the following: *"Despite some doubts, I understand the importance of vaccines in controlling the pandemic."*

4. Understanding of Long-term Effects

Participant in Focus Group 1 says that: *"I'm curious about any potential long-term effects, but I trust ongoing research to provide answers."*

Participant in Focus Group 2 indicates that: *"There's a need for more information on the long-term effects of the vaccines to alleviate concerns."*

Participant in Focus Group 3 has it that: *"Long-term effects are a concern, but I weigh them against the immediate benefits of vaccination."*

5. Belief in Crucial Role of Vaccines

Participant in Focus Group 1 asserted that: *"I believe vaccines are essential in ending the pandemic and preventing future outbreaks."*

Participant in Focus Group 2 indicates: *"Despite some skepticism, I recognize the role vaccines play in saving lives and reducing hospitalizations."*

Participant in Focus Group 3: *"I have faith in the science behind vaccines and their ability to protect us and our communities."*

Key Informant Interview Responses

The themes emerging from the key informant interviews were presented in Table 3.

Table 3. Key Informant Interview Responses

	Themes
Theme 1	General Attitudes Towards COVID-19 Vaccination
Theme 2	Factors Influencing Attitudes Towards COVID-19 Vaccination
Theme 3	Discussion with Family or Friends About COVID-19 Vaccination
Theme 4	Specific Concerns or Fears Regarding COVID-19 Vaccination
Theme 5	Confidence in the Safety and Effectiveness of COVID-19 Vaccines
Theme 6	Barriers or Challenges in Accessing COVID-19 Vaccination

The interview responses provide insights into various themes related to attitudes towards and factors influencing COVID-19 vaccination among adolescents. These themes include general attitudes towards vaccination, factors influencing attitudes, discussions with family or friends about vaccination, specific concerns or fears regarding vaccination, confidence in vaccine safety and effectiveness, and barriers or challenges in accessing vaccination.

THEME 1. General Attitudes Towards COVID-19 Vaccination

Respondent 1: *"I've noticed a positive shift, especially among those with family members affected. They see vaccination as a protective measure."*

Respondent 2: *"Mixed feelings, some are eager for protection, while others question the need for vaccination, influenced by various factors."*

Respondent 3: *"Many adolescents are curious but cautious. They want to understand more before making a decision."*

THEME 2. Factors Influencing Attitudes Towards COVID-19 Vaccination

Respondent 4: *"Peer influence is strong, and reliable information plays a vital role. Those who trust their sources tend to be more receptive."*

Respondent 5: *"Past experiences with vaccinations shape attitudes. Also, family opinions and cultural beliefs impact their perspectives."*

Respondent 6: *"It's a mix of media influence and community discussions. Adolescents often mirror the opinions they encounter."*

THEME 3. Discussion with Family or Friends About COVID-19 Vaccination

Respondent 1: *"Families play a crucial role. Supportive discussions help ease concerns, but differences in opinions are common."*

Respondent 2: *"Adolescents often consult family members. Some encounter resistance, while others find encouragement."*

Respondent 3: *"Discussions vary. Some families are well-informed and supportive, while others have reservations."*

THEME 4. Specific Concerns or Fears Regarding COVID-19 Vaccination

Respondent 4: *"Speed of development is a concern. Addressing these fears requires targeted education campaigns."*

Respondent 5: *"Fear of side effects is prevalent. Clear communication about vaccine safety is essential."*

Respondent 6: *"Misinformation causes fear. Correcting false beliefs is an ongoing challenge."*

THEME 5. Confidence in the Safety and Effectiveness of COVID-19 Vaccines

Respondent 1: *"Trust in science is a key factor. Those who follow reputable sources are more confident."*

Respondent 2: *"Doubts persist, especially among those exposed to misinformation. Continuous education is needed."*

Respondent 3: *"Confidence levels vary. Effective communication on vaccine safety is critical."*

THEME 6. Barriers or Challenges in Accessing COVID-19 Vaccination

Respondent 4: *"Transportation remains a hurdle, especially in remote areas. Making vaccination centres accessible is crucial."*

Respondent 5: *"Awareness about vaccination centres is lacking. Improving outreach can enhance accessibility."*

Respondent 6: *"Logistical challenges affect access. Overcoming these hurdles requires community-specific strategies."*

Discussion

The study found that adolescents had a modest level of trust in their knowledge about the COVID-19 vaccine. This is consistent with the discoveries made by Abbas et al. (2021), who uncovered a diverse range of beliefs and misconceptions regarding COVID-19 vaccines within a population in Sindh, Pakistan. Nonetheless, the diverse degrees of trust among the participants in the study emphasise the intricate nature emphasised by Acheampong et al. (2021) in their analysis of vaccination hesitancy in Sub-Saharan Africa, highlighting the necessity for focused educational programmes to tackle uncertainty.

The Bole District survey revealed a notable level of doubt in determining the proper age group for vaccination, as participants expressed uncertainty regarding the correct age range. The uncertainty observed in this study aligns with the results of Efendi et al., (2022), who discovered sociodemographic variables that

impact the level of COVID-19 vaccine compliance among teenagers in Indonesia. Nevertheless, the current study's moderate degree of understanding differs from Lv et al., (2021) comprehensive analysis, which highlighted protection, and effectiveness of COVID-19 vaccinations in teenagers, indicating more substantial grasp in that area.

The participants' dependence on healthcare experts or reliable sources for information. The results of Cai et al., (2021) study align with this, as they underscored the favourable sentiments Chinese teenagers have about COVID-19 vaccines, with a particular emphasis on the influence of healthcare providers in creating these beliefs. Nevertheless, the participants' dependence on healthcare experts contradicts the results of Rehati et al., (2022) in Chinese urban areas, where vaccine reluctance was detected among teenagers even before the vaccines were accessible. The variation in vaccine distribution and public opinion may be attributed to contextual disparities.

The finding displayed a range of awareness levels concerning the advantages of COVID-19 vaccinations, with participants considering themselves partially to entirely misinformed. This discovery aligns with Wang. et al., (2022) study on vaccine hesitation among adolescents in sub-Saharan Africa, indicating that insufficient understanding contributes to hesitancy. However, the study's moderate degree of comprehension is different from Adjaottor et al., (2022) study, which predicted COVID-19 stress and vaccination acceptability among adolescents in Ghana. This highlights the complex nature of attitudes towards vaccination.

The Bole District study indicated a significant participant not experiencing any side effects, indicating a moderate level of overall experience with side effects. This is consistent with Lv et al., (2021), which highlighted the safety of COVID-19 vaccinations in children and adolescents. Nevertheless, the current study's moderate degree of expertise differs from the results of Rehati et al., (2022), who discovered vaccine hesitation among Chinese teenagers prior to the availability of vaccines, suggesting diverse attitudes and experiences.

The focus group conversations yielded qualitative insights that offered nuanced perspectives on concerns and uncertainty. The participants' reference to misunderstandings related to vaccination-induced virus or DNA modification aligns with the existing body of work on vaccine misinformation [18]. In addition, barriers to accessing information, such as limited internet connectivity and the spread of misinformation, correspond with the issues raised by Abbas et al., (2021), underscoring the importance of tailored communication techniques in various settings.

The findings of the Bole District study regarding the awareness of COVID-19 vaccines among adolescents are consistent with certain features of previous research. These findings highlight the significance of healthcare providers, the varying degrees of confidence, and the widespread presence of misinformation. Nevertheless, differences in levels of understanding, lack of certainty regarding age-specific details, and encounters with adverse reactions introduce subtle aspects that are not completely reflected in the existing literature. This highlights the necessity for interventions and communication strategies that are specific to the context and tailored to the distinct dynamics of the study population.

This discovery aligns with the wider body of research on vaccination hesitancy, as demonstrated by Acheampong et al., (2021) and Kabakama et al., (2022), who investigated the understanding and opinions regarding COVID-19 immunisations among adult individuals in Ghana. The diverse emotional reactions observed among participants underscore the necessity of customised communication tactics to effectively address distinct concerns and cultivate favourable attitudes.

The finding highlights the acknowledgement of vaccination's role in promoting public health. This discovery is consistent with Alhassan et al., (2021) study in Ghana, which examined the reluctance of adults to receive vaccines. The study highlights the significance of comprehending public attitudes to shape effective vaccination campaigns [8]. The discovery underscores the importance of comprehending the social processes that shape vaccination attitudes, as elucidated by Fan et al., (2021) among university students in mainland China. Key Informant 1's reference to the influence of family dynamics is consistent with existing research on the effects of family conversations on vaccination choices.

The importance of implementing focused educational initiatives to improve trust in scientific knowledge, as emphasised by Key Informant 1. This is consistent with research conducted by Uscinski et al., (2020) van Prooijen & Douglas, (2018), which examined the elements that influence the acceptance of conspiracy theories. These studies highlight the significance of countering disinformation to foster trust in vaccination efforts.

The range of viewpoints, as evidenced by the average rating of 2.95, underscore the necessity for focused communication tactics, specifically targeting apprehensions over the rapidity of vaccine creation, as emphasised by Key Informant 4. This is consistent with Wolff, (2021) research, which utilised the Theory of Planned Behaviour to investigate individuals' intentions to receive the COVID-19 vaccine. The study highlights the need of addressing perceived risks in vaccination efforts.

Key informants had specific worries and fears about COVID-19 vaccination, including apprehension about potential side effects and the impact of disinformation. These qualitative observations are consistent with the existing body of research on the influence of conspiracy ideas [15] and the necessity of effective communication to address concerns connected to vaccines Greenhawt et al., (2021).

The study's findings regarding adolescents' views towards the COVID-19 vaccination programme in Bole District offer a comprehensive insight into the complex aspects that influence perceptions and acceptance. Combining numerical findings with qualitative observations improves the level of understanding, highlighting the significance of customised communication tactics to tackle various issues and promote favourable attitudes towards vaccination.

The intricacies pertaining to safety perceptions align with the findings of Adane et al., (2022) underscoring the significance of comprehending and resolving issues among healthcare professionals in Ethiopia. When evaluating the efficacy of vaccines in providing protection, it was found that participants perceived them as highly successful, and some considered them to be moderately effective, and few claimed that they were not beneficial at all. These are aligned with studies conducted by Bagateli et al., (2021) in Brazil, emphasising the importance of using focused communication techniques to tackle vaccine reluctance among parents.

The motivations for vaccination were found to be varied, with some individuals seeking to safeguard their own health, the health of others and desiring a restoration of normalcy in their lives. The findings highlight the importance of using customised communication strategies, as emphasised in the research on vaccination hesitancy in Ghana [8].

The study's findings shed light on the complex web of views and attitudes among adolescents in Bole District surrounding COVID-19 immunisations. The examination of pertinent literature emphasises the crucial requirement for tailored communication strategies and focused public health campaigns to tackle the complex factors influencing vaccination acceptance and hesitancy. This study provides useful insights into the larger comprehension of public views regarding COVID-19 vaccines, thus enhancing the

existing research on vaccine hesitancy and its determining factors.

Conclusions

The study revealed a moderate level of COVID-19 vaccine-related knowledge among adolescents in Bole District. While a significant portion demonstrated awareness, a noteworthy proportion exhibited gaps in understanding. This suggests the need for targeted educational interventions to enhance knowledge levels, ensuring a more informed adolescent population regarding COVID-19 vaccines.

Adolescents generally exhibited positive attitudes towards the COVID-19 vaccination campaign. A substantial percentage expressed willingness to participate, reflecting a favourable disposition towards vaccination. However, the presence of vaccine hesitancy signals the importance of addressing specific concerns. Tailored communication strategies and community engagement initiatives may prove instrumental in fostering more positive attitudes and mitigating hesitancy.

The study found diverse perceptions among adolescents about the safety, efficacy, and significance of COVID-19 vaccines. While a significant proportion perceived vaccines as safe and effective, a considerable number expressed reservations. These findings underscore the complex nature of vaccine-related perceptions, emphasizing the necessity for nuanced public health messaging that addresses precise concerns and builds trust.

A positive correlation between COVID-19 vaccine-related knowledge and vaccine uptake was observed among adolescents. This underlines the pivotal position of knowledge in persuading vaccination behaviour. Strengthening awareness through targeted educational initiatives may contribute to increased vaccine acceptance and uptake among adolescents.

The study identified a moderate positive relationship between adolescents' perceptions of COVID-19 vaccines and their vaccination behaviour. While positive perceptions were associated with higher vaccination rates, addressing concerns expressed by those with more negative perceptions becomes crucial. Tailoring interventions to address specific perceptions can contribute to a more favourable vaccination landscape.

Recommendations

1. The Ministry of Health as a policy making institution should develop and implement a comprehensive and targeted educational program aimed at enhancing COVID-19 vaccine-related knowledge among adolescents. This can be achieved through collaboration with educational institutions, community leaders, and youth organizations, ensuring the dissemination of accurate and accessible information to address existing knowledge gaps.
2. Ghana Health Service, responsible for policy implementation, should focus on community engagement and communication strategies tailored to address vaccine hesitancy especially adolescents as a target group. This involves actively involving community leaders, Opinion leaders and local health practitioners in disseminating information, fostering a positive attitude towards vaccination, and dispelling myths and misconceptions. The implementation of mobile vaccination clinics in schools and communities can also facilitate and increased access to vaccines.

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Conflicts of Interest

The authors declare no competing/conflicts of interests.

Informed Consent

Written consent was sought after participants were counselled and the questionnaires explained to the best understanding of the participants before questionnaire administration.

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Effect of Learning Cycle Approaches on Students' Achievement in Science in Senior High School

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Abstract

The study examined the effect of learning cycle approaches on academic achievement of students in science. It employed a quasi-experimental non-randomized pre-test, post-test experimental group design. The study used a mixed method approach of both qualitative and quantitative method of data collection and analysis. A detailed lesson plan was prepared to ensure active involvement of students in the learning process. Using the multi-stage sampling procedure, three classes were purposively selected and 120 students were randomly selected to take part in the study. Data was collected through the use of the Science Achievement Test (SAT), interviews, and observations. The data collected was analyzed using the Statistical Package for Service Solutions (version 26.0). The statistical tools employed for the analysis are descriptive statistics (mean and standard deviation) and inferential statistics (t-test and ANOVA). The results showed that:

1. *There was no statistically significant difference in the pre-test scores for the three model class groups. However, there was a statistically significant difference in the post-test scores for the three model groups.*
2. *Also, there was a significant and very large effect of the 3E, 5E, and 7E models on the students taught with the 3E, 5E, and the 7E learning cycle approaches in favour of the 7E.*
3. *There was no significant difference in scores for low- achievers and high achievers taught with the 3E, 5E, and 7E models.*

Keywords: *Achievement, High Achievers, Low Achievers, Learning Cycle Approach, Science.*

Introduction

Learning cycle approach is a pedagogical method that encourages students to engage in a scientific inquiry process through multiple stages, including exploration, concept development, and application. It is a widely utilized pedagogical strategy in science education that emphasizes active engagement, hands-on experiences, and reflection to enhance students' understanding of scientific concepts. This approach is grounded in constructivist learning theory, which posits that students construct knowledge through experiences and interactions with the environment. By incorporating the Learning Cycle model into science instruction, educators aim to promote deeper learning, critical thinking skills, and a more thorough understanding of scientific principles among students.

This study aims to investigate the impact of the learning cycle approach on students' achievement in school.

By guiding students through a series of hands-on investigations, discussions, and reflections, the learning cycle approach aims to foster deep understanding of scientific concepts and principles. Research has shown that the learning cycle approach can improve students' conceptual understanding, problem-solving skills, and critical thinking abilities in science. By actively engaging in the process of inquiry, students are able to make connections between

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their prior knowledge and new information, leading to greater retention and application of content.

Furthermore, the learning cycle approach promotes a student-centered learning environment, where students take ownership of their learning and collaborate with their peers to construct meaning together. This collaborative learning approach has been shown to enhance students' communication skills, teamwork abilities, and overall motivation to learn.

Several studies have investigated the impact of the Learning Cycle approach on students' academic achievement in science. For instance, a study by [23] found that teaching through the Learning Cycle approach improved students' scientific reasoning skills in a science classroom. Similarly, [19] demonstrated that implementing the Learning Cycle model led to enhanced understanding of matter and molecules among middle school students.

In addition, research by [5] evaluated the effectiveness of the BSCS 5E instructional model, which incorporates the Learning Cycle approach, in enhancing students' achievement in science. The findings of their study suggested that the 5E model was effective in improving students' understanding and retention of scientific concepts.

Furthermore, [9] compared the academic outcomes of students in introductory physics courses taught using interactive-engagement methods, including the Learning Cycle approach, with those taught using traditional methods. The study found that students in courses utilizing interactive-engagement methods showed greater improvement in conceptual understanding and problem-solving skills.

Through a review of existing literature and an empirical study, this study aims to examine the impact of the learning cycle approach on students' achievement in science. By analyzing student performance on assessments, surveys, and interviews, this study will provide valuable insights into the effectiveness of the learning cycle approach in enhancing students' learning outcomes in science education. Ultimately, this research seeks to contribute to the ongoing dialogue on effective pedagogical strategies for promoting student achievement in science.

Integrated science is a core subject in the curriculum of the education system in Ghana. The philosophy behind it is production of scientific literate citizens who will be able to use scientific knowledge to solve their everyday problems and also make informed choices and decision at every turn. Consequently, no country can develop without focusing its goal in training citizens who will be scientifically literate, where citizens will not rely on superstitions but will rely on the scientific explanations in their everyday occurrences.

Due to its usefulness in our everyday life, it has been made a core subject in both Junior and Senior high schools in Ghana. This means that each student should the integrated science subject and must get a good pass mark before getting admission to any tertiary institution in the country.

Emphasizing on its importance [3] observed that Science education is needed in Ghana to produce the necessary human resource and skilled labour force to manage our local industries and educational institutions.

Despite it numerous benefits to the individual and the nation at large students still perform poorly in the subject. The chief examiner every year complain about student poorly performing in some of the topics like Magnetism, hydrocarbons, Acid base and Salts, Variation, Hereditary and Evolution, rocks and Mole Concepts [7]. It is therefore necessary to find ways to enhance students' performance in this subject.

This can be achieved through the provision of effective and appropriate learning experiences to the learner. Teaching over the years has been an effective means of impacting these appropriate learning experiences to the learner. It is therefore the duty of the teacher to select appropriate teaching methods and

materials to facilitate the impacting of these learning experiences to the learner. A desirable change in the learner can best be achieved through the use of appropriate teaching methods [25]. The teacher must also consider the needs of the learner when selecting these methods [9] was of the view that teaching methods work efficiently best when they are aligned with the needs of the learner this is because every learner interpret and responds to issues and experiences in their unique way.

The methods employed by teachers in teaching science have a great impact on the understanding and interest developed by students in the subject [21]. Observed that the use of inappropriate teaching methods contributes to the low participation and performance of students in science. If a teacher does not choose appropriate method in teaching a particular topic, it ends up making students developing poor attitude for the subject even if the teacher has much knowledge in the subject matter. According to [21] 'most commonly used teaching methods at both basic and secondary levels have been found to be lecturing; question and answer; explanations of procedures and note giving". Therefore, there is the need to equip our teachers with both the pedagogy and the content knowledge to enable them teach effectively [13] opined that the method of teaching each subject play a pivotal role in enhancing the efficiency of the practitioners.

Due to its numerous merits in the educational set up, several teaching methods and approaches have been developed to enhance effective teaching of subject matter, content and learning experiences to the learner in a way that will help the learner to easily and meaningfully understand the concepts being taught in the class. These teaching methods were developed through theories of learning as their bases for their philosophical explanation [25].

Science is knowledge obtained by using methods based on systematic observation of the natural environment. In science learning, teachers plan and prepare learning activities so that students do the activities to acquire the knowledge. Many learning models can be used by the teacher in reaching the learning goals. One of these learning models is the learning cycle model. Previous studies have indicated that the application of learning cycle model can facilitates students learning because it helps the student to directly interact with the environment to learn and analyze the phenomena for easily understanding of the concept and achievement of the learning goals.

It also involves students actively in the learning process by offering students the opportunity to explain and express their views, interpret and refine their ideas. Thereby improving on students learning outcomes.

Basically, there are two distinct methods of teaching. These are teacher-centered and student-centered. The teacher-centered method of teaching has its origin from the behavioral learning theory which emphasizes on the provision of appropriate stimuli which will generate the desired outcome in the learner. In this method of teaching students become passive recipient of information from the teacher. Student-centered method however, is built on the constructivist theories which stresses on the active involvement of the learner in the construction of knowledge through the interaction with peers and the learning environment. The influence of constructivist theory has been in existence since the early 1980s and it has had great impact on educational policies and classroom practices.

The Ghanaian Senior High School Integrated Science syllabus advocate for the use of constructivist approaches of teaching which is student-centered in teaching the concept in the syllabus to the learners. This is because the constructivist approach to teaching has proved to promote students understanding of concepts and development of skills to meet the demand of the 2nd century [25].

The Integrated Science teachers unfortunately find themselves in an awkward

situation as to what student-centered method to use since the syllabus did not spell out which student-centered method to use to teach a particular topic in the syllabus.

There are various constructivists teaching approach. The learning cycle has been found to be one of the predominant constructivist teaching approaches which emphasizes on the inquiry-based method of teaching. The inquiry-based method of teaching promotes learning through active questioning, investigation and hand-on activities.

This learning cycle come in several phases. The first version has 3 phases from which different version of the model were generated as four, [5]. It is very necessary for the Integrated Science teacher to know how effective each of this phase is so that they can make informed decisions as to which one they would use. It is in the light of this lack of clarity that this research seeks to explore the effectiveness of each this phase on selected concept in Integrated Science lesson.

The teaching and learning of Integrated Science in most senior high school face a lot of problems. Poor attitude shown by students, poor method of teaching the subject, poor performance of students and lack of materials for teaching the subject [1, 21, 24]. Several studies have indicated that students still learn science by rote learning and therefore affect their understanding of the science concept and consequently affect their interest too because no meaningful learning occurs [9].

Many stakeholders of education have condemned the state of teaching and learning of integrated science at the Basic level and Senior high schools in the country [1, 24, 25]. Many researchers have recommended the inquiry-based learning cycle method as the most effective approach of teaching science that can results in greater achievement in science, better retention of concepts, improved reason ability of students, effective development of process skills in science and improvement of attitudes of students towards science and learning [1, 24, 25].

Despite the recommendations made by several researchers about learning cycle as an effective approach in improving students' achievement and retention of concepts in science, teachers have been found not using it [2].

[25] compared the 3E, 5E and the conventional approach of teaching on students' achievement in Biology. Their findings revealed that students who were taught Biology with 3E and 5E performed better than those taught with the conventional approach.

This confirms [2] who compared the 3E learning cycle approach of teaching to that traditional approach and found out that the experimental group which was instructed using the 3E learning cycle approach performed better on the posttest than the control group which was instructed with the traditional method

This study will investigate the effect of learning cycle approach of teaching on the academic performance of high achievers and low achievers at senior high schools. It will also find out the specific effect of the 3E, 5E, and 7E learning model on the academic achievement and retention scores of students in senior schools.

Objectives of the Study

The purpose of this study was to examine the effect of learning cycle approaches on selected concepts in integrated science in integrated science. The study will specifically:

1. Find out if there is a significant difference in the mean achievements and retention scores among students instructed on selected concepts in Integrated Science through 3E, 5E and 7E learning model.
2. Find out the effect of 3E learning cycle approach on the mean achievement and retention of selected concepts in integrated science.

3. Find out the effect of 5E learning cycle approach on the mean achievements and retention of selected concepts in integrated science.
4. Find out the effect of 7E learning cycle approach on the mean achievements and retention of selected concepts in integrated science.
5. Find out if there is significant difference between the post-test scores of low achievers and high achievers when instructed with 3E learning cycle approach.
6. Find out if there is significant difference between the post-test scores of low achievers and high achievers when instructed with 5E learning cycle approach.
7. Find out if there is significant difference between the post-test scores of low achievers and high achievers when instructed with 7E learning cycle approach.

Research Questions

1. What is the significant difference in the mean achievements and retention scores among students instructed on selected concepts in Integrated Science through 3E, 5E and 7E learning cycle approach?
2. What is the effect of 3E learning cycle approach on the mean achievement and retention score of selected concepts in integrated science?
3. What is the effect of 5E learning cycle approach on the mean achievements and retention score of selected concepts in integrated science?
4. What is the effect of 7E learning cycle approach on the mean achievement and retention scores of selected concepts in integrated science?
5. Is there any significant difference between the post-test scores of low achievers and high achievers when instructed with 3E learning cycle approach on selected concepts in integrated science?
6. Is there any significant difference between the post-test scores of low achievers and high achievers when instructed with 5E learning cycle approach on selected concepts in integrated science?
7. Is there any significant difference between the post-test scores of low achievers and high achievers when instructed with 7E learning cycle approach on selected concepts in integrated science?

Significance of the Study

It is hoped that the findings of this study will help integrated science teachers to know which of the learning cycle phase is appropriate for teaching the selected concepts in integrated science in Senior high schools.

It will also encourage the integrated science teachers to adopt inquiry-based learning cycle model to teach concepts in integrated science in Senior high school.

It will again make the school authorities encourage and motivate their teachers to use inquiry-based learning cycle model to teach integrated science in senior high school.

It will serve as evidence for the National Council for Curriculum and Assessment to propose for teachers to use inquiry-based learning cycle model for teaching integrated science in senior high school.

Delimitations of the Study

This study investigated the effect of learning cycle approaches of teaching on academic achievement and retention of selected concepts in integrated science in the Obuasi Municipality which is in the Ashanti Region of Ghana.

Specifically, the study focused on only SHS Two- Gold students because they were at school during the period of the study the other SHS students were on vacation.

The study covered the variable such as the effect of learning cycle approaches such as the 3E, 5 E and the 7 E on the academic achievement of students in some selected concepts in integrated science in senior high school.

The study covered four sub-topics in Magnetism, Rocks, Acid Base and Salt and Variation, Inheritance and Evolution. These topics were selected because the chief examiner keep reporting students' difficulty in them. Obuasi Municipality was selected for this study because the researcher has currently been posted to the area to teach. Therefore, the researcher will have enough time to visit these schools for the study.

Limitations of the Study

The major limitation to this study was the menace of Covid 19 pandemic. This reduces the effective interaction of students with their peers due to fear of contacting the disease through contacts.

Also, initially students resisted the inquiry process in which the teacher asks questions and the students explore and search for answers supporting it with evidence and communicating their findings.so rejected to their role as explorers. They were used to conventional method of teaching where the teacher only gives information and the students listen and take notes. The researcher.

Also, there was the need to train teachers in extensive professional development in inquiry-based learning cycle method of teaching but only two science teachers were willing to undergo such training.

Literature Review

The theoretical framework for this research study on the effect of the learning cycle approach on students' achievement in science is based on the constructivist theory of learning, which posits that students actively construct their own understanding of the world through a process of inquiry, exploration, and reflection [22]. The learning cycle approach, as proposed by [15] is a method of instruction that is grounded in constructivist principles and emphasizes hands-on, experiential learning through a sequence of stages that include concrete experience, reflective observation, abstract conceptualization, and active experimentation.

According to the constructivist theory, learning is a process of actively constructing knowledge through interactions with the environment and social interactions with others [28]. The learning cycle approach provides students with opportunities to engage in authentic scientific inquiry and experimentation, which can lead to deeper understanding and more meaningful learning experiences [11]. By following the stages of the learning cycle, students are able to build on their prior knowledge, make connections between new concepts and existing knowledge, and apply their understanding in real-world contexts.

Research has shown that the learning cycle approach can lead to improvements in students' understanding of scientific concepts, problem-solving skills, and overall academic achievement in science [18]. By engaging students in hands-on activities, encouraging them to ask questions, and providing opportunities for reflection and discussion, the learning cycle approach can foster a deeper conceptual understanding and help students develop critical thinking skills [4]. This study was grounded on 3E, 5E, 7E learning Cycle Models. Learning cycle is model which is student centered. It provides opportunities for students to develop confidence through active involvement of students during the learning process. In 1970, based on Jean Paget's cognitive development theory, Robert Karplus proposed a learning strategy in the form learning cycle. Even though this strategy was first used in elementary school, many studies have indicated that application of this teaching approach has been widespread at various levels of education, including universities [10] defined learning cycle as an arrangement of learning process in such a way from a series of activities and stages so that learning competencies are mastered by students through their active involvement in the whole series of

activities. This model uses a constructivist approach where knowledge is built on students own knowledge. Therefore, if the knowledge construction process occurs well then students understanding of the material learned will be improved and meaningful learning can be achieved.

Even though there are several constructivist teaching and approaches, the inquiry-based learning cycle approach has been found to mostly recommend by researchers to support students learning and academic achievement. [2].

Ref. [12] found out that inquiry -based method of teaching is very rewarding for both the male and female students and should not be limited to reading of text book but students should be allowed to investigate into problems in the society and provide solutions to these problems. Scientific knowledge must lead to solving societal problems. [10] opined that learning cycle is an inquiry-based teaching strategy and therefore seeks to promote learning through investigation and hands on activities. Many Science researchers in the science education field have tried to develop teaching approach which encourages learner-centeredness [20] opined that one of the best ways to use learner centered pedagogical approach in the classroom situations is by using learning cycles. This approach involves series of planed strategies used by the instructor during the teaching learning process. The learning cycles are based on mental development theory by Jean Piaget.

The learning cycle approach is a teaching method that aims to engage students in an active and participatory learning process by incorporating multiple stages of exploration, conceptual development, and application. This approach is often used in science education to help students develop a deeper understanding of scientific concepts and improve their critical thinking skills. In recent years, there has been increasing interest in examining the effectiveness of the learning cycle approach on students' achievement in science.

A study by [9] investigated the impact of the learning cycle approach on students' understanding of chemical bonding concepts. The researchers found that students who were taught using the learning cycle approach demonstrated significant improvements in their understanding of the concepts compared to students who were taught using traditional methods. The study also found that students who experienced the learning cycle approach were more engaged and motivated to learn.

Similarly, a meta-analysis by [2] examined the effects of the learning cycle approach on students' achievement in science across multiple studies. The meta-analysis found that the learning cycle approach had a positive impact on students' achievement, with effect sizes ranging from moderate to large. The researchers concluded that the learning cycle approach was an effective teaching strategy for improving students' understanding of scientific concepts.

Furthermore, a study by [2] investigated the impact of the learning cycle approach on students' understanding of energy concepts in middle school science. The researchers found that students who were taught using the learning cycle approach showed significantly higher gains in their understanding of energy concepts compared to students who were taught using traditional methods. The study also found that the learning cycle approach helped students develop a deeper conceptual understanding of energy and improved their ability to apply their knowledge to real-world situations.

This learning cycle has different phases. The first version has only 3 phase and this consist of exploration, concept development and expansion [5].

In the exploration phase the teacher allow the students to investigate into a given scientific concept that the teacher has initiated in the class. The learners are given enough opportunity to think freely and engage in peer

discussing within the concept given. The teacher provides the necessary tools, materials and equipment that will enable the learners to go through the exploration phase successfully. The students also collaborate with each other within their assigned group to gather the necessary data that will help them solve the problem given to them by the teacher. They also make necessary predictions and hypotheses based on the evidence collected. They record and interpret and organize their findings.

The teacher also encourages the learners to work together in a collaborative and cooperative manner. The teacher may also ask probing questions to redirect the students' investigations.

This phase stimulates students' curiosity, develops the need to know something [10]. Indicated that this phase offers opportunity for the learner to utilize their five senses as much as they interact with the environment through activities such as practicum, analyzing articles, observing and discussing natural phenomena. These activities should stimulate their high level of thinking as they begin to ask themselves questions as to how and why things occur in the way they are occurring. The emergence of such questions shows that students are ready for the next phase known as the concept development phase.

In the concept development (explanation), the learning process is supposed to lead to a balance between the concept the learner already knows and the concepts that have just been learned through activities that requires reasoning skills such as discussions [5]. Also, under this phase both the teacher and the learner have an active role to play. The learners are given the opportunity to verbalize their conceptual understanding. They are allowed to explain the underlying principles the scientific concepts given to them.

The teacher also encourages the students to explain the concepts in their own words and solicit for clarifications and justification from the students. The teacher also facilitates the discussions of the students' findings. The teacher then formally introduces the definitions and scientific terms in the topic. Ref. [5] opined that under this phase the students listen critically from their peer group explanations and can questions others explanations.

The next phase of the 3E learning cycle is the expansions phase where the students are allowed to extends and apply the concepts to new situations. Ref. [14] cautioned that teacher should be very carefully not to introduce unknown concepts to students at this stage.

The next learning cycle model is the 4E model which consists of four phases of instruction within the learning cycle. They are the Engagement, the exploration, the explanation and the evaluation.

At the engagement stage, the teacher generates the interest and stimulate the excitement of the students towards the concept. The teacher also finds out what the students already know and their misconceptions. Ref. [5] were of the view that this phase should be to encourage and motivate the learners to develop more in-depth desire to learn about the concept to be discussed. The students also do brainstorming to express their ideas to their peer groups. The exploration phase offers the students the opportunity to investigate into the scientific concepts. The students make some predictions base on the evidence collected. They collect and interpret data collected. Ref. [5] opined that at the explore phase the teacher can acts as consultant for the students. This phase aim at developing students understanding of the scientific principles underlying the concepts discussed.

The third phase of the 4E learning model is the explanation phase. In this phase the students are given the opportunity to demonstrate their conceptual understanding. The students explain the concepts in their own words and their teacher can ask for clarification and justification from the students.

The fourth phase of the 4E learning cycle is the evaluation phase. Under this phase the

teacher assesses students understanding of the concepts with formative and summative assessment. The students will also answer the questions asked by the teacher and may be ask to interpret data.

In the 5E learning cycle, there is a combination of the three phases in the 3E learning cycle and the addition of the latest two phases, they are engaging before exploring and evaluate at the end of the cycle.

The 5E learning model also consists of five phases within the learning cycle. These are the engagement, exploration, explanation, elaboration and evaluation.

In the engagement stage the prior knowledge of the students is review and link to new concepts through the use of short activities that promote curiosity. The teacher makes connections between past and presents learning experiences. Students are mentally engaged in the concept, process, or skills to be learned. The teacher also captures the students' interest and make them curious about the topic and concept to be learnt [5] stressed that this phase provides an opportunity for the teacher to find out what students already know and think about the topic or concept to be developed.

At the exploration phase the teacher involve the students in the topic providing them the opportunity to build their own knowledge through investigating and researching and manipulating of the materials. Student build a set of common experience as they work in groups and this prompt sharing and communicating. At this stage, the teacher acts as a facilitator guiding the students focus and the students actively learn through inquiry-based learning process.

The explanation phase focus students' attention on particular aspects of their engagement and exploration phase exploration experiences and provides students opportunity to demonstrate their findings, their conceptual understanding through discussion and presentations. It also provides the teacher the opportunity to introduce the concept, terms and explanations.

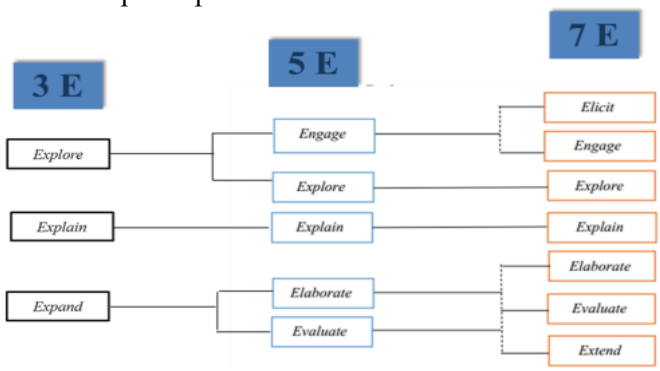

Figure1. Development of Learning Cycle by Arthur Eisenkraft [30].

The fourth phase of the 5E learning model is the elaboration phase after the discussions and explanations about the main ideas and scientific principles underlying the concepts it is important to involve the students in further experiences that extends the concepts and process to new situations. The students are encouraged to apply the concepts to new situations [14] stressed that the 'elaboration phase facilitates the transfer of concepts to closely related but new situations.

The last phase of the 5E learning model is the evaluation stage. The teacher gives the students opportunity to demonstrate their understanding of the concept. The teacher can administer both formative and summative assessment to determine each student understanding of the concepts [5].

The 7E learning model is a paradigm shift in the instructional approach [5]. It consists of 7 phases of instructions within the learning cycle. They are the elicitation, engagement,

exploration, explanation, elaboration, evaluation and extension.

The first phase of the 7E learning model is the elicitation stage. Under this phase the teacher draws students' attention to the prior knowledge and understanding of the concepts under study. The teacher tries to build new knowledge on the existing knowledge. The teacher may provide external stimulus in the form of concept cartoons, mind maps that will give them idea about the concept which will be study. The students try to connect given concept with their prior knowledge. At the engagement phase, the teacher focuses students thinking on the content by providing them the opportunity to talk to each other in their respective group. The teacher also generates and stimulate the interest of the learners towards the concept. The student also brainstorms during this stage [5] was of the view that they can use think-pair share technique to express their ideas to their peers.

The third phase of the 7E learning model is the exploration phase where students are given the opportunity to work together in a collaborative and cooperative manner. They make observations, design experiment, record data, organize data, make graph, and interpret among their peer groups.

At the explanation phase the students are given the opportunity to communicate their conceptual understanding and explain the concept with their own words. They listen to their peer group explanation and other group members explanations. This phase provide opportunity to introduce 'formal language, scientific terms and content information that might makes students prior experiences easier to describe' [21].

The next phase is the elaboration phase which has to do with the extensions of the learners' conceptual understanding. The teacher assists the students to think alternative explanation of the concept and the students use their prior knowledge to ask more questions, make decisions and draw reasonable conclusion from evidence. Students apply symbols, definition, concepts and skills to solve problem related to concept learned [11].

The 6th phase of the 7E model is the evaluation phase. The teacher provide opportunity for students to assess and evaluate their own learning [22].

The evaluation can be in the form of formative or summative assessments, formal or informal assessment. The students can also be asked to complete a summary report during the evaluation phase.

The last phase of the 7E model is the extension phase. According to Sharma (2008) 'the aim of adding this phase is to inform the teacher that applying traditional assessment ways is not the last process.' It was to remind the science teacher the importance of transferability of the concept learned. The student practice transfer of learning by applying what they learned in the classroom to new situations. Students are also required to think, search, explain and find examples of the application of new concepts and skills that they have learnt.

Conceptual Framework

The conceptual framework for this research study on the effect of the learning cycle approach on students' achievement in science is based on the premise that the learning cycle approach, which incorporates hands-on, experiential learning and emphasizes inquiry-based instruction, has a positive impact on students' understanding of scientific concepts and their academic achievement in science. Drawing from the constructivist theory of learning [22, 28] the learning cycle approach is designed to engage students in active learning experiences that help them construct their own knowledge through experimentation, reflection, and application.

The learning cycle approach is built upon a framework of four key stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation

[15]. In the concrete experience stage, students engage in hands-on activities and experiments that allow them to directly interact with scientific phenomena. Through reflective observation, students reflect on their experiences, make connections between new information and prior knowledge, and identify patterns or relationships. In the abstract conceptualization stage, students develop theoretical understanding of the concepts through discussion, reading, and instruction. Finally, in the active experimentation stage, students apply their knowledge and skills in new contexts, test hypotheses, and further refine their understanding through practice.

Research has demonstrated that the learning cycle approach can facilitate deeper understanding of scientific concepts, enhance problem-solving skills, promote critical thinking, and improve overall academic achievement in science [11] [18]. By engaging students in active inquiry, providing opportunities for hands-on exploration, and encouraging reflection and discussion, the learning cycle approach promotes a deeper level of engagement and fosters a more meaningful learning experience for students.

In this research study, the conceptual framework will guide the design and implementation of the learning cycle approach in a middle school science classroom. The research will assess the impact of the learning cycle approach on students' achievement through pre- and post-tests, observations, and interviews. By examining the relationships between the key components of the learning cycle approach and students' academic outcomes, the study aims to provide insights into the mechanisms through which the learning cycle approach influences students' achievement in science.

Materials and Methods

The study employed a quasi-experimental non-randomized pre-test, post-test experimental group design. The study used a mixed method approach of both qualitative and quantitative method of data collection and analysis [6]. This approach was adopted because there was the need for the researcher to support the quantitative data with qualitative data for better understanding of how effective this teaching approach aid in teaching integrated science.

The quantitative part of this study was a quasi-experimental design a pretest-posttest

Non-equivalent group. This design was adopted because it was not possible to have complete randomization of subjects as this will disturb school organization. Quasi-experimental design is an empirical study used to estimate the causal impact of an intervention on its target population. Therefore, intact classes were randomly assigned to the experimental groups as 3E, 5E, and 7E.

The 3E experimental group were given treatment using 3E learning cycle approach, the 5E experiment group were also instructed with 5E learning cycle approach and 7E experiment group were also given instruction in 7E learning cycle approach. All the three groups however received the same test at the same time period.

A detailed lesson plan was prepared to ensure active involvement of students in the learning process. A pre-test was given to all the students in the three groups in order to measure their prior knowledge before the start of the instruction. A post-test was also given to the students 3 days after instruction in order to measure the effectiveness of the teaching approaches employed.

The qualitative data was obtained through the use of interviews where views of the students were solicited to ascertain the effectiveness of the approached used for instruction in the various experimental group. The use of the interview also helped to obtain in- depth information on how students perceived the learning cycle approach.

Some students from all the three groups were selected to interview after the instruction

including the three research assistants who did the instruction.

Population

Population is defined as the entire aggregation of cases that meet a designated set of criteria. It comprises the entire aggregation of elements in which the researcher is interested. They are the target group about which the researcher is interested in obtaining information and drawing conclusion from.

The target population for this study was all the Form 2 Senior High School students in the Obuasi municipality numbering 1200. The accessible population was the Form 2 Gold track students. This because the other Green-track students were not at school during data collection period. The accessible population were obtained from the following schools, Christ the King Catholic Senior High School, Obuasi Secondary Technical Senior High School and Sam Boachie Senior High School. Christ the King and Obuasi Secondary Technical Senior High School are public Senior high school while Sam Boachie Senior High school is private own school.

Sample and Sampling Techniques

Sampling refers to the process of selecting a portion of the population to represent the entire population. It enables the researcher to study a relatively small number of units in place of the target population. A multi-stage sampling techniques was used to select the schools and classes to be used for the study. Three schools were purposively selected from the total number of schools in the municipality. Purposive sampling was used to select these schools because these schools have a well - structured facilities as well as well trained teachers [6] opined that purposive sampling is employed because of special characteristic of the sample facilitating the purpose of the study. Simple random sampling technique was use to select 3E, 5E and 7E intact classes for the study. The 3 intact classes were selected from general Arts class in the three schools selected. 40 students were selected randomly from each of the three classes for the study. This is because according to [8] it ensures that all key characteristics of individuals in the population are included in the same proportion and it increases the likelihood of the sample being a true representation of the population. These classes were named 3E, 5E, 7E for easy identification.

In all a sample size of 120 was employed to carry out the study. This sample size was sufficient enough for this study because according to [8] for experimental and causal comparative studies, we recommend a minimum of 30 individuals per group'.

Table 1. The Distribution of the Sample by Schools and Forms

School	Class size	No. of Student Selected
OBUASI SEC TECH	500	40
CKC	250	40
SAM BOACHIE	200	40

Instruments

A test is a measuring instrument used to measure learners' knowledge, skills and aptitude. It may be administered orally, verbally, on paper or a computer in a predetermine area which requires the test taker to demonstrate his knowledge or skills.

In this study to ensure objectivity the integrated science multiple choice questions were adapted from West African Examination Council objective questions. The test items covered all the units that were taught during the interventional period. The test consists of two sections that is section I and section II. The

section I contain multiple choice questions and answers.

The section II also consist of the essay type questions in which students were to provide short answers to them. A marking scheme was prepared before administering the test to the students.

The use SAT is to assess students' achievement and retention on what they have been taught. To ensure validity, SAT was developed based on the table of specification.

The Semi-Structured Interview

The researcher prepared a semi-structured interview guide to collect data for the study. It was design to collect data from all the three experimental group selected. 5 students from each group were conveniently selected for the interview. This was to help the researcher to know how the participants were impressed about the method the teacher used and their understanding and performance so far in the concept taught. Semi-interview guide was used because the researcher wanted to gather descriptive data on the respondent own words as to how they feel about the method used to teach the concepts by the research assistant. The interview guide had 10 questions with some having follow up questions. These questions sought to find out whether the inquiry-based method used has had impact on their understanding and achievement in the concept taught.

Structured Observation

Observation as a research instrument provide the researcher the opportunity to observe the participant in the natural settings. Observation as data collection instrument can be structured or unstructured. In this study a structured observation was undertaking. The following were observed during the instruction.

1. The interaction between students-students and the teacher-students47
2. The participation and contribution of students in the learning process
3. Behavior and attitude of students towards learning
4. How students ask questions and responds to questions asked by the teacher.
5. How motivated students were to learn the concept taught.

Validation of Instrument

The science achievement test (SAT) and the other instructional materials like the lesson notes, table of specification were face validated by two experts in science education in the department of science and Technology university of Cape Coast.

The experts were to check whether the answers to the questions were correct or not. Also, they were to check whether the lesson notes prepare for the lesson were appropriate and correct. Suggestions from the experts were used to review the instruments and the instructional materials. Items that were considered too difficult or simple were restructured, and those that were not relevant were eliminated based on the experts' advice.

Reliability of the Test Instrument

The science achievement test (SAT) was trial-test to ascertain its reliability coefficient by administering it randomly to a 40 selected SHS students who were not part of the study. Test pretest procedure was used in the administration of the instruments to the students. Three intact SHS two classes were randomly sampled as experimental. These were the 3E group, the 5E group and 7E group.

Three research assistants were employed and trained by the researcher to teach the instructional units. Each of the experimental group were taught using 3E, 5E, 7E, learning cycle approach respectively. The test items (SAT) were administered to the two group in the form of pre-test before the treatment to ascertain their entry behavior. After the teaching, the test was reshuffled and administered again to the group to obtain the stability of the instruments. The scores from the

post-test were compared with the pre-test to ascertain if there could be any correlation between the two scores from the test. A Pearson product moment correlation coefficient used to obtain the reliability which gave a coefficient of 0.92. According to Frankel and Wallen (2000), a reliability coefficient of alpha value 0.7 and above is considered suitable to make possible group predictions which are sufficiently accurate. Therefore, the pre-test results satisfy the minimum prescribed reliability coefficient.

Data Collection Procedure

The Science Achievement Test (SAT) was used for data collection. The instrument was administered during the study and the scores were obtained and analyzed.

Treatment Procedure

The study was conducted during the normal school lesson periods. This is because of the Covid 19 pandemic there was no other way to have access to the students apart from the normal lesson periods. The normal time table of the three schools were used. Before starting the actual treatment, the researcher used four days to train the three integrated science teachers who assisted the study. The following areas were covered in the orientation for the three research assistants.

1. The purpose of the study
2. The integrated science concepts to be taught and how it will be taught
3. The procedure for the administration of the instrument
4. The 3E, 5E, 7E learning cycle approaches

This orientation program was to ensure homogeneity of instruction among the groups and the only difference was that each of the experimental group received instruction through different phases of the learning cycle approaches, thus the 3E, 5E, and 7E.

Intact classes were assigned to all the experimental groups after which the Science Achievement Test (SAT) was administered as pre-test. This took one week before the actual teaching began. During the treatment period, each of the experimental group 3E, 5E and 7E were taught some selected topics in integrated science using the 3E, 5E, 7E, learning cycle approach respectively. The actual teaching took four weeks to cover all the selected concepts.

The researcher prepared the lesson notes for the 8 weeks activities. The topics were selected from the areas the chief examiner has repeatedly reported that students have difficulties in them. The topics which were covered in the interventional process were rocks, acid bases and salt, magnetism and variations, hereditary and inheritance. A sub-topic was picked from each topic for the study. The participants of the study were put into eight groups of 30 with each group receiving instructions twice per week.

Three different lesson plans namely 3E lesson plan, 5E lesson plan and 7E lesson plan were prepared on the selected topics for the study. These lesson plans were used to instruct 3E, 5E and 7E group respectively.

The lesson plan was developed to ensure active involvement of students in the learning process. The activities in the lesson plan were implemented by considering the stages of 3E, 5E and 7E learning cycle model. In the engagement stage the teacher tried to increase students' attention make them become interested in the lesson and also ready to learn. The teacher ensured that students get the opportunity to make some connections between previous knowledge and present learning experiences.

In the exploration stage the teacher gave the students the chance to explore the topic and also gave the materials to the students to observe, record their observations, discuss their findings and interpret their findings. The teacher only went round to guide, provide feedback to students as they work in their respective groups.

The students were given the opportunity to demonstrate and presents their findings in the explanation stage. The teacher guided the students on how to make coherent and

consistent make generalization in the presentation. In the elaboration stage the students were given the opportunity to discuss how they can apply their knowledge in new situations. In the final stage which is the evaluation stage, the teacher then provided the students with activities which were used for both formative and summative assessment. This stage aided the researcher to make inferences and conclusions about the method employed and its effects on students understanding.

After the treatment the pre-test were reshuffled and administered as post-test to both groups. The post-test was marked by the research assistants with the marking scheme prepared by the researcher. The researcher then allowed a gap of four weeks and reshuffled the post-test and re-administered it again to ascertain if the knowledge gain was retained. This was to measure the retention of concepts learned during the intervention period. The retention test was scored analyzed.

In determine the low achievers and the high achievers, the researcher set a bench mark for the student. The bench mark was 50. Those students who score below the 50mark set were regarded as low achievers and vice versa.

Results

The data collected for the study was analyzed and interpreted based on the research questions formulated. Table 3-5 presents the results on the research questions.

Table 2. Mean Achievements and Std. Deviation of Pre-test and Post- test Scores among Students Instructed on Selected Concepts in Science through 3E, 5E and 7E Learning Model

class	N	Pre-test Mean	Std.	Post-test Mean	Std Deviation	Mean gain
3E	40	10.68	1.54	14.97	2.41	4.29
5E	40	10.78	1.33	24.52	2.03	13.47
7E	40	10.77	1.36	23.88	1.6	13.11

Table 2 above shows the mean achievement and standard deviation of pre-test and post-test scores among students instructed on selected concepts in science through 3E, 5E and 7E learning model. The pre-test means scores for 3E, 5E and 7E were 10.68, 10.78 and 10.77 respectively with their standard deviation 1.54, 1.33 and 1.36 respectively. This means that 5E learning model class had the highest score in the pre-test with mean difference of 0.01 which is very insignificant. This indicates that 3E, 5E and 7E class were almost at the same level of achievement before the intervention. The post-test means scores however differ for the various class. The post-test means scores for the 3E, 5E, 7E class were 14.97, 24.52 and 23.88 respectively. The standard deviations scores for the three group were 2.41, 2.03, and 1.6 respectively.

Table 3. Mean Retention and Std. Deviation Scores among Students Instructed on Selected Concepts in Integrated Science through 3E, 5E and 7E Learning Model

class	N	Pre-test Mean	Std.	Post-test Mean	Std deviation	Mean gain
3E	40	10.68	1.54	14.33	1.76	10.68
5E	40	10.78	1.33	24.43	1.96	13.38
7E	40	10.77	1.36	21.16	1.69	10.39

Source: Field Survey (2021)

Table 3 above shows the mean achievement and standard deviation of pre-test and retention test scores among students instructed on selected concepts in integrated science through 3E, 5E and 7E learning model. The pre-test means scores for 3E, 5E and 7E were 10.68, 11.05 and 10.77 respectively with their standard deviation 1.54, 1.60 and 1.36 respectively. This means that 5E learning model class had the highest score in the retention test with mean difference. This indicates that 3E, 5E and 7E class were almost at the same level of achievement before the intervention. The retention means scores however differ for the various class. The retention means scores for the 3E, 5E, 7E class were 14.35, 24.43 and 21.16 respectively. The standard deviations scores for the three group were 1.76, 1.96, and 1.69 respectively. Thus, the 5E model class showed more achievement than the other two model classes after the interventions.

To assess the significant difference in the mean achievements and retention scores among students instructed on selected concepts in Integrated Science through 3E, 5E and 7E learning model, the one-way between-groups Analysis of Variance (ANOVA) was conducted to determine the significant difference in the mean achievements and retention scores among students instructed on selected concepts in Integrated Science through 3E, 5E and 7E learning model.

Table 4. ANOVA Results of Mean Achievement and Retention Scores

		Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Pre-test	Between Groups	.800	2	.400	.200	.819
	Within Groups	233.525	117	1.996		
	Total	234.325	119			
Post-test	Between Groups	2277.800	2	1138.900	**273.434**	**.000**
	Within Groups	487.325	117	4.165		
	Total	2765.125	119			
Retention	Between Groups	2782.717	2	1391.358	**424.731**	**.000**
	Within Groups	383.275	117	3.276		
	Total	3165.992	119			

A one-way between-groups analysis of variance was conducted to explore the difference in the mean achievements and retention scores among students instructed on selected concepts in Integrated Science through 3E, 5E and 7E learning model. Participants were divided into three groups (Group 1: 3E; Group 2: 5E; Group 3: 7E). Thus, for the pre-test results, there was no statistically significant difference at the $p > 0.05$ level in the pre-test scores for the three groups: $F(2, 117) = 0.20$, $p = 0.819$. Despite not reaching statistical significance, the actual difference in mean scores between the groups was quite small. The effect size, calculated using eta squared, was 0.003. Post-hoc comparisons using the Tukey HSD test indicated that the there was no significant difference in the mean score for all the three groups after the pre-test.

In addition, results for the post-test scores revealed that there was a statistically significant difference at the $p < 0.05$ level of significance

in the post-test scores for the three groups: F (2, 117) = 273.434, p = 0.000. The actual difference in mean scores between the groups was large. The effect size, calculated using eta squared, was 0.82. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for the 3E group (M = 14.97, SD = 1.54) was significantly different from the 5E group (M = 24.52, SD = 2.03) as well as the 7E group (M = 23.88, SD = 1.6). Also, there was a significant difference between the 5E group and the 7E group.

Furthermore, the retention test results after the intervention showed that there was a statistically significant difference at the $p < 0.05$ level of significance in the intervention test scores for the three groups: F (2, 117) = 424.731, p = 0.000. The actual difference in mean scores between the groups was large. The effect size, calculated using eta squared, was 0.88. Post-hoc comparisons using the Tukey HSD test indicated that the mean score after the retention test for the 3E group (M = 14.97, SD = 1.54) was significantly different from the 5E group (M = 24.52, SD = 2.03) as well as the 7E group (M = 23.88, SD = 1.6). However, the 5E group and the 7E group did not differ from each other.

Table 5. Shows the Effect of the Learning Cycle (3E, 5E, 7E) Approaches on the Mean Achievement and Retention Score of Selected Concepts in Integrated Science, the One-way Repeated Measures ANOVA was used

Model	Hypothesis df	Error df	Wilks' Lambda	F	p-value	Partial Eta Squared
3E	2	38	0.185	83.59	0.00	0.815
5E	2	38	0.025	739.50	0.00	0.975
7E	2	38	0.018	1051.99	0.00	0.982

Source: Field Survey (2021)

A one-way repeated measures ANOVA was conducted to compare scores on the students' achievement Test during the pre-test, post-test, and the retention tests. The means and standard deviations are presented in Table 1. For the students taught with the 3E learning cycle approach model, there was a significant effect of the 3E model, Wilks' Lambda = 0.185, F (2, 38) = 83.59, $p < 0.05$, multivariate partial eta squared (0.815) showed a very large effect of the 3E model on the students' mean achievement and retention scores (Cohen, 1988). Additionally, the results of the 5E model used to instruct students in the 5E class revealed that there was a significant effect of the 5E learning cycle approach, Wilks' Lambda = 0.025, F (2, 38) = 739.50, $p < 0.05$, multivariate partial eta squared (0.975) showed a very large effect of the 5E model on the students' mean achievement and retention scores. Finally, the results of using the 7E learning cycle approach to teach the students in the 7E model group revealed a significant effect of the 7E learning cycle approach, Wilks' Lambda = 0.018, F (2, 38) = 1051.99, $p < 0.05$, multivariate partial eta squared (0.982) showed a very large effect of the 7E model on the students' mean achievement and retention scores.

Is there any significant difference between the post-test scores of low achievers and high achievers when instructed with 3E, 5E, and 7E learning cycle approaches on selected concepts in integrated science?

The independent sample t-test was used to determine whether there was a statistically significant difference between the post-test scores of low achievers and high achievers when instructed with 3E, 5E, and 7E learning cycle approaches on selected concepts in integrated science. The results are shown in Table 5.

Table 6. T-test Statistics of Low Achievers and High Achievers Post Test Scores

Sex of teachers	N	Mean	Std. Deviation	df	t-value	p-value
3E Learning Cycle Approach						
Low Achievers	22	15.18	2.68	38	0.59	0.56
High Achievers	18	14.72	2.08			
5E Learning Cycle Approach						
Low Achievers	23	24.09	2.09	38	-1.62	0.11
High Achievers	17	25.12	1.83			
7E Learning Cycle Approach						
Low Achievers	24	24.13	1.45	38	1.21	0.23
High Achievers	16	23.50	1.79			

Source: Field Survey (2021)

An independent-samples t-test was conducted to compare the performances of low achieving students and high achieving students thought using the various 3E, 5E, and 7E learning models. For the students instructed using the 3E model, the results of their posts test showed that there was no significant difference in scores for low achievers (M = 15.18, SD = 2.68) and high achievers (M = 14.72, SD = 2.08; t (40) = 0.59, p = 0.56, two-tailed). The magnitude of the differences in the means (mean difference = 0.46, 95% CI: –1.45 to 2.09) was very small (eta squared = 0.009). Furthermore, analysis of the results obtained from the post-tests of the students instructed using the 5E model showed that there was no significant difference in scores for low achievers (M = 24.09, SD = 2.09) and high achievers (M = 25.12, SD = 1.83; t (40) = -1.62, p = 0.11, two-tailed). The magnitude of the differences in the means (mean difference = 1.03, 95% CI: –1.11 to 2.03) was moderate (eta squared = 0.06). Finally, the post-test result of the students instructed with the 7E learning cycle approached revealed that there was no significant difference in scores for low achievers (M = 24.13, SD = 1.45) and high achievers (M = 23.50, SD = 1.79; t (40) = 1.21, p = 0.23, two-tailed). The magnitude of the differences in the means (mean difference = 0.63, 95% CI: –2.32 to 0.25) was very small (eta squared = 0.04).

Discussion of Findings

The descriptive analysis of the data collected from the test results showed that the 5E learning model class had the highest score in the pre-test, post tense, and retention tests conducted. However, the ANOVA results revealed that there was no statistically significant difference in the pre-test scores for the three groups showing that there are no significant variations in pre-test results of the 3E, 5E, and the 7E model classes. This means that the entry behavior of the students before the study was conducted were equal. However, the post-test scores showed a significant difference between the results of the 3E, 5E, and the 7E model classes with the actual mean difference in the results measured by the eta-squared revealing a large effect. This means that the intervention of the model classes had significant effects on the students' understanding of the selected topics.

Thus, there was a significant difference between the achievements of the 3E model class and the 5E model class as well as the 7E model class and a difference between the achievement of the 5E model class and the 7E model class. This result may be explained by the active participation of students at every stage of the instructional models. This therefore means that the difference between the test scores of the class model groups was due to result of the intervention. This, thus, agrees with the finding of Vygotsky (1978) that

learning is facilitated by social interaction with more sophisticated individuals that provide guidance during the learning process.

When the students were left for some time before the retention test was conducted, it was expected that there would be variations in the achievements of the students. Thus, the results showed that there was a statistically significant difference in the achievement of the students. This may not be necessarily due to the intervention since the students might have consulted their learning resources and materials to get more insight into the selected topics. That notwithstanding, the results showed that the effects of the intervention on the students' achievement in the retention test was very large with the 3E model group performing significantly than the 5E and the 7E model groups with no significant difference in the achievement of the 5E and the 7E model groups. The results of this study agree with the assertion made by Ngalimun (2014) that when learning cycles are arranged in such a way to form series of activities and stages, learning competences are mastered by students.

Furthermore, the study sought to determine the effect of the learning cycle (3E, 5E, 7E) approaches on the mean achievement and retention score of selected concepts in integrated science. Using the one-way repeated measures ANOVA, it was found that there was a significant and very large effect of the 3E, 5E, and 7E models on the students taught with the 3E, 5E, and the 7E learning cycle approaches. Hence, the models used for the intervention have had significant impacts in the achievement of the students with the 7E model having the largest impact on the students' mean achievements and retention. Thus, from the works of Vygotsky (1978), it can be deduced that guidance provided by science teachers during instruction may have influenced the conceptual understanding of the students, which resulted in their better achievements. This also agrees with the findings of Hiccan (2008) who examined the influence of 5E learning cycle approach on students' achievement in linear equations in one variable and found that in the 5E learning cycle group, the pre- and pro-test achievement scores were significantly different.

Finally, to determine whether there was any significant difference between the post-test scores of low achievers and high achievers when instructed with 3E, 5E, and 7E learning cycle approaches on selected concepts in integrated science, it was found that there was no significant difference in scores for low achievers and high achievers taught with the 3E, 5E, and 7E model. Thus, the 3E, 5E, and 7E models used for the intervention has no significance difference on the academic achievement of low achieving students and high achieving students. This means that the low achieving and high achieving students exhibited same level of understanding after the models were used to teach them resulting in almost the same performance when they were assessed after the models were utilized to determine the effect of the model on their achievements.

This was evident in the 3E and the 7E models resulting in a very small effect in the achievement of the low achievers and the high achievers with the 5E model having a moderate impact in the achievement of the low achievers and the high achievers after the post-tests. This means that the students in the learning cycle classrooms benefited in about the same margin irrespective of their level of achievement before the intervention. The results may be explained with the fact that the use of the learning cycles in the teaching of the concepts made the understanding and internalization of the concepts taught easier, especially for the low achieving students, which made them became par in their performances in the post-test with the high achieving students. Thus, [9] stated that in the activities based on the learning cycle sequence, as demonstrated in this study, the teacher created interest and curiosity to draw the students' attention and excite them, in the

phase of engagement; provided opportunities for students to make them discover the topic and create a situation of need-to-know setting the phase for the explanation phase.

Conclusion

Based on the findings of the study, the following conclusions were made:

1. At the pre-test stage, all the model class groups showed the same level of understanding in the concepts whilst during the post-test and retention stage, the learning cycle approaches had a significant influence on the students' achievements hence the differences between the 3E model class and the 5E model class as well as the 7E model class whereas there was no difference in the achievement of the 5E and the 7E model class after the retention test.
2. The models used for the intervention have had significant impacts in the achievement of the students with the 5E model having the largest impact on the students' mean achievements and retention.

The 3E, 5E, and 7E models used for the intervention have no influence on the academic achievement of low achieving students and high achieving students. This means that the low achieving and high achieving students exhibited same level of understanding after the models were used to teach them resulting in almost the same performance when they were assessed after the models were utilized to determine the effect of the model on their achievements.

Recommendations

The following recommendations were made based on the findings of the study:

Science teachers should adopt the use of the learning cycle approaches to teach science concepts to the students to arouse the students' interest in the subject since the use of learning approaches have the tendency to increase the achievement of students.

Suggestions for Further Research

Further studies is needed into learning cycle which could help science teachers to understtand what influences students conceptual change in learning cycle class, the influence of learning cycle on students' attitude towards science, and teachers' sex differentials and use of learning cycle as an instructional method. Further studies can also be conducted to unravel the significance difference between male and female students' achievement using learning cycle approache

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Factors Behind the Lower Contribution of Graduates to Entrepreneurship in North Kivu, DRC

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Abstract

In this study on the factors of the lower contribution of graduates to entrepreneurship in North-Kivu in the DRC, our objectives were to identify the obstacles that make most graduates not ready to engage in entrepreneurship, to check whether the obstacles are the same for secondary and tertiary education finalists and to find strategies to develop entrepreneurship skills at school. So, we questioned finalists, 74 from secondary school and 48 from tertiary education. The results obtained with chi-square at 1 and 5% threshold show that they are all poorly prepared to entrepreneurship. The results of the survey have led us to note that most graduates are not ready to be entrepreneurs because they are not motivated to entrepreneurship. They want to continue their studies, apply for a job. There is lack of entrepreneurship course in all fields of study, lack of creativity and risk-taking, lack of information about business creation support system. Secondary and tertiary education finalists face the same obstacles of theoretical learning, lack of experience with entrepreneurs, lack of skills including creativity, a spirit of initiative, the risk-taking. Strategies to develop entrepreneurship skills are as follows: the integration of entrepreneurship courses into the learning curriculum in all fields of study, focusing learning on the practices about skills of business creation at school, work sessions with tutors, the partnership with entrepreneurial referents, the learning with various approaches including the workplace learning, solving problem and the project-based learning approaches.

Keywords*: Contribution, Entrepreneurship, Factor, Graduate.*

Introduction

A country's economic development depends on many factors, including "increases in the two principal factors of production (labor and capital), and the third, technological progress, which generates productivity gains." [1]. The main vector for these factors is education, which guarantees the development of human capital. In fact, as UNESCO/OECD [2] points out, "there is now evidence that human capital is a key factor in economic growth, and new evidence indicates that it is also associated with a range of non-economic benefits such as improved health and well-being. Investment in human capital and involvement in education has thus taken center stage in strategies to promote economic prosperity, higher employment and social cohesion". It should be noted that access to employment, production and processing largely dependent on entrepreneurship. It is through education that schools develop in learners the appropriate skills for employment and entrepreneurial attitudes, among which are "autonomy, creativity, curiosity, a spirit of initiative, a certain appetite for risk. and also team spirit and a desire for commitment. This is the basis of the entrepreneurial spirit, which can be defined as the ability to move from an idea to a concrete project. It is therefore fundamental to know oneself, to have learned to take a step back from one's own functioning, one's limits and one's strengths" [3]. In fact, it's up to the school to help learners achieve this. "Education is

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commonly believed to be important for the success of entrepreneurial activity"[4] . Indeed, speaking of the DRC the mission of secondary and tertiary education "is to develop students' critical thinking, creativity and intellectual curiosity, and to prepare them either for a trade or profession, or for higher education and/or university studies if they have the interest and aptitude. [5]. Given the mission of education in the DRC, we understand that the school is the best tool for producing employees and entrepreneurs. Paradoxically, according to the World Bank [6], "the DRC is one of the five poorest nations in the world. In 2023, some 74.6% of Congolese lived on less than $2.15 a day. Around one in six people living in extreme poverty in sub-Saharan Africa live in the DRC". In addition, it has a high unemployment rate, as we can see from the Agence Nationale pour la Promotion des Investissements [7]: "the incidence of poverty averages 80% and the unemployment rate 84%". And finally, it has far fewer entrepreneurs with both secondary and tertiary education qualifications than the rest of the country. Looking at the article by Paul Omandji Lokonde [8], we see that "among young entrepreneurs in Kinshasa, secondary school graduates, together with those from tertiary education, are less numerous than young entrepreneurs with no qualifications or who have not studied". In the towns of Butembo and Beni, the situation of entrepreneurs is not different from that in Kinshasa. The majority of entrepreneurs in this area have no school qualification and they are not registered. Among the 260 or so businesses affiliated to INPP in Butembo [9], 17% were set up by university graduates, 18% by secondary school graduates and 65% by non-graduates or those who had not studied. This observation drew our curiosity, and we wanted to know why secondary school and tertiary graduates, who are supposed to know more or better and be better prepared than others for entrepreneurship, are less numerous among entrepreneurs. According to studies by Théophile Dzaka-Kikouta and colleagues at the Observatoire de la Francophonie Economique [10], the main obstacles to youth entrepreneurship are: "socio-cultural attitudes, weak entrepreneurial skills, regulatory barriers, difficulties in accessing credit, macroeconomic instability and the absence of support and coaching services". Yet, "the Government of the DRC has positioned entrepreneurship as one of the priority levers for economic development. However, this sector suffers from a number of constraints, such as the virtual absence of large companies, the non-use of formal accounting, the opacity of the tax framework, the high rate of informal businesses, and so on. In addition to these dysfunctions, women, with a remarkable presence in the sector, experience specific constraints". Without focusing specifically on women, it should be noted that according to the World Bank [11], women entrepreneurs face the following main obstacles: "difficulties in accessing financing, lack of support services, inappropriate regulations, social prejudice, heavy family responsibilities and low levels of education are the main obstacles to female entrepreneurship". So it's clear that all entrepreneurs, whether graduates or not, face many obstacles. However, considering *the low level of education* and *the weakness of entrepreneurial skills* among the main obstacles as presented above, we think that the entrepreneurship sector would have more graduates than non-graduates, as they presumably don't have these difficulties given their certificates and the purpose of secondary and tertiary education in the DRC. However, we have seen the opposite. We think that the problem for graduates lies at the very level of taking the initiative when they leave school. That's why we put the following questions on which this study will answer:

- Why most secondary and tertiary education graduates are not ready for entrepreneurship?

- Are the obstacles faced by secondary and tertiary finalists different?
- What strategies schools can use to ensure that most graduates be ready for entrepreneurship?

Hypothesis

- Most finalists in both the secondary and tertiary education are not ready to be entrepreneurs for a number of reasons, the most salient of which would be linked to:
  - *lack of motivation for entrepreneurship*. They are motivated to continue studies, applying for a job;
  - *poor learning skills for entrepreneurship*: lack of entrepreneurship course in all fields of study, lack of creativity and experience, difficulty of risk-taking and market knowledge, lack of information about business creation support system, etc.
- Both secondary and tertiary education finalists face the same obstacles of theoretical learning and the lack of tutoring and student carrier day activities with entrepreneurs and with experimented entrepreneur referents;
- There are several strategies that schools should use to develop entrepreneurship skills. They include: integration of entrepreneurship courses into the learning curriculum in all fields of study, focusing learning on the practices about skills of business creation at school including creativity, autonomy and spirit of initiative, work sessions with tutors, the partnership with entrepreneurial referents, the learning with various approaches including the workplace learning, solving problem and the project-based learning approaches, the diversification of professional fields of study.

Objectives

- Identify the obstacles that prevent most graduates from becoming entrepreneurs;
- Verify whether the obstacles are the same for secondary school finalists as for those in tertiary education;
- To find strategies to develop entrepreneurship skills at school.

Methodology

Using comparative approach, our research was carried out on a population made up of people with the following characteristics: being a secondary school or tertiary finalist in the towns of Butembo and Beni. We selected 14 secondary schools and 6 tertiary education institutions in which we worked with a sample of 70 secondary school finalists and 120 tertiary education finalists who wished to participate in our survey by answering our questionnaire.

The survey method, which is used to "collect the personal views of individuals concerning their knowledge, attitudes or behavior" [12], was used in our study. It is proved useful because it enables "primary data to be collected from a questionnaire administered to a sample drawn from a target population. It is a scientific research method designed to collect information systematically in order to describe, explain and compare individual and social objectives and phenomena." [13]. In using this method, we resorted to the questionnaire technique, which is "a self-reporting instrument used to gather information about variables of interest to the researcher" [12]. The questionnaire is "a technique for collecting quantifiable data in the form of a series of questions asked in a precise order. It can be used to gather a large number of testimonies or opinions" [14]. The data we obtained were presented in tables to facilitate analysis on the basis of frequencies and percentages. We used the Chi-square comparison test [15] according to this formula,

$$Q^2 = \sum \frac{N_{ij} - \frac{(L_i \times C_2)^2}{n}}{\frac{L_i \times C_2}{n}}$$

and fractile values for the distribution of Chi-square test [16] to determine whether secondary school finalists differ from tertiary

finalists about: motivation, learning content, entrepreneurial skills and learning approaches with the null hypothesis (Ho) which states that there is no significant difference between secondary school finalists and tertiary education finalists and the alternative hypothesis (Ha) which states that there is significant difference between secondary school finalists and tertiary education finalists.

Our sample is presented as follows: Ladies are 115 or 60.52% and gentlemen are 75 or 39.47%. Among them 70 or 36.84% are finalists at secondary school and 120 or 63.16% are finalists at tertiary education. The fields of study for secondary school finalists in our sample are: Nutrition, Pedagogy, Veterinary, Medical Techniques, Accounting, Social Techniques, Agriculture, Agricultural Industry, Building, Sciences. And the fields of study for the tertiary education finalists in our samples are: Physiotherapy, Law, Communication, Political Science, Sciences and Civil Engineering, Economical, Agronomic, Management, Education, Psychology, Nutrition, Pharmaceutical Sciences, Public Health, Laboratory Technology, Veterinary, Biomedical, Accounting, Nursing, Computer Science.

Results

We have presented the results we obtained in tables for a good analysis

Preparation for Entrepreneurship

Ambitions after Studies

Table 1. Responses to the Question of What the Finalists Plan to do After their Studies

Response	**Secondary school finalists**		**Tertiary education finalists**		**Total line Li**	**Activity**	**Secondary school finalists**		**Tertiary education finalists**		**F**	**%**
	of	**tf**	**of**	**Tf**			**f**	**%**	**f**	**%**		
Yes	52	74,288	68	56,66	12	Continue studies	43	64,28	53	45	99	52,1
						Apply for a job	18	25,71	51	42,5	69	36,31
						Rest for a while	3	4,28	4	3.32	7	3.67
						Play politics	2	2,85	3	2,5	5	2,63
						Start a business	2	2,85	8	6,66	10	5,26
No	18	25,712	52	43,33	70	***Sous-total***	***70***	***100***	***120***	***100***	***190***	***100***
Total column line Cj	**70**	**100**	**120**	**100**	**n= 190**							
$Q^2\ obs = 5{,}87$						**TOTAL**						

Source: Our Survey

Q^2 critical at the 1% significance level and the degree of freedom of 1 is 6.63.

Decision: as critical Q^2 , $6.63 > Q^2$ obs, 5.87, we keep the null hypothesis. It means that secondary school and tertiary education finalists have got the same motivation after graduation.

Comment: From this table 1 we see that when leaving school, the finalists plan to do many things and especially to continue their studies in 52.1%, to apply for a job in 36.31% and to start a business in 5.26%.

The Existence of Concepts on Entrepreneurship

Table 2. Responses to the Question of Whether Learners have been Informed how to Start a Business and the Courses that gave them this Information

Reponse	**Secondary schoolFinalists**				**Tertiary education Finalists**				**Total line Li**
	frequency		***Course***		**frequency**		***Course***		
	of	**tf**	**Entrepreneurship**	***Other Course***	**of**	**tf**	**Entrepreneurship**	***Other Course***	
Yes	**51** or *72.85%*	44.94	46 or *90.19%*	5 or *9.81%*	**71** or *59.16%*	77.05	36 or *51.70%*	35 or *49.30%*	**122**
No	**19** or *27.15%*	24.31	-	-	**49** or *40.84%*	41.68	-	-	**68**
Total column line Cj	**70**	**100**			**120**	**100**			**n= 190**
$Q^2\ obs = 3.13$									

Source: *Our Survey*

Q^2 critical at the 5% significance level and the degree of freedom of 1 is 3.84

Decision: as critical Q^2 , 3.84 $> Q^2$ obs, 3.13, we keep the null hypothesis.

Comment: In Table 2, we see that 72.85% of secondary school finalists and 59.16% of tertiary education finalists know about business creation. The 64.42% of finalists who are informed about entrepreneurship learned through different courses including entrepreneurship course in 90.19% at secondary school and in 51.70% at university.

Obstacles to Business Creation

Table 3. Responses to the Question of what are the Obstacles to Starting One's Own Business

Response	**Secondary school finalists**		**Tertiary education finalists**		**Total line Li**	**Obstacles**	**Secondary school finalists**		**Tertiary education finalists**		**F**	**%**
	fo	**ft**	**fo**	**Ft**			**F**	**%**	**f**			
Yes	69	98.57	115	95.53	184	Starting capital	19	25,33	78	43,57	97	38,18
						Creativity and experience	30	39.99	41	22.88	71	27.93
						Risk-taking and Market knowledge	13	17,33	23	12.84	36	14.16
						The context of the current economic crisis	2	2,66	7	3,91	9	3,54
						Financial risks and workload	9	11.99	14	7.81	23	9.04
						The administrative constraints of creating a business	2	2,66	16	8,92	18	7.08
No	1	1.42	5	4.16	6	-	-	-	-	-	-	-

Total column line Cj	**70**	**100**	**120**	**100**	**190**							
$Q^2\ obs = 0{,}44$						**TOTAL**	***75***	***100***	***179***	***100***	***254***	***100***

Source: *our survey*

Q^2 critical at the 5% significance level and the degree of freedom of 1 is 3.84

Decision: as critical Q^2 , 3.84 $> Q^2$ obs, 1.05, we keep the null hypothesis.

Comment: This table shows that the finalists have many difficulties in creating their own businesses. The most frequent are: lack of start-up capital in 38.18%; lack of creativity and experience in 27.93% and lack of Risk-taking and market knowledge in 14.16%.

Business Creation Support System

Table 4. Responses to the Question to Verify Knowledge of the Business Creation Support System

Response	**Secondal school finalists**		**Tertiary education finalists**		**Total line Li**
	Of	**tf**	**of**	**tf**	
Yes	0	0	0	0	0
No	70		120		190
Total column line Cj	**70**	**70**	**120**	**120**	**n= 190**
$Q^2\ obs = 0$					

Source: Our Survey

Q^2 critical at the 5% significance level and the degree of freedom of 1 is 3.84

Decision: as critical Q^2, 3, 84> $Q^2 obs$, 0, we keep the null hypothesis.

Comment: Here we see that 100% of secondary and tertiary education finalists have not knowledge of business creation support system.

Tutoring activities

Table 5. Response to the Question of Whether there was Entrepreneurial Tutoring activity During the Training

Réponse	**High school finalists**		**Tertiary education finalists**		**Total line Li**	**F**	**%**
	Fo	**ft**	**fo**	**ft**			
Yes	0	0	0	0	0	0	0
No	70	70	120	120	190	190	100
Total column line Cj	**70**			**120**	**n= 190**	**190**	**100**
$Q^2\ obs = 0$							

Source: Our Survey

Q^2 critical at the 5% significance level and the degree of freedom of 1 is 3.84

Decision: as critical Q^2 , 3.84 $> Q^2$ obs, 0, we keep the null hypothesis.

Comment: This table shows that 100% of the finalists did not do any tutoring activity during the training.

Student Career Days

Table 6. Responses to the Question of Whether there were Student Career Days during the Training

Réponse	High school finalists		Tertiary education finalists		Total line Li	F	%
	Of	ft	f	ft			
Yes	0	0	0	0	0	0	0
No	70	70	120	120	190	190	100
Total column line Cj	**70**			**120**	**n= 190**	**190**	**100**
$Q^2\ obs = 0$							

Source: Our Survey

Q^2 critical at the 5% significance level and the degree of freedom of 1 is 3.84

Decision: as critical Q^2 , 3.84 $> Q^2$ obs, 0, we keep the null hypothesis.

Comment: This table shows that the 100% of finalists did not attend student career days.

Entrepreneur Referent for the School

Table 7. Responses to the Question of Whether Schools have Entrepreneur Referents

Response	High school Finalists		Tertiary education finalists		Total line Li	F	%
	Of	tf	of	tf			
Yes	0	0	0	0	0	0	0
No	70	0	120	0	190	190	100
Total column line Cj	**70**		**120**		**n= 190**		**100**
$Q^2\ obs = 0$							

Source: Our Survey

Q^2 critical at the 5% significance level and the degree of freedom of 1 is 3.84

Decision: as critical Q^2 , 3.84 $> Q^2$ obs, 0, we keep the null hypothesis.

Comment: This table shows that the 100% of finalists' schools did not have entrepreneur referents.

Entrepreneurship at School

Table 8. Responses to the Question about Solutions which can ensure that Schools Produce Entrepreneurs

Response	High school finalists		Tertiary education finalists		Total line Li	Learning approach	Solution path	High school finalists		Tertiary education finalists		F	%
	of	tf	of	tf				f	%	f	%		
Yes	70	70	120	120	190	Workplace learning approach	Training entrepreneurship in all the fields of study.	34	46.56	74	38.73	108	40.9

						Project-based learning approach	Train in creativity, autonomy spirit of initiative and risk-taking	13	17,8	43	22,51	56	21,21
						Solving problem approach	More practical learning with right approaches	20	27,39	48	25,13	68	25,75
						Workplace learning approach	Do tutoring activities and student career days with entrepreneurial referents	6	8.19	26	17	32	12.11
No	70	0	0	0	0		***Sub-total***	***73***	***100***	***191***	***100***	***264***	***100***
Total column Cj	**70**		**120**		**n= 190**								
$Q^2\ obs = 0$							**TOTAL**						

Source: Our Survey

Q^2 critical at the 5% significance level and the degree of freedom of 1 is 3.84

Decision: as critical Q^2 , $3.84 > Q^2$ obs, 0, we keep the null hypothesis

Comment: Through this table we find various solutions to the difficulties of creating finalists to create their own businesses. According to their statements, teachers should apply more the workplace learning, solving problem and the project-based learning approaches. And in 40.9% they propose the entrepreneurship course in all the fields of study; in 25.75% that make training more practical with appropriate approaches; in 21.21% to train learns in creativity, autonomy spirit of initiative and risk-taking while they are still at school; in 12.11% to do tutoring activities and student career days with entrepreneurial referents.

Discussion

The results of the Chi-square statistical test at the 1% and 5% threshold support that there is no significant difference between secondary and tertiary education finalists regarding entrepreneurship. They are all poorly prepared and have difficulty of creating their own businesses. Indeed, the results in Table 1 show that the finalists hardly think about creating their own businesses because they have not been prepared to start business despite the results in Table 2 which show that most of finalists have information on business creation. And most of them had this information in secondary school, but without practical experiences. This can be seen from the results in Table 3, which show how difficult it is for finalists, whether from secondary or tertiary education, to create their own businesses, mainly due to a lack of start-up capital, creativity, experience, risk-taking and knowledge of the market. This confirms our second hypothesis according to which secondary school as well as tertiary education finalists have the same obstacles of theoretical

learning and the lack of tutoring and student carrier day activities with entrepreneurs and with experimented entrepreneur referents. In these conditions, schools hinder entrepreneurial integration and professional opportunities for learners. Because “the challenges of tutoring are multiple, both in the present moment and in a long-term perspective. Today, it meets a crucial need for personalized support, whether in school, university or professional settings. It plays a central role in the integration of learners or new employees, while providing regular support to promote educational success.”[17] Also, “no matter where you are in your career and what your objective is, participating in a career day will put all the chances on your side to facilitate your professional project”[18]. And even if finalists were given money to start their businesses, they would not be able to, because they have no entrepreneurial experience with entrepreneurs as the results in tables 4, 5, 6 and 7 show us. In addition to theoretical teaching, it turns out that the finalists have no motivation to entrepreneurship as we have seen with the results in table 1. This confirms our first hypothesis according to which most young finalists in second school as well as those in tertiary education are not ready to start their own businesses for several reasons, the most salient of which are lack of motivation for entrepreneurship, poor learning skills for entrepreneurship including lack of entrepreneurship course in all fields of study, lack of creativity and experience, difficulty of risk-taking and market knowledge, lack of information about business creation support system, There is a need for school to bring learners improving entrepreneurial skills. According to Jennifer Herrity, [19] the following steps can help: “take a course, attend events and workshops, seek out experienced mentors, build your leadership skills, learn how to manage finances”. The results in Table 8 support that the school will have to apply workplace learning, solving problem and the project-based learning approaches more in teaching than the theoretical collective approach by training in a practical way and introducing learners to entrepreneurship through the training in creativity, autonomy, spirit of initiative and risk-taking while they are still at school. This confirms our third hypothesis according to which there are various strategies that schools should develop to better prepare young finalists to do entrepreneurship. Among these we have the integration of entrepreneurship courses into the learning curriculum in all fields of study, focusing learning on the practices about skills of business creation at school including creativity, autonomy, spirit of initiative, risk-taking, work sessions with tutors, the partnership with entrepreneurial referents, the learning with various approaches including the workplace learning, solving problem and the project-based learning approaches, the diversification of professional fields of study. This leads us to recall the concept of competency. Actually, according to OECD [20], “the concept of competency implies more than just the acquisition of knowledge and skills; it involves the mobilization of knowledge, skills, attitudes and values to meet complex demands. Future-ready students will need both broad and specialized knowledge” with right approaches as mentioned above among which the problem-solving method, a “learner-centered approach that encourages students to apply critical thinking, reasoning, and creativity to solve challenges. It focuses on developing students’ ability to identify problems, explore potential solutions, and apply their knowledge in a range of scenarios. This method aims to encourage independent thinking and deepen understanding of topics to make it more achievable to apply them to a real-world situation” [21] and the workplace learning that “is the process of acquiring knowledge, skills, and attitudes through experience in the workplace. Workplace learning is an ongoing process that brings together people to learn and grow. Workplace learning means more than just

attending workshops or webinars; it's about sharing ideas, collaborating on projects, and working through challenges together" [22].

Conclusion

In this study on the reasons for the lower contribution of graduates to entrepreneurship in North-Kivu, our problem is structured around these questions:

- Why most secondary and tertiary education graduates are not ready for entrepreneurship?
- Are the obstacles faced by secondary and tertiary finalists different?
- What strategies schools can use to ensure that most graduates be ready for entrepreneurship?
- Identify the obstacles that prevent most graduates from becoming entrepreneurs;
- Verify whether the obstacles are the same for secondary school and tertiary education finalists;
- To find strategies to develop entrepreneurship skills at school.

To achieve this, we collected data using a survey method and questionnaire technique. We processed the data using frequency scoring with statistical analysis based on percentages and chi-square.

We found the following:

- Most graduates are not ready to be entrepreneurs because they are not motivated to entrepreneurship. They want to continue their studies, apply for a job, . There is lack of entrepreneurship course in all fields of study, lack of creativity and experience, difficulty of risk-taking and market knowledge, lack of information about business creation support system, …
- Secondary and tertiary education finalists face the same obstacles of theoretical learning and the lack of tutoring and student carrier day activities with entrepreneurs and with experimented entrepreneur referents;
- Strategies to develop entrepreneurship skills are as follows: the integration of entrepreneurship courses into the learning curriculum in all fields of study, focusing learning on the practices about skills of business creation at school including creativity, autonomy, spirit of initiative, risk-taking, work sessions with tutors, the partnership with entrepreneurial referents, the learning with various approaches including the workplace learning, solving problem and the project-based learning approaches, the diversification of professional fields of study.

The results obtained during this study therefore confirmed all our hypotheses.

This article presents the educational factors or challenges behind the lower contribution of graduates to entrepreneurship and the educational solution in terms of entrepreneurship skills and learning approach for graduates to be ready to start up their business.

Conflict of Interest

There is no conflict of interest.

Acknowledgements

None.

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ABO and Rh Blood Group Distribution and its Relationship with Coagulation Factor VIII among Healthy Ghanaians

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Abstract

The ABO and Rh blood group systems play essential roles in transfusion medicine and have been implicated in the risk of thrombotic and hemorrhagic disorders through their influence on coagulation factors. This study assessed the distribution of ABO and Rh blood groups and their relationship with coagulation factor VIII (FVIII) levels in healthy Ghanaians. A cross-sectional study was conducted among 118 adults aged 18–60 years at three hospitals in Tema, Ghana. Blood groups were determined using standard agglutination methods, and FVIII antigen (FVIII:Ag) levels were measured using ELISA. Complete blood counts were analyzed to assess hematological parameters. The distribution of ABO groups was: O (28.0%), A (26.3%), B (24.6%), and AB (21.2%), with 90.7% of participants being Rh-positive. Mean FVIII:Ag levels did not significantly differ across ABO groups (p = 0.714), and no significant association was found with Rh status. Interestingly, group O individuals had the highest mean platelet volume (MPV), and a weak negative correlation was observed between FVIII:Ag and MPV (r = –0.205, p = 0.039). Age and sex showed no significant influence on FVIII:Ag levels. These findings suggest that while the ABO and Rh distributions in this Ghanaian cohort align with expected regional patterns, their impact on FVIII levels may be less pronounced compared to other populations. The novel observation of elevated MPV in group O individuals warrants further investigation. Understanding the interplay between blood groups and coagulation factors in African populations is essential for refining risk assessments for thrombotic and bleeding disorders.

Keywords: *ABO Blood Group, Ghanaian Population, Factor VIII, Rh Factor.*

Introduction

The ABO blood group system, first identified by Karl Landsteiner in 1900, is the most clinically significant of the 36 known human blood group systems and is designated No. 001 by the International Society of Blood Transfusion [1, 2]. While best known for its role in blood transfusion compatibility, the ABO system extends beyond red blood cells, with its carbohydrate antigens (A, B, H) expressed on a wide range of cells, including platelets, epithelial cells, and vascular endothelial cells [3, 4]. Because of this broad tissue distribution, ABO antigens are considered histo-blood group antigens, playing critical roles not only in transfusion reactions and organ transplantation but also in susceptibility to diseases.

The ABO system has four main phenotypes A, B, AB, and O whose incidence varies widely across populations. In the United States, AB is least common (4%), followed by B (10%), A (41%), and O (45%), with 85% of Caucasians and 95% of Black Americans being Rh-positive [5, 6]. In Nepal, O is most common (34.9%), while in sub-Saharan Africa, including Tanzania and Ghana, blood group O predominates, accounting for over 50% of the population, and Rh-positivity exceeds 90% [7-9].

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Beyond transfusion medicine, ABO blood groups have been linked to susceptibility to several diseases, including urinary tract infections, diabetes mellitus, gastric cancer, cardiovascular diseases, and even lifespan differences [5, 10-12]. One of the most intriguing associations is the relationship between ABO groups and thrombotic risk. Studies, especially from Europe and North America, have consistently shown that non-O blood groups are associated with elevated levels of von Willebrand factor (vWF) and coagulation factor VIII (FVIII), both key players in hemostasis [5, 13]. Individuals with blood group O typically have ~25% lower vWF and FVIII levels compared to non-O individuals; within non-O groups, AB shows the highest levels, followed by B and A [5]. This biochemical difference partly explains the two- to four-fold increased risk of venous thromboembolism observed in non-O individuals compared to those with group O.

However, much of the current knowledge on the ABO–vWF–FVIII relationship comes from studies in Caucasian and Asian populations, with relatively little data available from African populations, including Ghana. Additionally, few studies have examined the interaction of ABO groups with full blood count (FBC) parameters, such as platelet count and mean platelet volume (MPV), or assessed whether factors like age and sex modify these relationships. Considering that both genetic and environmental factors may influence hemostasis in African populations, there is a need for local data to better understand potential differences.

Materials and Methods

Study Area

The study was conducted in Tema, located in the Tema Metropolitan Area (TMA) within the Greater Accra Region of Ghana. TMA is a coastal metropolis bordered by Kpone Katamanso and Ningo-Prampram Districts to the northeast, Ledzokuku-Krowor Municipal to the southwest, Adenta Municipal and Ga East Municipal to the northwest, Akuapim South District to the north, and the Gulf of Guinea to the south [14]. The Ashaiman Municipal is an enclave within the TMA. The metropolis spans approximately 396 km², with Tema as its capital, situated within the coastal savannah zone. Tema's geographic coordinates are 5°40′0.0012″ N latitude and 0°0′0.0000″ E longitude. According to the 2010 Population and Housing Census, the total population of TMA was 292,773, and recent estimates by the Ghana Statistical Service (GSS) report a population of 310,853, with a density of 784 people/km²—significantly above the national average of 124 people/km² [14].

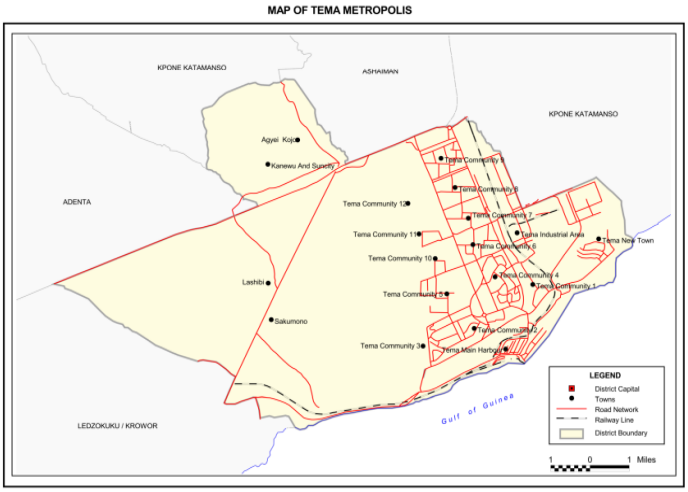

Figure 1. Map of Tema Metropolis, Indicating the Study Area [15]

Study Design

This was a prospective, analytical cross-sectional study conducted between July and September 2022. After obtaining ethical clearance, 118 healthy adults aged 18–50 years were recruited from the Tema Metropolis, based on predefined inclusion and exclusion criteria. Laboratory analyses were performed at the Hematology Unit of Tema General Hospital (TGH) Laboratory and Wenchi Methodist Hospital. Prior to sample collection, participants were interviewed, and detailed personal, family, medical, and drug histories were obtained. Written informed consent was secured from all participants.

Study Population

Participants included healthy individuals visiting Tema General Hospital, VALCO Hospital, and Trust Clinic for blood donation or routine medical check-ups. Healthy was defined as individuals without a history of deep vein thrombosis, liver or kidney disease, hypertension, acute sepsis, hemophilia A, hemophilia B (Christmas disease), von Willebrand disease, or other coagulopathies.

Sample Size and Method

For this study, the sample size was determined by referencing the methodology of [5], who conducted a comparable study on ABO blood groups and coagulation factors. Based on their minimum sample size and considering the study objectives, a target of at least 120 participants was established to ensure adequate statistical power and meaningful analysis. Simple random sampling method was used in the selection of participants until the minimum sample size for the study was exceeded

Inclusion Criteria

The study included healthy individuals aged 18–55 years who visited the participating health facilities for routine medical examinations, blood donation, or while accompanying relatives. Both males and females were eligible for inclusion. Additionally, Ghanaian nationality was a prerequisite for participation.

Exclusion Criteria

Individuals were excluded if they had a history of deep vein thrombosis, hemophilia A, hemophilia B (Christmas disease), von Willebrand disease, or any other coagulopathy. Additional exclusions included those with liver disease, kidney disease, hypertension, acute sepsis, or individuals taking medications that affect clotting factor activity, such as warfarin. Persons younger than 18 years or older than 55 years were excluded, as were pregnant women due to their prothrombotic state. Furthermore, individuals with chronic inflammatory disorders, hyperlipidemia, cerebrovascular disease, psychiatric illness, malignancy, smoking history, prolonged immobilization, or paralysis were also excluded from the study.

Determination of Blood Types

The blood group of each participant was determined by using both the forward and reverse typing methods of tube typing. The ABO forward typing and Rh typing were done simultaneously using the tube method. For each participant, a 3 to 5% suspension of their red cells was prepared using normal saline. The ABO forward grouping results were confirmed using the ABO reverse grouping.

Measurement of Full Blood Count

Two milliliters of venous blood were collected from each participant into tubes containing the anticoagulant ethylenediaminetetraacetic acid (EDTA). The samples were gently mixed to ensure proper anticoagulation and then analyzed for full blood count (FBC) parameters.

Analysis of FVIII: Ag using Quantitative Sandwich ELISA

The concentrations of factor VIII antigen (FVIII:Ag) in participant samples were analyzed at Wenchi Methodist Hospital using

the MR-96A microplate reader (Mindray) and ELISA kits from Melson Shanghai Chemical Ltd. (Melson Shanghai Chemical LMT). Plate washing was performed using the BIO-RAD PW40 automatic microplate washer, a compact, programmable device equipped with an eight-channel washing comb, a vacuum pump, and built-in dispensing pumps.

The ELISA assay followed the quantitative sandwich principle for measuring FVIII:Ag in human serum, cell culture supernatants, and other biological fluids. In this method, microtiter plate wells pre-coated with purified human factor VIII antibody serve as the solid-phase capture antibody. Samples containing FVIII:Ag were added to the wells, where the antigen bound to the immobilized antibody to form an antibody–antigen complex. A secondary antibody conjugated with horseradish peroxidase (HRP) was then added, forming a "sandwich" complex: antibody–antigen–enzyme–antibody.

After thorough washing, tetramethylbenzidine (TMB) substrate was added. The HRP enzyme catalyzed the conversion of TMB to a blue-colored product. The reaction was stopped by adding sulfuric acid, changing the solution to yellow, and the absorbance was measured spectrophotometrically at 405 nm. The FVIII:Ag concentrations in the samples were determined by comparing their optical densities (ODs) to a standard curve generated using known standards provided in the ELISA kit.

Results

Socio-Demographic Characteristics of the Study Participants

Among the 118 participants, 75 (63.6%) were male and 43 (36.4%) were female. The largest age group was 31–40 years, accounting for 44 participants (37.3%), followed by the 20–30-year group with 36 participants (30.5%). Regarding marital status, 75 participants (63.6%) were married, while 43 (36.4%) were single as represented in Table 1.

Table 1. Socio-Demographic Characteristics of the Study Participants

Variables Categories Frequency (%)			
Age	20-30	36	(30.5)
	31-40	44	(37.3)
	41-50	28	(23.7)
	51-60	10	(8.5)
Sex Marital Status	Male	75	(63.8)
	Female	43	(36.4)
	Single	43	(36.4)
	Married	75	(63.6)

Data Presented in Frequencies with Corresponding Percentages in Parentheses

Distribution of ABO and Rh Blood Groups among Study Participants

Table 2 present with the number and percentage distribution of ABO and Rh blood groups among the study participants. Blood group O was the most predominant at 28.0%, followed by group A at 26.3%, group B at 24.6%, and group AB at 21.2%. Additionally, the vast majority of participants (90.7%) were Rh D positive.

Table 2. Number and Percent Distribution of Blood Groups of the Study Participants (N=118)

Blood Group	Number	Frequency (%)
A	31	26.3%
B	29	24.6%
O	33	28.0%
Total (N)	**118**	**100%**

Data Presented in Frequencies with Corresponding Percentages. N=Total Number

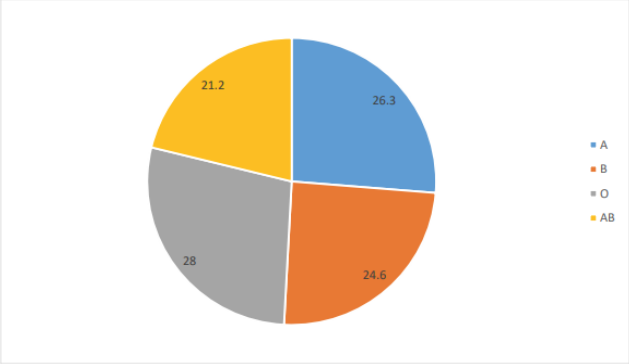

Figure 2. Distribution of Study Participants based on ABO Blood Groups (N=118). Total Number of Study Participants; A: Blood Group A; Blood Group B; AB: Blood Group AB; O: Blood Group O

Participants Demographics Stratified by Plasma FVIII:Ag Levels

Table 3. depicts the demographics of study participants stratified by serum FVIII:Ag levels. Participants within the 20-30 age group had the highest mean concentration of FVIII:Ag (137.554 ±41.688), followed by 41-50 age group (122.870±48.444), 31-40 age group (119.733±37.867) and the 51-60 age category had the least mean FVIII:Ag concentration. There was no statistical difference (P=0.243) in the mean FVIII:Ag levels among the various age categories. This implies age may have minor or limited influence on the FVIII levels of the participants.

The mean FVIII:Ag level was higher (129.394±46.531) among the male study subjects compared to their female counterparts (119.734 ± 30.789) even though the mean FVIII:Ag levels did not differ statistically (p=0.226) between the male and female genders. The mean FVIII:Ag level did not differ significantly between married and single participants.

Table 3. Participants' Demographics Stratified by Plasma Factor VIII levels

Variable Category Factor FVIII:Ag/ng/ml				***P-Value***
Age	20-30	137.554	± 41.688	*0.243*
	31-40	119.733	± 37.867	
	41-50	122.870	± 48.444	
	51-60	119.255	± 32.455	
Sex	Male	129.394	± 46.531	*0.226*
	Female	119.734	± 30.789	
Marital Status	Single	130.758	± 43.273	*0.336*
	Married	123.073	± 40.658	

Sex and Marital Status Compared using Students' T-test and Age Categories Compared using ANOVA. FVIII:Ag levels Presented as Mean ± SD.

Association between FVIII: Ag and Blood Groups

Table 4. illustrates the association between FVIII:Ag levels and blood group antigens. FVIII:Ag levels were highest among participants with blood group A (130.50 ±45.67), followed by blood group AB (129.02 ± 30.83), blood group B (125.87 ± 42.3) and individuals with blood group AB had the least mean concentration of FVIII:Ag. There was no significant statistical difference (p=o.714) in the mean concentrations of FVIII:Ag among the various ABO antigens.

Table 4. Association between Factor VIII: Ag and Blood Groups

Factor VIII: Ag							
Blood Groups	**Mean**		**95% Confidence Interval for Mean**		**Minimum**	**Maximum**	***p-value***
			Lower Bound	**Upper Bound**			
A(N_1=31)	130.50 ±	45.67	113.74	147.24	48.250	217.800	
B (N_2=29)	125.87±	42.38	109.76	142.00	51.350	217.350	0.714^{NS}
AB (N_3=25)	129.02±	30.83	116.30	141.74	71.000	193.600	
O (N_4=33)	119.15±	44.90	103.23	135.07	31.650	209.950	
Total(N=118)	125.87±	41.61	118.30	133.46	31.650	217.800	

Parametric data (presented in means ± standard deviation) were generated by One-way ANOVA.N: Total number of subjects; N1; number of participants with blood group A; N2; number of participants with blood group B; N: number of participants with blood group AB; N4: number of participants with blood group O. p-value<0.05 was deemed acceptable level of significance. NS: Not significant.

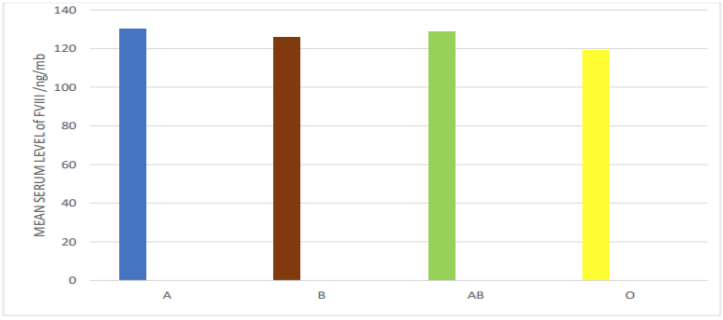

Figure 3. Shows the Graphical Representation of Mean FVIII:Ag Levels among Participants with the Various Blood Group Antigens

Figure 3. Mean FVIII:Ag concentrations of participants according to their ABO blood groups (N=118). Total number of participants; A: Blood group A; B: Blood group B; AB: Blood group AB; O`: Blood group O.

Participants Demographics Stratified by Plasma Factor VIII Levels

Table 5. shows the demographics of the study participants stratified by plasma FVIII:Ag levels. The mean plasma concentration of FVIII:Ag was higher in males (129.394±46.531) than in the female participants (119.734 ± 30.789). The mean FVIII:Ag levels did not differ significantly between the male and female study participants (p=0.226). The mean FVIII:Ag levels did not differ significantly between participants who were married and those who were not married (p=0.336).Though, the mean FVIII:Ag levels did not differ significantly among the various age groups (p=0.243), the levels were higher among participants within the 20-30 years age group (137.554±41.688), followed by the 41-50 years age group (122.870±48.444), 31-40 age group (119.733±37.867) and 51-60 years age group (119.255±32.455).

Table 5. Participants Demographics Stratified by Plasma Factor VIII levels

Variable Category Factor FVIII				*P-Value*
Age	20-30	137.554	± 41.688	*0.243*
	31-40	119.733	± 37.867	
	41-50	122.870	± 48.444	
	51-60	119.255	± 32.455	
Sex	Male	129.394	± 46.531	*0.226*
	Female	119.734	± 30.789	
Marital Status	Single	130.758	± 43.273	*0.336*
	Married	123.073	± 40.658	

Sex and Marital Status Compared using Students' T-test and Age Categories Compared using ANOVA.

FVIII:Ag Levels Presented as Mean ± Standard Deviation.

Association between FBC Parameters and the Blood Groups of Participants

Table 6 show the association between the ABO blood groups and FBC parameters of the study participants. The mean platelet volume (MPV) varied statistically (p=0.046) among the various ABO blood groups with group O individuals having the highest MPV.

Table 6. FBC vs Blood Groups of the Study Participants

Variables	BLOOD GROUP								
	A		**B**		**AB**		**O**		***p-value***
RBC/10*12/l	4.2	(4.0- 4.6)	4.6	(4.34.8)	4.3	(3.9 4.7)	4.5	(4.2 5.0)	*0.098*
HCT%	36.6	(32.9- 38.3)	37.8	(34.4 40.5)	35.7	(33.7 37.8)	38.9	(33.7 41.9)	*0.301*
HB/g/dl	12.3	(11.4- 13.5)	13.4	(11.8 14.1)	12.1	(11.5 12.8)	12.6	(11.5 14.3)	*0.451*
MCV.fl	84.8	(80.0- 88.6)	84.1	(79.7 86.5)	83.7	(81.4 87.5)	84.4	(77.4 88.7)	*0.964*
MCH/pg	29.1	(27.0-30.6)	29.3	(27.1 30.6)	28.7	(27.9 30.0)	28.8	(26.4 30.4)	*0.855*
MCHC/g/dl	34.67 ± 1.41 34.49 ± 1.17 34.02 ± 0.76 (34.16 ±1.38)								*0.165*
RDWCV%	13.8	(13.3 14.7)	13.7	(13.2 14.7)	13.7	(13.3 14.5)	14.3	(13.6 14.9)	*0.503*
RDWSD/	66.9	(62.1 70.0)	63.7	(59.1 69.4)	64.7	(61.1 68.9)	66.1	(41.5 70.7)	*0.901*
WBC10*9/l	4.8	(4.3 6.0)	5.3	(4.8 6.0)	6.1	(4.8 7.0)	4.9	(4.0 6.3)	*0.303*
LYM#	2.04 ± 0.64 2.08 ± 0.63 2.30 ± 0.86 2.09 ± 0.80								*0.638*
GRAN	2.3	(1.7 2.9)	2.7	(1.8 3.6)	2.8	(2.0 4.5)	2.3	(1.6 2.8)	*0.360*
MID	0.6	(0.4 0.7)	0.6	(0.4 0.8	0.6	(0.4 1.0)	0.5	(0.4 0.8)	*0.910*
LYM%	42.6	(26.1 52.3)	41.4	(30.4 50.0)	43.3	(27.4 47.7)	42.3	(31.1 52.0)	*0.938*
GRAN%	46.04 ± 15.12 49.03 ± 14.35 49.45 ± 12.62 46.34 ± 11.16								*0.724*
MID%	10.76 ± 3.51 11.13 ± 6.52 10. 30 ± 3.46 11.27 ± 5.0								*0.977*
PLT/1089/l	232.4 ± 68.96 231.3 ± 65.09 235.8 ± 67.61 234.4 ± 53.22								*0.917*
MPV/fl	8.12 ± 1.13 8.31 ± 1.01 8.23 ± 1.61 9.01 ±1.26								***0.046***
PDW/fl	11.1	(10.3 12.3)	11.5	(10.4 12.4)	10.9	(10.3 11.8)	11.9	(10.8 12.7)	*0.169*
PCT%	0.2	(0.1 0.2)	0.2	(0.2 0.2)	0.2	(0.1 0.2)	0.2	(0.2 0.3)	*0.389*
PLCR/%	15.74 ± 6.87 16.36 ± 5.96 16.13 ± 9.50 20.62 ± 7.55								*0.072*

Hb=Haemoglobin, HCT=Haematocrit, MCV=Mean Cell Volume MCH=Mean Corpuscular Haemoglobin,MCHC=Mean Corpuscular Haemoglobin Concentration, RDW-CV=Red Cell Distribution Width-Coefficient of Variation, WBC=White Blood Cell, MPV=Mean Platelet Volume. Parametric data (presented in means ± standard deviation) were generated by

One-Way ANOVA (posthoc analysis) and Non-Parametric data presented in medians (25th-75th percentiles) were generated by Kruskal-Wallis Test, and p<0.05 was considered statistically significant.

Plasma Levels of FVIII between Study Participants of "O" vs "Non-O" Blood Groups

Table 7. represents a comparison in the mean FVIII:Ag levels between "O" and non-"O" individuals. There was no statistical difference (P=0.276) in the mean serum concentrations of FVIII:Ag between "O" and "Non-O individuals, though individuals with the non-O blood group recording the highest mean serum levels of FVIII:Ag (128.48 ± 40.24) against their blood group O counterparts (119.15 ± 44.90).

Table 7. Plasma Levels of Factor VIII between Study Participants of "O" vs "Non-O" Blood Groups

Variable	Factor FVIII:Ag/ng/ml	*p-value*
Group O	119.15 ± 44.90	*0.276*^{NS}
Non-O Group	128.48 ±40.24	

Parametric data (presented in means ± standard deviation) were generated by Independent Sample T test.

NS: Not significant

Correlation between FBC and Serum FVIII Levels among the Study Participants

Table 8. Shows the correlation between FBC parameters and serum FVIII:Ag levels of the study participants. There was no statistical difference in the mean FVIII:Ag levels and the FBC parameters except the MPV. There was a weak negative correlation (r = -0.205 at p=0.039) between the MPV and the mean serum concentration of FVIII:Ag.

Table 8. Correlation between FBC and Plasma Factor VIII Levels among the Study Participants

Parameters	Correlation (r)	*p-value*
RBCX10^{12}/L	-0.32	0.748
HCT%	-0.19	0.847
HB g/dl	0.020	0.840
MCV, Fl	0.018	0.851
MCH, pg	0.012	0.903
MCHC, g/dl	-0.031	0.756
RDW-CV%	0.060	0.546
RDW-SD	0.096	0.330
WBC10*9/l	0.062	0.530
LYM#	-0.023	0.817
GRAN	0.063	0.526
MID	-0.085	0.387
LYM%	-0.003	0.976
GRAN%	-0.047	0.141
MID%	-0.143	0.141
PLT/1089/l	-0.093	0.338
MPV/fl	**-0.205**	**0.039**^{S}
PDW/fl	-0.115	0.247
PCT%	-0.169	0.088

PLCR/%	-0.182	0.066

Hb=Haemoglobin, HCT=Haematocrit, MCV=Mean Cell Volume MCH=Mean Corpuscular Haemoglobin, MCHC=Mean Corpuscular Haemoglobin Concentration, RDW-CV=Red Cell Distribution Width-Coefficient of Variation, WBC=White Blood Cell, MPV=Mean Platelet Volume. Parametric data were generated by Pearson correlation and Non-Parametric data presented using spearman correlation and p<0.05 was considered statistically significant;NS: significant.

Discussion

In our study, the distribution of ABO blood groups followed the sequence O > A > B > AB, with group O being the most prevalent (28.0%) among participants. This finding is consistent with reports from the Greater Accra region of Ghana, where blood group O was also predominant [8]. The high frequency of group O in our cohort aligns with the known predominance of group O in African populations. Additionally, an overwhelming majority (90.7%) of our participants were Rh(D) positive, consistent with other Ghanaian and African studies [5, 16, 9] confirming that Rh-positive phenotype is the norm in local and regional populations.

Despite the general agreement, some geographic variations were noted. For example, a study in the Ashanti region of Ghana reported a distribution of O > B > A > AB [9], while in Bangladesh, [5] found B > O > A > AB, and in Senegal, [16] reported A > O > B > AB. These discrepancies likely reflect ethnic and racial variation, population genetics, and migration patterns.

Regarding factor VIII antigen (FVIII:Ag) levels, we found no significant differences across age groups ($p = 0.243$), although the 20–30-year group had the highest levels. This aligns with [17], who reported weak or non-significant correlations between FVIII and age in non-severe hemophilia A patients. In contrast, [18] reported significantly higher FVIII levels with advancing age, although their study included children, which may explain the difference. We also found no significant sex differences in FVIII:Ag, supporting prior observations that baseline FVIII and von Willebrand factor (vWF) levels are generally similar between men and women.

We observed higher mean FVIII:Ag in blood group A, followed by AB, B, and O (A > AB > B > O), but these differences were not statistically significant. This pattern is consistent with the known influence of ABO blood groups on plasma vWF and FVIII levels. Individuals with blood group O have ~20–25% lower vWF (and FVIII) levels than non-O groups due to the absence of A/B glycosylation on vWF, which increases its clearance [19-21]. Our results align with studies by [22] and [17] , who also reported no significant ABO effects on FVIII. However, [5] and [23] reported significant ABO effects, with non-O groups (particularly B) showing higher FVIII levels. Notably, Song et al. observed racial differences, with ABO explaining ~15% of vWF variability and a smaller share of FVIII variability.

A novel finding in our study was the significantly higher mean platelet volume (MPV) in group O participants ($p = 0.046$). This association has not been widely reported, and its biological basis is unclear. ABO antigens can be adsorbed onto platelets, but whether they influence platelet size or production is unknown. One speculative explanation is that genetic factors near the ABO locus or linked to vWF may subtly affect platelet morphology. Further research is needed to explore this observation.

We also identified a weak but significant negative correlation between FVIII:Ag and MPV ($r = –0.205$, $p = 0.039$), suggesting a minor inverse relationship. It is possible that the lower FVIII/vWF levels in group O, combined with their higher MPV, contributed to this pattern, although causality cannot be inferred. Future studies with larger samples and mechanistic analyses are needed to clarify these associations.

Limitations of our study include the modest sample size, geographic concentration in Tema, and lack of vWF measurement. We also focused on adults aged 18–55, limiting generalizability to children or older adults. Nonetheless, our study contributes valuable data on ABO and Rh distribution and FVIII:Ag levels in a healthy Ghanaian population, highlights the potential influence of blood group on coagulation profiles, and identifies novel areas for further investigation

Conclusion

Based on the analysis of our data, we conclude that blood group O is the predominant ABO blood group (28.0%) among the study population, followed by blood groups A (26.3%), B (24.6%), and AB (21.2%). Nearly all participants were Rh-positive. Our findings did not show a significant influence of ABO blood group on FVIII:Ag levels, suggesting that, in this Ghanaian population, ABO type may not substantially contribute to thrombosis risk via FVIII elevation. Interestingly, participants with blood group O exhibited the highest mean platelet volume (MPV), indicating a possible link between ABO type and platelet size. Additionally, we observed a weak negative correlation between FVIII:Ag levels and MPV. Age and sex were not found to significantly influence FVIII:Ag levels in this cohort.

Recommendations

We recommend further studies including individuals of all age groups and ethnic backgrounds across Ghana to better understand the distribution of ABO blood groups and their relationship with coagulation factors. Additionally, comprehensive assessment of the entire hemostatic system including von Willebrand factor, fibrinogen, and other clotting parameters would provide a more complete picture of hemostasis and thrombosis risk in the Ghanaian population.

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Examining the Influence of Climate Change on Human Wildlife Conflict in Mosi-Oa-Tunya and Sioma Ngwezi National Parks

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Abstract

This study examined the impact of climate change on human-wildlife conflict (HWC) in two ecologically distinct protected areas in Zambia: Mosi-Oa-Tunya National Park (MoTNP) and Sioma Ngwezi National Park (SNNP). Utilizing a mixed-methods approach, data were collected from 171 households around MoTNP and 250 around SNNP through semi-structured questionnaires, complemented by 10 key informant interviews (KIIs) and 2 focus group discussions (FGDs) per site. Secondary data on climate and wildlife were obtained from the Zambia Meteorological Department (ZMD) and the Department of National Parks and Wildlife (DNPW). Quantitative data were analyzed using Microsoft Excel and SPSS Version 30.The findings revealed significant climate variability, including declining rainfall trends (59 mm/year/decade in MoTNP and 43 mm/year/decade in SNNP) and rising temperatures, contributing to prolonged dry seasons and droughts. These climatic changes correlated with increased HWC incidents. SNNP reported a higher prevalence of HWC (92%) compared to MoTNP (79.5%). Four primary HWC types were identified: crop damage, property destruction, livestock depredation, and human attacks, predominantly occurring during the dry season and daylight hours. In MoTNP, elephants, baboons, monkeys, and buffaloes were the key conflict species, while SNNP also reported significant conflict with hippopotamuses, crocodiles, hyenas, lions, and leopards. Communities employed deterrents such as physical barriers and fireworks, while park management focused on education and sensitisation. The study recommends a context-specific, adaptive HWC mitigation strategy that addresses climatic, socio-economic and ecological drivers. These findings provide critical insights for wildlife managers and policymakers to develop sustainable and inclusive climate-resilient HWC mitigation.

Keywords: *Climate Change, Climate Variability, Human-Wildlife Conflict, Mitigation.*

Introduction

Climate change has become one of the most pressing global challenges, with widespread implications for both the environment and human societies. Among its many ecological impacts, climate change is significantly influencing the dynamics of human-wildlife interactions. As ecosystems shift due to rising temperatures, altered rainfall patterns, and increased frequency of extreme weather events, wildlife species are forced to adjust their behaviors and movement patterns, often bringing them into closer contact with human populations [1]. These shifts disrupt traditional ecological balances and have intensified the frequency and severity of human-wildlife conflict (HWC), particularly in regions where

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humans and wildlife coexist in shared landscapes [2].

Human-wildlife conflict arises when the behavior or needs of wildlife directly interfere with human livelihoods, safety, or property, or conversely, when human activities negatively affect wildlife habitats and survival. In sub-Saharan Africa, where many communities live near protected areas and wildlife corridors, such conflicts are increasingly common and pose a threat to both biodiversity conservation and local socioeconomic development. In Zambia, for instance, between 2002 and 2008, an estimated 347 people were killed by wildlife, with crocodiles, elephants, and hippos accounting for most fatalities [3]. These figures highlight the magnitude of HWC in the country and underscore the urgent need for effective mitigation strategies.

Despite growing awareness of the links between climate change and HWC, comparative research that examines how these dynamics vary across different protected areas remains limited. This study addresses that gap by focusing on two ecologically and socio-economically distinct national parks in Zambia: Mosi-Oa-Tunya National Park (MoTNP) and Sioma Ngwezi National Park (SNNP). These two parks offer a unique opportunity for comparative analysis due to their contrasting settings. MoTNP is located within the urbanized environment of Livingstone, a city with significant infrastructure and tourism activity in southern Zambia. In contrast, SNNP lies in the remote Sioma District in the western region of the country, characterized by rural settlements, low population density, and communities that depend heavily on natural resources for sustenance.

These differing settings reflect unique pressures on wildlife and human populations and thus generate distinct human-wildlife conflict dynamics. The absence of comparative studies addressing how climate-induced changes interact with these localized pressures limits the formulation of responsive and context-specific mitigation strategies.

This study aims to fill this research gap by conducting a comparative assessment of climate-related human-wildlife conflict across these two national parks. It will:

1. Investigate the frequency, patterns, and spatial distribution of human-wildlife conflict incidents in both Mosi-Oa-Tunya and Sioma Ngwezi
2. Examine the socio-economic determinants influencing conflict in the surrounding communities, such as livelihoods, land use, and household vulnerability
3. Assess the perceptions, attitudes, and adaptive responses of key stakeholders, including local communities, park management, and conservation authorities, towards HWC.

By analysing how climate variability influences wildlife behaviour and resource competition, and by evaluating the effectiveness of current mitigation efforts, the study seeks to inform the development of adaptive and inclusive conflict management strategies. These insights will be crucial for shaping conservation policies that enhance resilience, safeguard biodiversity, and support sustainable livelihoods and development for communities co-existing with wildlife.

Methods and Materials

Study Area Location and Description

Sioma Ngwezi National Park (5,276 km^2) lies in Western Zambia, bordering Namibia and Angola, and includes part of the West Zambezi GMA. Mosi-Oa-Tunya National Park (6,600 ha) is Zambia's second smallest park, located in Livingstone and uniquely surrounded by communities without a buffer zone. Both national parks are within the KAZA TFCA.

Research Design

This study employed a comparative case study design to examine the influence of climate change on human-wildlife conflict in

Mosi-Oa-Tunya and Sioma Ngwezi National Parks. A mixed-methods approach integrated quantitative analysis of climate trends, conflict records, and socio-economic data with qualitative insights from interviews and focus group discussions. This combination enabled a comprehensive understanding of context-specific human-wildlife interactions, adaptive responses, and the socio-ecological dynamics at play. Triangulation of data sources ensured methodological rigour, allowing for both statistical assessment and nuanced interpretation of the impacts of climate change and variability on conflict patterns [4].

Population Study

The target population consisted of all households around Mosi-Oa-Tunya National Park and Sioma Ngwezi National Park, as well as the involved wildlife management personnel. There are 53,394 people in Sioma Ngwezi and 43,181 people around Mosi-Oa-Tunya National Park, giving a total of 96,575 people.

Sampling Frame

The study's sampling frame comprised populations living near Mosi-Oa-Tunya and Sioma Ngwezi National Parks, totalling 43,181 and 53,394 individuals, respectively. It included key villages, wards, and chiefdoms within and around park boundaries, capturing areas most affected by human-wildlife conflict. For SNNP, five core villages Dihehe, Imusho, Ngweze, Mbao, and Mbala were central, alongside others in the surrounding Game Management Area. In MoTNP, settlements such as Chief Mukuni's village, Simonga (Sekute Chiefdom), and wards like Zambezi, Shungu, and Dambwa Central were included. This comprehensive geographic sampling frame ensured representation across diverse socio-ecological contexts, supporting robust qualitative and quantitative data collection.

Sample Size

Selecting the appropriate sample size from a large population was critical to avoiding research and/or inference bias. To obtain statistically acceptable results, the required sample size for questionnaire surveys was based on the following calculations:

The sample size was obtained using the Taro [$n = N/1 + N(e)^2$] formula as follows:

$n = N/1 + N(e)^2$

Where n = the required sample of study.

N = total population of study.

e= (0.05 marginal error).

Therefore:

$n = 96,575/1 + 96,575(0.05)^2$

$n = 383$

Table 1. Sample Size Determination for MoTNP and SNNP

National Park	Population	Sample Size Calculation	Sample Size
Sioma Ngwezi	53,394	(63,038/ 96,575) *383	250
Mosi-Oa-Tunya	43, 181	(43,181/ 96,575) *383	171

At 95% level of significance and 5% margin of error, sample size was 212 for SNNP and 171 for MoTNP residents.

Sampling Procedure

The study employed a systematic random sampling technique to select households near the national parks, with stratification to ensure representation across diverse communities and demographic groups. Additionally, purposive sampling was used to identify key informants from park management, government agencies, community leadership, and conservation NGOs, ensuring inclusion of expert perspectives on human-wildlife conflict and climate change.

Data Collection Methods

Primary data were collected through semi-structured questionnaires, focus group discussions, and key informant interviews. A total of 171 respondents in MoTNP and 250 in

SNNP were purposively selected using a homogenous sampling technique between 2023 and 2024. Additionally, 10 key informant interviews were conducted in each park. Random sampling was applied for household surveys, while non-probability sampling guided key informant selection. Secondary data included 24 monthly HWC reports from 2023-2024 under the Department of National Parks and Wildlife (DNPW), alongside data on wildlife corridors and hotspots from DNPW and partners. Climate trends and projections were sourced from meteorological reports and regional/global climate literature.

Data Analysis

Microsoft Excel (2019) and SPSS (Version 30) were used to analyse quantitative data. To investigate conflict species, HWC types, climate variables, and mitigation strategies, pivot tables, descriptive statistics, frequency distributions, and cross-tabulations were used. Pie charts and bar charts were among the visualisations used to highlight important trends and patterns. Excel was used to transcribe, code, and thematically analyse qualitative data from focus groups and key informant interviews to find themes of climate change, adaptive responses, and human-wildlife conflict. Combining qualitative and quantitative data improved the study's validity and gave researchers a thorough grasp of the dynamics between HWC and climate change.

Ethical Considerations

Ensuring respondent confidentiality and anonymity was fundamental to maintaining the ethical integrity of this study. By established research ethics [5], all sensitive data were handled with strict confidentiality and accessed only by the core research team. Participants were assured that their responses would remain anonymous and would be used solely for academic purposes. No personally identifiable information was recorded or disclosed to third parties, thereby safeguarding participant privacy and upholding the credibility of the research process.

Results

Frequency, Patterns, and Spatial Distribution of Human-Wildlife Conflict Incidents in Mosi-Oa-Tunya and Sioma Ngwezi National Parks

In Sioma National Park, a vast majority of respondents (92.0%) reported having personally experienced human-wildlife conflicts in the past years. Only 8.0% of respondents indicated that they had not experienced such conflicts. While in Mosi-Oa-Tunya National Park, a slightly smaller majority of respondents (79.5%) reported experiencing human-wildlife conflicts in the past years. A notable 20.5% of respondents stated that they had not experienced such conflicts (Table 2).

Table 2. Distribution of Whether Respondents Personally Experienced any Human-Wildlife Conflicts in the Past Years

	MoTNP		**SNNP**	
Description	**Frequency**	**Percent**	**Frequency**	**Percent**
Yes	136	79.5	230	92
No	35	20.5	20	8
Total	171	100	250	100

In Sioma Ngwezi National Park, the survey revealed a few human-wildlife conflicts, particularly centred around crop damage and raiding by elephants and hippos, as well as livestock depredation by hyenas, crocodiles, and lions. Respondents vividly described the challenges they face, with one lamenting, *"Elephants trampled over my maize field,*

leaving nothing but destruction in their wake." Another respondent poignantly expressed, "The hippos threaten our lives whenever we try to tend to our fields near the river."

Additionally, incidents of wildlife attacks on humans were reported, including encounters with crocodiles and hippos. One respondent recounted a harrowing experience, saying, *"I narrowly escaped a hippo attack while I was fishing along the riverbank. It was a terrifying ordeal that I never want to experience again."* These direct quotes provide a glimpse into the real and immediate dangers faced by individuals living near wildlife habitats.

In Mosi-Oa-Tunya National Park, similar conflicts were reported, including elephant attacks, property damage by elephants, and crop raids by elephants and baboons. One respondent shared, *"The elephants destroyed our crops overnight, leaving us with nothing to harvest."*

Additionally, incidents of wildlife attacks on humans were reported, including encounters with crocodiles and hippos. One respondent recounted a harrowing experience, saying, *"I narrowly escaped a hippo attack while I was fishing along the riverbank. It was a terrifying ordeal that I never want to experience again."* These direct quotes provide a glimpse into the real and immediate dangers faced by individuals living near wildlife habitats. In Mosi-Oa-Tunya National Park, similar conflicts were reported, including elephant attacks, property damage by elephants, and crop raids by elephants and baboons. One respondent shared, *"The elephants destroyed our crops overnight, leaving us with nothing to harvest."* Another highlighted the issue of wildlife intrusion, stating, *"Baboons frequently break into our homes, causing damage and stealing food."*(Figure 1).

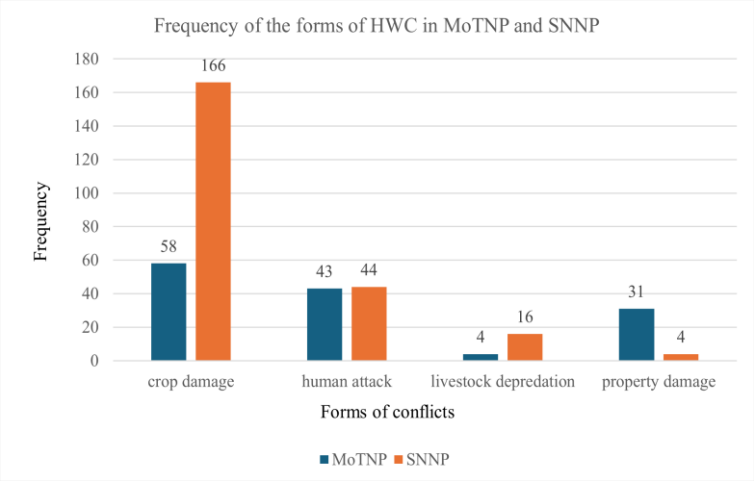

Figure 1. Frequency of the Different forms of Human Wildlife Conflicts Experienced in Mosi-Oa-Tunya and Sioma Ngwezi National Parks

Wild animals are responsible for different forms of conflicts and their threat levels in the two landscapes vary significantly. In SNNP, elephants were the most problematic species accounting for 68.2 % of the recorded HWC cases. The elephant conflicts were broken down into the following forms of conflicts; crop damage (63%), Human attacks (3.9%) and Property damage (1.3%). Hippos were the second most problematic species in SNNP, accounting for 14.4% of the recorded conflicts. Hippo conflicts were segmented as human attack (8.3%) and crop damage (6.1%). The third most problematic animal in SNNP was the crocodile, representing 5.7% of the recorded conflicts in SNNP. crocodile conflicts were segmented as human attack (3.5%) and livestock depredation (2.2%). Other notable conflict causing species in SNNP were the Eland (3.2%), Hyena (2.6%), Lions (2.6%),

Buffalo (1.7%), Leopard (0.8%) and Baboons/Monkeys (0.8%) (Figure 2).

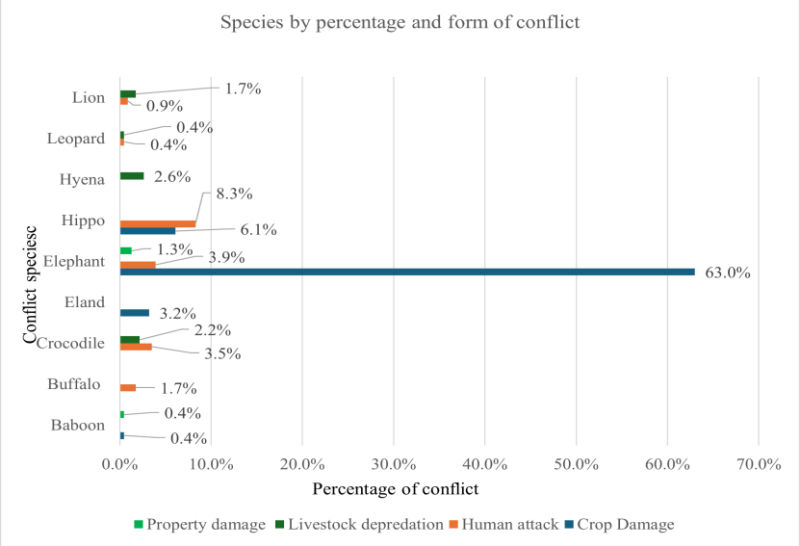

Figure 2. Frequency Percentages for the Various Forms of Human Wildlife Conflicts per Specie in Sioma Ngwezi National Park

In MoTNP, elephants were the most problematic species, accounting for 68 % of the recorded HWC cases. The elephant conflicts were broken down into the following forms of conflicts; crop damage (33%), Human attacks (19%) and Property damage (16%). Baboons and Monkeys were the second most problematic species in MoTNP, accounting for 20% of the recorded conflicts. Baboons and Monkey conflicts were segmented as human crop damage (8%), property damage (7%) and Human attack (5%). The third most problematic animal in MoTNP was the Buffalo, representing 5% of the recorded conflicts. Other notable conflict-causing species in MoTNP were the Hippo (3%) and Crocodile (3%). Despite MoTNP having no resident carnivores, sightings of carnivores have been confirmed, with hyena accounting for (1% of recorded conflicts through livestock depredation (Figure 3).

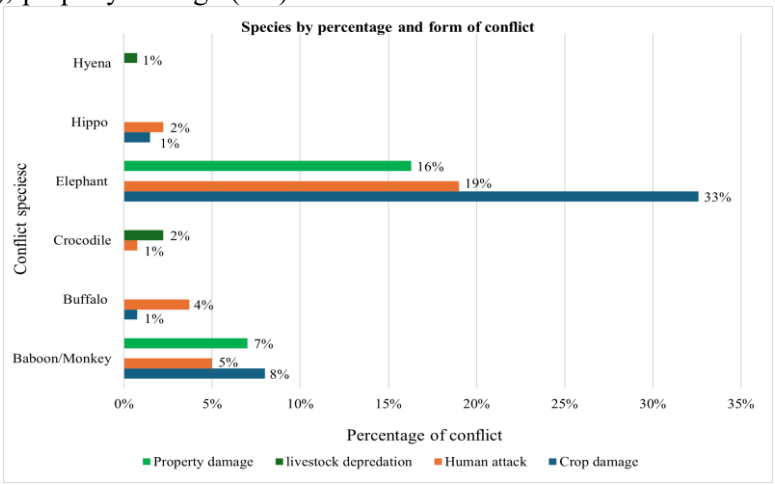

Figure 3. Frequency Percentages for the Various Forms of Human Wildlife Conflicts per Specie in Mosi-Oa-Tunya National Park

The temporal patterns of human wildlife conflict were observed in terms of time (day or night) and season (wet or dry) in which the incidents occurred. Results indicated that the

majority (57%) of human wildlife conflicts incidents in Sioma Ngwezi National Park occurred during the day compared to those that occurred during the night (43%). This trend was also seen in Mosi-Oa-Tunya National Park, though with a higher percentage of conflicts that occurred during the day (70%) compared to those that occurred during the night (30%) (Figure 4).

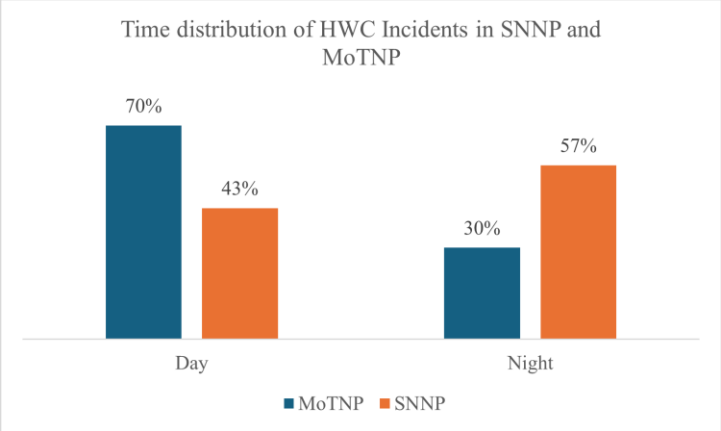

Figure 4. Proportion of Conflict Incidents that Occur during Daytime and Nighttime in Mosi-Oa-Tunya and Sioma Ngwezi National Parks

The results obtained on the seasonal distribution of HWC incidents indicated that the majority (67%) of human wildlife conflicts incidents in Sioma Ngwezi National Park occurred during the dry season compared to those that occurred during wet season (33%). A similar trend was also observed in Mosi-Oa-Tunya National Park, though with a higher percentage of conflicts that occurred during the dry season (80%) compared to those that occurred during the wet season (20%) (Figure 5).

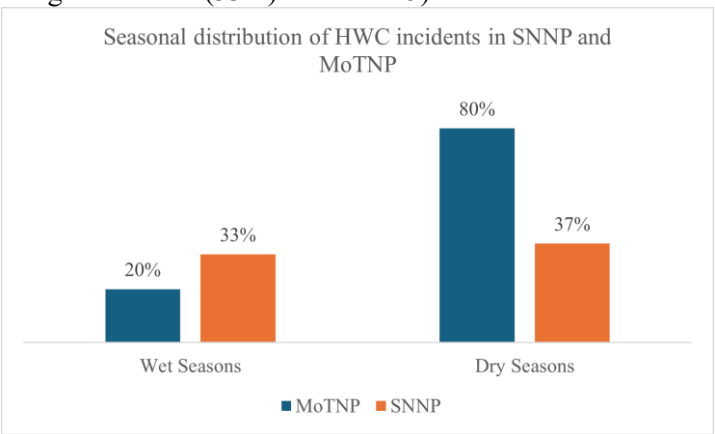

Figure 5. Proportion of Conflict Incidents that Occur During Wet and Dry Season of the Year in Mosi-Oa-Tunya and Sioma Ngwezi National Parks

From the key informant interviews and focus group discussions, the participants were asked to name and locate the areas where most of the conflicts occur within the study areas. The areas were marked by taking coordinates (Table 3 and Table 4) and located on a map of human-wildlife conflicts (Figure 6 and Figure 7). The map shows the human-wildlife conflict hotspots (or areas where a lot of conflicts occur). The hotspots were located both inside and outside the park boundaries.

Table 3. Summary of Identified Communities that are HWC Hotspots with GPS Coordinates and the most Prevalent Form of Conflict in MoTNP

SN	LATITUDE	LONGITUDE	COMPOUND	FORM OF HWC
1	-17.917912	25.893658	Nsongwe	Human Elephant Conflict
2	-17.917927	25.893625	Simasiku	Human Elephant Conflict
3	-17.930831	25.902325	Mukuni	Human Elephant Conflict
4	-17.902718	25.939903	Dambwa, Mukuni	Human Elephant Conflict
5	-17.871534	25.959313	Chise	Human Elephant Conflict
6	-17.870009	25.981795	Muchinga	Human Elephant Conflict
7	-17.86999	25.981793	Mukalahani	Human Elephant Conflict
8	-17.900142	25.975674	N'gandu	Human Elephant Conflict
9	-17.944686	25.955478	Machenje	Human Elephant Conflict
10	-17.903142	25.911858	Siamapa	Human Elephant Conflict
11	-17.874828	25.837916	Sewerage	Baboon and Elephant Conflict
12	-17.868148	25.84915	Cold storage	Human Elephant Conflict
13	-17.860985	25.851509	217	Human Elephant Conflict
14	-17.860963	25.851496	Simoonga	Human Elephant Conflict
15	-17.808681	25.716612	Sinde	Human Elephant Conflict
16	-17.661893	25.905846	Sons of thunder	Human Elephant Conflict
17	-17.661847	25.905852	Musokotwane	Human Elephant Conflict
18	-17.618848	25.837868	Sinde mission	Human Elephant Conflict
19	-17.618868	25.837751	Kananga	Human Elephant Conflict
20	-17.851457	25.818776	Parklands	Human Elephant Conflict
21	-17.854553	25.819636	Nakatindi	Baboon and Elephant Conflict
22	-17.859015	25.826668	Morelight	Human Elephant Conflict
23	-17.863889	25.831781	INDECO	Human Elephant Conflict
24	-17.863885	25.831818	DVS Extension	Human Elephant Conflict
25	-17.866761	25.839311	Maloni	Human Elephant Conflict
26	-17.883345	25.874659	Linda	Baboon and Elephant Conflict
27	-17.863463	25.858443	Railways	Human Elephant Conflict
28	-17.85735	25.879739	Libuyu	Human Elephant Conflict
29	-17.857356	25.879727	Kalaluka	Human Elephant Conflict
30	-17.855306	25.910237	Silozi	Human Elephant Conflict
31	-17.886472	25.859034	Maramba bridge	Human Elephant Conflict
32	-17.928011	25.864870	Victoria border	Baboon conflict
33	-17.924937	25.867957	Zesco station	Baboon conflict
34	-17.874972	25.851803	Foleys land rover	Buffalo conflict
35	-17.878474	25.858628	Elephant view/Munga	Baboon and Elephants
36	-17.883694	25.842795	Gate 1 area	Baboon/Monkey conflict
37	-17.911121	25.863739	Dry Manzi	Human Hippo Conflict
38	-17.821261	25.796492	Airport	Buffalo conflict

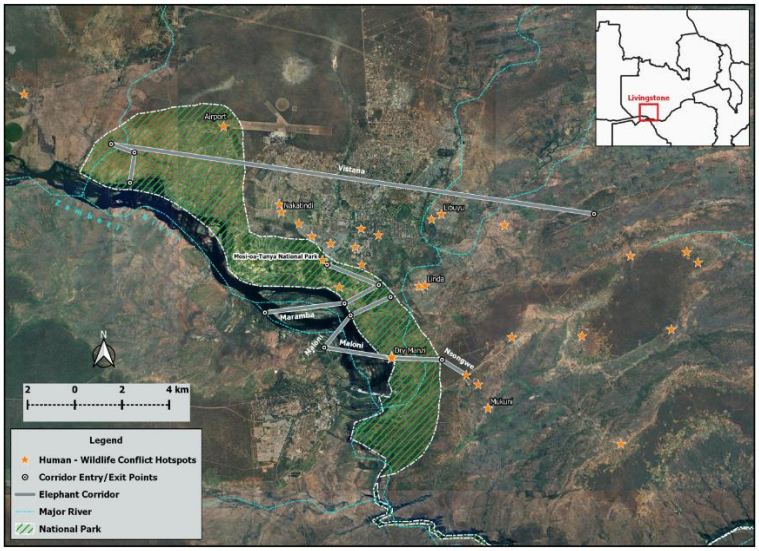

Figure 6. Map of HWC Hotspots in MoTNP

Table 4. Summary of Identified Communities that are HWC Hotspots with GPS Coordinates and the most Prevalent Form of Conflict in SNNP

SN	LATITUDE	LONGITUDE	COMMUNITY	FORM OF HWC
1	-17.01474	23.9607	Kalobolelwa	Human Elephant Conflict
2	-16.990501	23.951212	Kalobolelwa	Human Elephant Conflict
3	-17.23728	24.11474	Mutemwa Lusu	Human Elephant Conflict
4	-17.15797	24.05826	Mutemwa Lusu	Human Elephant Conflict
5	-17.38381	24.17863	Silolo	Human Elephant Conflict
6	-16.79216308	23.74784519	Kaale	Human Elephant Conflict
7	-17.018667	23.96456	Kalobolelwa	Human Elephant Conflict
8	-16.48349	23.24035	Nangweshi	Human Elephant Conflict
9	-16.41166	23.33824	Nangweshi	Human Elephant Conflict
10	-16.46509	23.3952	Kaanja	Human Elephant Conflict
11	-16.4747	23.40561	Kaanja	Human Elephant Conflict
12	-16.52009	23.4521	Kaanja	Human Elephant Conflict
13	-16.48574	23.41527	Kaanja	Human Elephant Conflict
14	-16.600523	23.499746	Malombe	Human Elephant Conflict
15	-16.60369	23.51259	Malombe	Human Elephant Conflict
16	-17.5339	23.25109	Imusho	Human Elephant Conflict
17	-17.5159	23.21008	Imusho	Human Elephant Conflict
18	-17.57464	23.38688	Mbala	Human Elephant Conflict
19	-17.61877	23.42844	Mbala	Human Elephant Conflict
20	-16.61764	23.52988	Malombe	Human Elephant Conflict
21	-16.86098	23.18677	Sipangule	Human Carnivore Conflict (HCC)
22	-16.88764	23.25069	Sipangule	Human Carnivore Conflict (HCC)
23	-17.59412	23.41261	Mbala	Human Carnivore Conflict (HCC)
24	-16.79203299	23.75121304	Kaale	Human Crocodile & Hippo Conflict
25	-17.46889899	24.24302003	Silolo	Human Crocodile & Hippo Conflict
26	-16.600523	23.499746	Malombe	Human Crocodile & Hippo Conflict

27	-16.37848	23.31594	Nangweshi	Human Crocodile & Hippo Conflict
28	-16.39609401	23.33107199	Nangweshi	Human Crocodile & Hippo Conflict
29	-17.23188	24.1089	Mutemwa Lusu	Human Crocodile & Hippo Conflict
30	-16.49151502	23.422725	Kaanja	Human Crocodile & Hippo Conflict
31	-17.23538	24.11334	Mutemwa Lusu	Human Crocodile & Hippo Conflict
32	-16.61837596	23.53643096	Sikuka	Human Crocodile & Hippo Conflict
33	-17.1553	24.06485	Mutemwa Lusu	Human Crocodile & Hippo Conflict
34	-17.48036	24.296656	Sililo	Human Crocodile & Hippo Conflict
35	-17.42123	24.19851	Sililo	Human Crocodile & Hippo Conflict
36	-16.79203299	23.75121304	Kaale	Human Crocodile & Hippo Conflict
37	-16.49289	23.41876	Kaanja	Human Crocodile & Hippo Conflict
38	-16.40051	23.31803	Nangweshi	Human Crocodile & Hippo Conflict

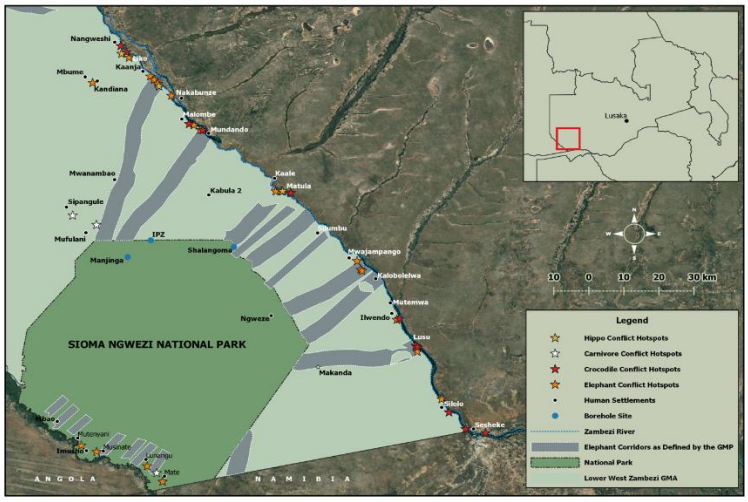

Figure 7. Map of HWC Hotspots in SNNP

Socio-economic Determinants of Human-Wildlife Conflict in Communities Surrounding Mosi-Oa-Tunya and Sioma Ngwezi National Parks

Human-wildlife conflict (HWC) is a pressing issue faced by communities living at the human wildlife interphase, often arising from competition for resources. In the context of Mosi-Oa-Tunya and Sioma Ngwezi National Parks, socio-economic factors are multifaceted and rooted in the complex interactions among human communities, wildlife populations, legislation and governance. Therefore, understanding how climate change variables are influencing the incidents of HWC can be better understood by incorporating these complex socio-economic determinants that have a bearing on HWC. This holistic approach is crucial for developing effective and adaptive management strategies that prioritize both wildlife conservation and community livelihoods, thereby helping to foster coexistence between humans and wildlife.

The socioeconomic determinants of HWC were collected from the 171 respondents in Mosi-Oa-Tunya National Parks and the 250 respondents in Sioma Ngwezi National Park. The responses were sorted and analysed revealing that 52% of respondents in Sioma Ngwezi National Park indicated poverty and lack off alternative livelihood options as one of the crucial drivers off HWC in the landscape. additionally, 32 % of respondents cited the lack of compensation legislation in conflict incidents as a serious socioeconomic factor that

influenced some conflicts. 12% of respondents indicated land use planning and land use changes while 4% indicated the status of people living alongside wildlife (co-existence) as a contributing factor to the prevailing HWC in Sioma Ngwezi National Park (Figure 8).

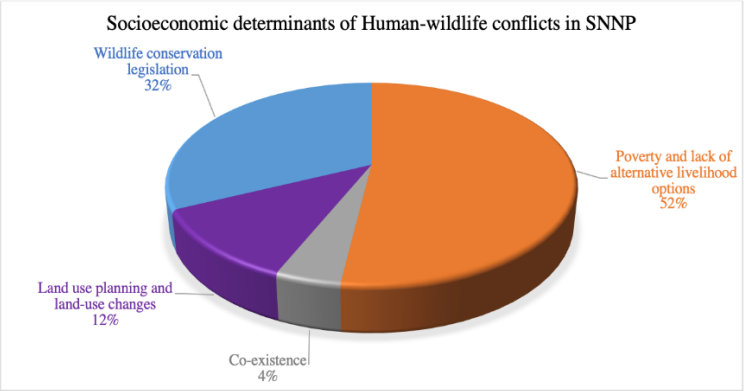

Figure 8. Chart Indicating the Proportions of Socioeconomic Determinants of HWC in Sioma Ngwezi National Park

In Mosi-Oa-Tunya National Park, respondents indicated that rapid urbanisation (33%), agriculture and human settlement expansion (29%), land use planning and land use changes (26%) and wildlife conservation legislation (12%) were the main social economic factors that influenced HWC (Figure 9).

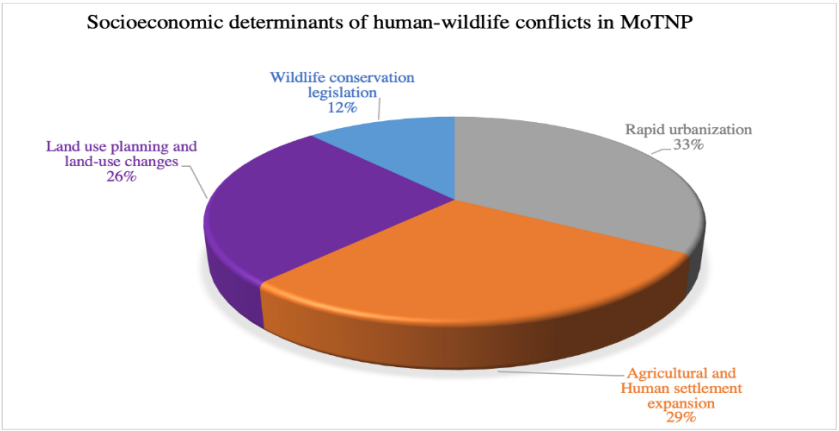

Figure 9. Chart Indicating the Proportions of Socioeconomic determinants of HWC in Mosi-Oa-Tunya National Park

Perceptions, Attitudes and Adaptive Responses of local Communities, Park Management Authorities, and other Stakeholders Regarding Human-Wildlife Conflict

Participants were asked to describe how severe they perceived the issue of human-wildlife conflicts in their community. The responses were divided into three categories: "Not severe at all," "Somewhat severe," and "Very severe (Table 5). Majority of respondents in Sioma Ngwezi National Park perceive the issue of human-wildlife conflicts as very severe, with 80.4% of respondents holding this view while a small proportion of respondents, 4.8%, viewed the issue as not severe at all. On the other hand, in Mosi-Oa-Tunya National Park, a similar trend was observed, albeit with slightly different percentages. Here, 67.8% of respondents perceived the issue as very severe, while 28.1% viewed it as somewhat severe and 4.1% of respondents felt that the issue was not severe at all (Table 5).

Table 5. Perception of the Severity of the Issue of Human-Wildlife Conflicts in the Community

	MoTNP		SNNP	
Description	**Frequency**	**Percent**	**Frequency**	**Percent**
Not severe at all	7	4.1	12	4.8
Somewhat severe	48	28.1	37	14.8
Very severe	116	67.8	201	80.4
Total	171	100	250	100

In Sioma Ngwezi National Park, the average perception of the severity of human-wildlife conflicts, measured on a scale of 1 to 3, is 2.76. This indicates that, on average, respondents perceive the issue to be closer to "very severe" than "somewhat severe." The median score of 3.00 and the mode of 3 further support this, suggesting that the most common perception among respondents is that the issue is "very severe." The standard deviation of 0.531 indicates that responses are relatively clustered around the mean, with little variation (Table 6).

In Mosi-Oa-Tunya National Park, the median and mode are both 3, indicating that the most common perception among respondents is also that the issue of human-wildlife conflicts is "very severe." The average score is 2.64, slightly lower than in Sioma Ngwezi National Park. The standard deviation of 0.561 suggests that there is slightly more variability in perceptions among respondents in Mosi-Oa-Tunya National Park compared to Sioma Ngwezi National Park, although both parks show a strong consensus that the issue is perceived as very severe (Table 6).

Table 6. Central Tendencies of the Perception of the Severity of the Issue of Human-Wildlife Conflicts in the Community

	N	Mean	Median	Mode	Std. Dev	Skewness	Kurtosis	Min	Max
MoTNP	171	2.64	3	3	0.561	-1.268	0.65	1	3
SNNP	250	2.76	3	3	0.531	-2.114	3.547	1	3

Respondents were asked if they had noticed any changes in wildlife behaviour around national parks recently. 82.8% of respondents in Sioma Ngwezi National Park indicated that they had noticed changes in wildlife behavior, while 5.2% said they had not noticed any changes, and 12% were not sure (Table 7). On the other hand, 73.1% of respondents in Mosi-Oa-Tunya National Park reported noticing changes in wildlife behavior, 14.6% said they had not noticed any changes, and 12.3% were not sure (Table 7).

Table 7. Distribution of Whether Respondents Noticed Changes in Wildlife Behaviour around the National Parks

	MoTNP		SNNP	
Description	**Frequency**	**Percent**	**Frequency**	**Percent**
Yes	125	73.1	207	82.8
No	25	14.6	13	5.2
Not sure	21	12.3	30	12
Total	171	100	250	100

Furthermore, the respondents were asked whether they believed the observed changes in wildlife behaviour were linked to climate change. In Sioma Ngwezi National Park, the majority of respondents (80.8%) believe that the changes in wildlife behavior, such as increased aggression and encroachment into human settlements, are linked to climate change. A smaller proportion of respondents (8.0%) do not believe there is a link, while 11.2% are not sure (Table 8).

In Mosi-Oa-Tunya National Park, a slightly lower percentage of respondents (63.7%) believe that the changes in wildlife behavior are linked to climate change. 15.2% of respondents do not believe there is a link, and 21.1% are unsure (Table 8).

Table 8. Respondents' Perception of Wildlife Behaviour being Linked to Climate Change

	MoTNP		**SNNP**	
Description	**Frequency**	**Percent**	**Frequency**	**Percent**
Yes	109	63.7	202	80.8
No	26	15.2	20	8
Not sure	36	21.1	28	11.2
Total	171	100	250	100

Participants were also asked to describe how they perceive the response of the national park management to human-wildlife conflicts. The responses were categorized into four groups: "Very effective," "Somewhat effective," "Not effective," and "Not sure." Table 9 below summarizes the responses. In Sioma Ngwezi National Park, 61.6% of respondents believed that the response of National Parks Management was not effective. Additionally, 16.8% of respondents found the response somewhat effective, while only 19.6% considered it very effective. In Mosi-Oa-Tunya National Park, the perceptions of the national park management's response were slightly different indicating that 57.9% of respondents believed that the response was not effective, 32.2% of respondents believed the response by national parks management was somewhat effective and 7.0% of respondents considered the response very effective (Table 9).

Table 9. Perception of Responses of National Park Management to Human-Wildlife Conflict Incidents

	MoTNP		**SNNP**	
Description	**Frequency**	**Percent**	**Frequency**	**Percent**
Very effective	12	7	49	19.6
Somewhat effective	55	32.2	42	16.8
Not effective	99	57.9	154	61.6
Not sure	5	2.9	5	2
Total	171	100	250	100

In Sioma Ngwezi National Park, the mean response to the perceived effectiveness of the national park management's response to human-wildlife conflicts was 2.46, with a median of 3.00 and a mode of 3. The standard deviation was 0.827, indicating a relatively high level of variability in responses. The distribution was negatively skewed (-0.818), suggesting that more respondents rated the response as not effective compared to those who rated it as very effective or somewhat effective. The kurtosis was -0.694, indicating a relatively flat distribution with fewer extreme responses (Table 10).

In Mosi-Oa-Tunya National Park, the median response was also 3.00, with a mode of 3. The standard deviation was 0.669, indicating a moderate level of variability in responses. The distribution was slightly negatively skewed (-0.667), suggesting a similar pattern to Sioma Ngwezi National Park, where more respondents rated the response as not effective. The kurtosis was 0.078, indicating a relatively normal distribution with no significant outliers (Table 10).

Table 10. Central Tendencies of the Perceptions and Responses of National Park Management to Human-Wildlife Conflicts

	N	Mean	Median	Mode	Std. Dev.	Skewness	Kurtosis	Min	Max
MoTNP	171	2.57	3	3	0.669	-0.667	0.078	1	4
SNNP	250	2.46	3	3	0.827	-0.818	-0.694	1	4

Perceptions and responses towards human-wildlife conflicts vary among stakeholders, reflecting a complex interplay of cultural, socioeconomic, and conservation values. DNPW Principal Ranger with more than a decade of experience, acknowledges, *"Communities living near Mosi-Oa-Tunya are divided in their perceptions of wildlife, with some fearing and resenting them, while others actively participate in conservation efforts."*

Respondents were asked whether they preferred to co-exist with wildlife in both Mosi-Oa-Tunya and Sioma Ngwezi National Park, 87% of respondents were for the idea of co-existence while only 13 % did not want humans to co-exist with wildlife in Mosi-Oa-Tunya. A way less proportion of 39% were for co-existence in SNNP with a higher proportion of respondents (61%) being against co-existence (Figure 10).

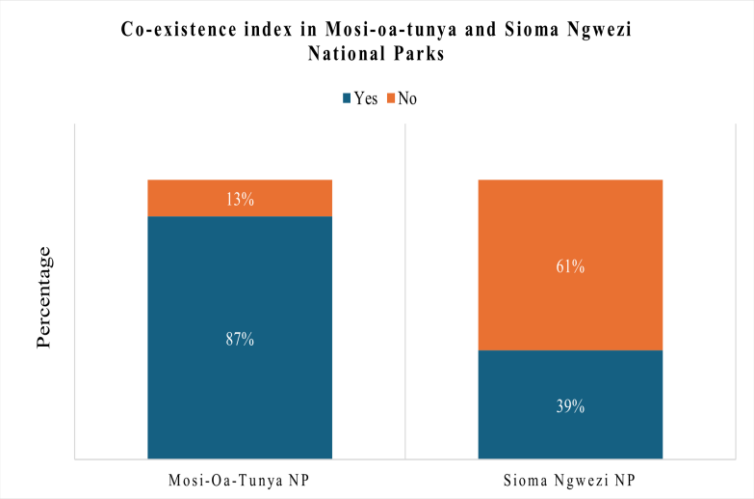

Figure 10. Showing the Wildlife Tolerance Level through the Co-existence Index in Mosi-Oa-Tunya and Sioma Ngwezi National Parks

Furthermore, the attitude of respondents towards wildlife was guaged through HWC retaliatory actions. Respondents were asked to give their experienced opinion and 93% of respondents in Mosi-Oa-Tunya national park perceived retaliatory killing not an ideal response to HWC. Conversely, retaliatory killing was a popular option in Sioma Ngwezi with 56% of respondents leaning towards its use (Figure 11)

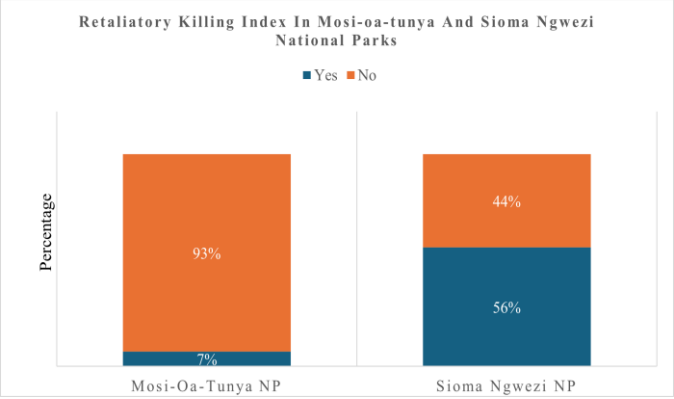

Figure 11. Showing the Wildlife Tolerance Level through the Retaliatory Killing Index in Mosi-Oa-Tunya and Sioma Ngwezi National Parks

Discussion

More people (92%) have experienced human-wildlife conflict in Sioma Ngwezi National Park than in Mosi-Oa-Tunya (79.5%). Human-wildlife contact grew in SNNP when settlements were legalised. Population density may enhance human-wildlife interactions in the two research regions. Despite having more people than SNNP, MoTNP has less wildlife-human conflicts[6]. reported similar results to current literature on cohabited human-wildlife conflicts in Tanzania's Ngorongoro Conservation Area.

In many instances, MoTNP and SNNP worried about wildlife-induced crop and property damage, livestock predation, and human attacks [7]. Population growth and urbanisation, agriculture, and commercial development have increased elephant, baboon, and buffalo interactions in MoTNP. Most MoTNP responders said elephants and baboons cause the most trouble. Due to biological diversity and an increasing legal human population in SNNP, elephants, hippos, hyenas, lions, and crocodiles assault crops, prey on livestock, and attack humans. In SNNP, elephants, hippos, crocodiles, elands, hyenas, lions, buffalo, baboons/monkeys, and leopards create the greatest conflict. These findings differed from [3], who identified animal species responsible for human injuries and deaths in Zambia from 2002 to 2008. Five common wildlife conflict species include Nile crocodile, elephant, hippopotamus, lion, and buffalo.

Crop destruction dominated human-wildlife conflict in Mosi-Oa-Tunya and Sioma Ngwezi National Parks, despite livestock depredation, injuries, and deaths. Agriculture was along the park boundaries. Farm proximity to protected areas dramatically increased crop loss [8]. Crop damage caused by wildlife is a common human-wildlife conflict [9, 10]. The cost of human wildlife conflict on both humans and wildlife remained unmeasured [11]

Conflicts between humans and predators detected four apex predators in SNNP: Nile crocodile, spotted hyena, lion, and leopard. The Zambezi River features crocodiles but no carnivores, hence MoTNP has negligible cattle depredation. Elephants dominated MoTNP animal conflicts (68%). More human-elephant conflicts (HEC) injuries and deaths confirmed this. Elephants damaged homes by breaking fences and falling into septic tanks. Wildlife-motorist RTAs have occurred due to road fragmentation in MoTNP. Road traffic killed giraffes, elephants, hippopotamuses, and buffalo in Mosi-Oa-Tunya National Park.

Dry season HWC disputes were more likely in MoTNP and SNNP (May-October) than wet season (November-April). In the wet season, restored seasonal rivers and pans provided feed and water, concentrating wildlife in core regions with little human interaction and shaping patterns. In contrast, the dry season

witnessed mature crops, lower feed mass, and desiccating seasonal rivers and pans, which caused elephants to encroach on agricultural and human habitation areas seeking food and water [12]. Elephants in SNNP migrated across Zambia, Namibia, Botswana, and Angola during wet and dry seasons, while the elephants in MoTNP migrated across Zambia, Zimbabwe, and Botswana. Elephants stayed in Mosi-Oa-Tunya National Park in the dry season and went to Zimbabwe and Botswana in the wet season, indicating how climate variability and change affect migration and activity patterns, increasing human-wildlife interactions [13].

Most HWC incidents in Sioma Ngwezi and Mosi-Oa-Tunya national parks occurred during the day and this was influenced by the involved animal species, species behavior, species adaptation, human activity cycle and the existing mitigation measures. Daytime confrontations increased among elephants that were both diurnal and nocturnal. Light pollution in the city of Livingstone acted as a deterrent that led to an increased shift to crepuscular or daylight activities by elephants. Baboons and vervet monkeys were primarily diurnal, contributing to the high HWC incidents experienced in broad daylight, particularly when human surveillance was low. Daytime human-wildlife conflict escalated in Mosi-Oa-Tunya National Park as human activity increased during day.

Unlike Mosi-Oa-Tunya National Park, Sioma Ngwezi National Park hosts nocturnal carnivore species such as lions and hyenas. Despite this, the park showed a similar temporal pattern and recorded more daytime conflicts attributed to the increased number of hippo and crocodile conflicts that occurred during the day as people were fishing and herding cattle, respectively. Additionally, Crocodiles are also targeted during daytime water-fetching missions by community members.

The interactions between human communities, wildlife populations, legislation, and governance present complex socio-economic issues affecting MoTNP and SNNP. Communities near wildlife in the two research sites suffer social and economic turmoil from HWC, and their adaptive capacity is lessened because the Zambian Wildlife Act No. 14 of 2015 does not provide for compensation of wildlife-induced damages and losses. [14] found that socio-economic dynamics affect global human-wildlife conflict patterns and intensity.

Both parks have lost tolerance for HWC and the problematic species, but SNNP, where residents have lived with animals for years, more so. This signifies a growing frustration arising from the incurred socio-economic losses that resulted in negative feedback on both humans and wildlife. The adaptive capacity and resilience of communities were reduced while retaliatory actions increased. Community members often pressured wildlife management authorities to kill problematic animals so that they could benefit in the sharing of the meat in MoTNP. In retribution, SNNP residents poached conflict species, impacting wildlife populations while undermining conservation efforts.

Rapid urbanization, agricultural expansion, human settlements and land-use planning and land use changes emerged as key socio-economic determinants of HWC in MoTNP. The rapid urbanization was responsible for habitat fragmentation, increased human-wildlife interactions, and altered ecosystems due to noise, traffic, and light pollution, disrupting wildlife behaviour. The lack of a MoTNP wildlife management plan caused considerable land-use changes from wildlife habitat to commercial or tourism infrastructure. While land use planning may reduce human-wildlife conflicts in MoTNP and SNNP, it was viewed to cause restrictions on communities from their ancestral land in SNNP. Human development and agriculture have disrupted wildlife habitats and increased human-wildlife interactions. This shows how urbanisation and development strain wildlife habitats and the

functions of ecosystems in supporting humans and wildlife. [15] observed that laws and land-use rules affect MoTNP communities, emphasising sustainable land management and community involvement.

Human-wildlife interactions are hurting conservation and development. Human-wildlife conflict in the two settings was exacerbated by negative effects on humans and their livelihoods. Most respondents in MoTNP and SNNP indicated that HWC was very severe and was a humanitarian crisis that caused injuries, deaths, economic losses, and generally affected the poorest and most marginalized communities living at the human-wildlife interface.

Wild animals are becoming more hostile and invading human habitats, causing conflicts and jeopardising lives and livelihoods. Both national parks' participants saw a major effect of climate change on animals. To understand the issue, both negative and positive interactions between humans and wildlife, HWC drivers, impacts, and the broader societal and political context [16] in the selected sites had to be identified.

Climate change was linked to wild animals' conflict-causing behaviour, although additional factors compounded human-wildlife conflict scenarios. Human settlements, agriculture, and commercial development strained MoTNP, while agricultural growth and timber harvesting affected SNNP fauna. Encroachments have fragmented wildlife habitats and blocked wildlife corridors that have existed for centuries, justifying some of the observed changes in wildlife behavior and space utilization patterns as wildlife adapted to the changing climate and environment.

The two parks viewed habitat fragmentation and conflict differently. Commercial infrastructure in MoTNP reduced wildlife utilization areas and escalated conflicts. These findings matched [17]. Lack of a buffer between human settlements and the park enhanced conflicts in MoTNP. The lack of adequate forage in MoTNP attributed to low precipitation, soils and vegetation, drove elephants into human settlement areas where they threatened humans, raided crops and destroyed property.

In contrast, SNNP demonstrates climate-induced behavioural changes in wildlife species due to water constraints, generating feed and water insecurity for the recovering wildlife population. Wildlife in SNNP exploit climate-sensitive seasonal water pans since the park did not have permanent rivers. Illicit timber cutting in SNNP negatively affected precipitation, temperature, leading to ecosystem degradation. Dry spells and extreme temperatures caused swift water and food depletion, thereby driving wildlife, including problematic species like elephants, closer to human settlements that are near existing natural water bodies such as the Zambezi and Kwando rivers around SNNP.

The locals understood that wildlife is wild and can threaten humans and property. SNNP dwellers were less willing to bear direct and indirect costs and risks of wildlife existence than MoTNP residents. These beliefs were impacted by human-wildlife coexistence's costs and advantages [18, 19]. Most MoTNP enterprises promoted human-wildlife co-existence through wildlife-based tourism, employing thousands of locals. While wildlife provided no benefits, SNNP people bore the brunt of human-animal conflict. Rural poor farmers regularly battled, aggravating their economic situation.

A majority of SNNP respondents were unhappy with the DNPW's response to HWC incidents. Response reduces HWC incidents during or after them [20]. Human-wildlife disputes can be resolved quickly to protect both people and wildlife. The response was inadequate because many HWC problems remained unresolved or worsened despite interventions. The fact that management activities deviate from community expectations supports [21]. who stress the need to understand human-wildlife conflict perceptions and

prioritise community issues to build effective co-existence strategies.

Unresolved conflicts changed people's attitudes and stimulated poaching or retaliation. Retaliators may be considered as "local heroes" in communities plagued by human-wildlife conflict (HWC) because they eradicate the source of conflict. These supports [22]. who observed that many SNNP community members recommended killing conflict predators to alleviate human-wildlife conflict. Because it focused more on HWC incidents, DNPW in MoTNP was deemed to perform better than SNNP. MoTNP's compact size allowed HWC response teams to reach most conflict zones within hours, improving human-wildlife conflict response. Despite the recorded HWC incidents in MoTNP, respondents commended managements' conflict resolution. This example shows how park administration struggles to resolve context-specific disputes [23].

The study results in both parks demonstrated that human-wildlife conflict management must acknowledge the many negative impacts of HWC on humans and wildlife and implement comprehensive mitigation techniques to decrease these impacts. Human-wildlife conflict resolution requires context-specific and site-specific mitigation measures. Park management can reduce conflict and promote sustainable human-wildlife co-existence by incorporating community feedback and customising mitigation measures to local needs [24].

Conclusion

The findings indicate that Mosi-Oa-Tunya National Park (MoTNP) and Sioma Ngwezi National Park (SNNP) are facing considerable impacts of climate change, evidenced by a decrease in annual precipitation rates of 59 mm/year/decade and 43 mm/year/decade, respectively. Temperature trends indicate a rise in both average and maximum temperatures, with a more significant increase observed in MoTNP (0.14°C/decade) compared to SNNP (0.08°C/decade). The observed changes have led to extended periods of dryness, postponed precipitation, and reduced rainy seasons, especially noted during the drought years of 2015/16, 2017/18, 2019/20, and 2023/24, increasing the vulnerability to drought in both areas. The wildlife-based economy that underpins local livelihoods in MoTNP is experiencing heightened pressure as wildlife behaviour adapts in response to climate stressors. Conversely, the residents of SNNP, primarily consisting of impoverished rural farmers, endure the significant impacts of HWC, with ongoing conflicts leading to economic difficulties. To tackle this intricate interplay, a comprehensive and adequately funded approach is essential, one that harmonises environmental conditions with socioeconomic demands, thereby fostering both the preservation of biodiversity and the well-being of local communities.

Limitations of the Study

This study had a relatively small sample size, which limits to generalizability of the findings. The study relied on self-reported data, which may be subject to social desirability and recall biases. Finally, limited community participation in identifying, validating, and mapping human-wildlife conflict (HWC) hotspots and wildlife corridors may hinder effective conflict resolution, corridor management, and long-term conservation planning.

Conflict of Interest

The author(s) declare that they have no competing interests.

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Recommendations

Based on the study findings, several key recommendations are proposed to strengthen human-wildlife conflict (HWC) management. First, the Department of National Parks and Wildlife (DNPW) should develop and implement Game Management Plans (GMPs) for Sioma Ngwezi and Mosi-Oa-Tunya National Parks to promote sustainable resource use and minimize conflict through effective zonation. Second, the Wildlife Act No. 14 of 2015 should be amended to incorporate compensation mechanisms for HWC-related losses, which could enhance community tolerance and reduce retaliatory actions against wildlife. Third, community participation in conflict mitigation should be scaled up by promoting locally led strategies that integrate indigenous knowledge. A holistic, multi-dimensional approach to HWC management is also recommended, incorporating ecological, social, and climate-responsive measures. Finally, DNPW should establish a comprehensive monitoring and evaluation system to assess the effectiveness of mitigation strategies, enabling continuous refinement and evidence-based improvements in the field.

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The Allocation and Impact of Oil and Gas Revenue on Rural Educational Infrastructure and Outcomes in Guyana (2021–2024)

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Abstract

This paper examines the allocation and impact of oil and gas revenues on rural infrastructure in Guyana within the period of 2021 to 2024. Guyana began oil production in 2019, and this has resulted in an expansion of its fiscal capacity exponentially. A significant chunk of the revenue has been devoted towards improving educational outcomes and quality in rural areas. This study evaluates budgetary allocations, assessing infrastructure developments along with education access and performance in Region 5. Using a quantitative method approach, document analysis and structured questionnaires were used to gather data from 260 educators in a full enumerative sample, and SPSS was used for analysis. Cronbach's Alpha ($\alpha = 0.81$), expert review, and triangulation using secondary documents were used to confirm reliability. The findings have shown a marginal increase in budgetary allocations, and considerable improvement in school infrastructure. However, there has been marginal progress relative to educational outcome but this is marred with the issue of disparities in implementation. Furthermore, prudent monitoring is cited as a challenge in the realization of intended benefits. This paper offers several key recommendations including but not limited to improving coordination, effective stakeholder engagement, and a commitment to increasing accountability and transparency. These can potentially maximize the impact of oil and gas revenue in this sector.

Keywords: *Access, Guyana, Infrastructure, Oil Revenue, Outcomes Rural Education.*

Introduction

Amid its emergence as an oil-rich country, Guyana has unprecedented fiscal space; this is both an opportunity for, and challenge to, sustainable development. One of the key areas for strategic investment is in education, which continues to be a platform for long-term human capital development. But rural education in Guyana has

historically been characterized by systematic disparities, including long-standing infrastructural shortfalls, a shortage of teaching resources, and inequalities in student performance compared to urban areas.

In contrast, the Government of Guyana has pledged a share of its oil revenues – managed through the NRF – to fill these deficits and, with it, the development commitment and ability to promote inclusive growth. National budgets 2021-2024 read with an expenditure increase for school infrastructure, particularly in rural areas, but the value of these investments in improved learning quality and equity are not well studied.

This paper examines the extent to which petroleum funded transfers have translated into improvements in rural educational facilities, access to education and student outcomes, paying attention to Region 5 (Mahaica-Berbice) in particular. Combining budget analysis with interviews with key stakeholders, the study examines the effectiveness and fairness of these

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interventions. It is intended to contribute to larger policy discussions concerning natural resource governance, accountability in public investment and the role of oil wealth in transfiguring social sectors in developing economies.

Context

Since 2020, Guyana's national development policy has increasingly been informed by the revenue from oil, with direct disbursements from the Natural Resource Fund (NRF) constituting a core element of the Guyana's public finance architecture. Education – long identified as a driver of inclusive growth – is one of the main victors of this fiscal largesse. Capital allocations for educational infrastructure, especially in far-flung and rural areas historically short of investment, are relatively higher in national budgets for 2021-24.

In Region 5 (Mahaica-Berbice), revitalization works were planned for schools, new classroom blocks would have been built while the dormitory facilities would have been expanded. They include relieving congestion, providing better access for hinterland students and the upgrading of learning environments in alignment with national education objectives. [1].

In the past, several international bodies have noted that despite financial allocations, implementation constraints became apparent during implementation. Both the World Bank (2020) and UNDP (2010) reports repeatedly pointed to:

1. Project cost over-runs/ material procurement delays, and
2. Contractor performance that is just getting unraveled, and
3. Poor and lack of local monitoring and evaluation systems. [2-4].

Additionally, Williams (2025) noted that inequalities in the distribution of resources between sub-regions led to concerns about equality and transparency. Coastal schools experienced more rapid improvements, whereas schools in more remote and/or Indigenous-serving communities, like Moraikobai, were left behind—reproducing spatial and socio-economic disadvantage [5].

These contextual dynamics emphasize that we should not just monitor the flow of money from natural resources, but rather question how the money is spent, and how effective and fair the spending is on the ground. The analysis is set within the context of this changing governance environment and considers whether petroleum wealth is being converted into sustainable education conditions for rural Guyanese.

Purpose of the Study

This study evaluates national budget composition trends, examines infrastructure development in Region 5, and reviews data on educational access and student performance to understand the extent to which oil and gas money has influenced rural education in Guyana. It seeks to determine whether an increase in fiscal resources has resulted in improved school infrastructure and student achievements/ learning. Finally, it also seeks to identify the main pressures and challenges that are affecting efficiency and equity.

Research Objectives

The study was guided by the following objectives:

1. To investigate the distribution of oil and gas revenue budgets educational infrastructure between 2021 and 2024 for Region 5 (Mahaica-Berbice).
2. To examine the spending trends and outcomes related to oil-funded infrastructure initiatives in Region 5
3. To analyze educators' views regarding the effects of oil revenue distributions on students' access to education and the quality of the educational environment.
4. To assess how educators perceive the impact of investments from oil funding on

student academic achievement in rural schools.

Review of Literature

Associative analysis on public resource allocation in education constantly points out that governmental fiscal input is highly contained in its governance mechanism. Although higher public spending is known to be positively correlated with infrastructural expansion and enhanced enrolment, point evidence from oil-violent developing economics further shows that in the absence of strong institutions, educational gains typically do not trickle down to improve education quality [6, 7].

This paradox is widely couched within the extant literature as the "resource curse," which refers to the phenomenon where resource rich countries perform poorly on social indicators as a result of governance problems, elite capture, and low absorptive capacity [8, 9]. In the case of education, Birdsall and Subramanian (2004) maintain that natural resources' wealth can also undermine governments' motivation to undertake inclusive human capital policies, mainly in rural or politically marginal areas [10].

Comparative experiences offer further insight. If Norway have shown how to translate resource wealth into a long-term educational investment through sovereign wealth management and participatory policymaking [11]. However, countries such as Nigeria and Venezuela exemplify the dangers of poor institutions and politicized education spending [12, 13]. Therein lies the paradox and perhaps reinforces the question on the right governance model for oil and gas resources.

Recent scholarship has also argued for the importance of local governance and stakeholder perceptions. As Kolstad and Wiig (2009) note, an absence of local voice and transparency may thus undermine even richly endowed aid interventions. World Bank (2018) outlines these as results-based financing, stakeholder engagement and transparent budgeting as important steps to alleviate the resource curse and consolidate their educational delivery systems. The divides recommend that education systems in resource-endowed countries require budget execution learning outcomes congruence and regional and community decision-making participation [14, 15].

In the case of Guyana, preliminary reviews of the Natural Resource Fund Act (NRF Act) and the national budgets of 2022 – 2024, evidence a commitment of borrowing against oil funds for increasing public investment, including in education (Ministry of Finance, 2023). GYD $12 billion was budgeted for rural education infrastructure between 2021 and 2024, with regions 5 benefitting directly. These capital projects consisted of the building of additional classrooms, lavatories and science laboratories (Ministry of Finance, 2023) [16, 17].

However, as this current paper documents, there are many hard problems that remain to be solved. Field evidence from Region 5 demonstrates that although there have been some infrastructural improvements, some resource allocation discrepancies still remain, slow project implementation and that stakeholders are not being included in the planning and monitoring activities. Numerous teachers also complain of an on-going shortfall in teaching material provision, restricted availability of educational technology, and little improvement in student achievement.

Similar to findings from oil-financed education projects in Ghana and Nigeria, where top down disbursements failed to result in bottom-up change as a result of bad governance, little capacity and excessive centralization mechanisms were in place [12, 13].

This thematic analysis of global literature and local evidence contributes to the understanding that high levels of resources are not a sufficient condition for transformation of

rural education systems. A strong governance architecture that is inclusive, transparent and locally responsive is essential for fiscal capital to be translated into better learning outcomes. In particular, this entails combining participatory planning, strengthening capacity for regional implementation and establishing strong accountability mechanisms for the use of funds [11, 15]

Theoretical Framework

This study is theoretically framed in two mutually reinforcing theories: the Resource Curse Theory and the Good Governance Framework.

Resource Curse Theory: Resource Curse Theory, first introduced by Sachs and Warner (1997), is one hypothesis arguing that nations with natural resource wealth exhibit low economic development as a result of the presence of weak institutions, rent seeking, and governance deficiencies [8]. Rather than driving development, natural resources can result in wasted public funds, lack of investment in key areas like education, and greater inequality. Within the context of oil-based development in Guyana, this theory offers a premise on which to assess whether oil monies have led to enhanced educational infrastructure and outcomes in rural areas, or whether the ills of the resource curse are being duplicated. A reoccurring statement is: "When institutional quality is low and decision making is unaccountable, resource abundance is a curse" [18].

Good Governance Framework: Good Governance Framework, promoted by organizations such as the World Bank and UNDP, focuses on transparency, participation, accountability, equity and efficiency in the management of the public sector [19]. This framework provides a useful context in which to also consider how oil-funded education projects in Region 5 have been organized, implemented, monitored, and regarded by stakeholders. It enables the study to examine if governance practices include all and contribute to equitable results in the education sector.

Combined, these frameworks facilitate a twinning of the structural risks involved in depending on natural resources with the institutional mechanisms that are required to guarantee the contribution of oil revenues to sustainable educational development.

Research Design

The study was quantitative and descriptive in nature and sought to critique the disbursement and use of oil and gas funds in rural education development in Guyana, more precisely Region 5 (Mahaica-Berbice). This methodological approach was suitable here since it enabled obtaining objective and numerical data on infrastructure investment, access, quality and education outcomes without managing variables.

Quantitative descriptive study is appropriate for public sector governance and policy implementation research, as it focuses on the systematic recording and analysis of measurable reality in order to infer phenomena about patterns in a population [20].

This methodology in this study contributed to being able to capture the broader picture of oil revenue expenditure in the education sector with its implications for service delivery as viewed by educators and available documents.

Population and Sampling

The target population was all teachers and education managers of public (primary, primary and secondary) schools in Region 5. A complete enumerative sample technique was used particularly in this sample study because of the single opportunity of the target population was manageable and also the researcher wanted to include as many subjects as he could collect a better representative sample.

Two hundred and sixty (260) fully surveyed responses were collected from teachers across the coastal, and riverine areas that provided

considerable ecological coverage of the sub-regional sampled locations. With this sample size, sufficient power was gained to generalize these findings to all of Region 5.

Unit of Analysis and Measurement Variables

Educators were chosen as the unit of analysis given their immediate interplay between the teaching context and policy products. The study utilized methodological design through a structured framework in which abstract constructs were connected to their observable indicators, a typical research design practice in education [20, 21]. These operational variables were constructed to measure perception and experience of the educators on oil revenue inspired educational reforms in Region 5.

Table 1. Operationalization of Key Constructs in Educator Perception Study

Construct	Operational Indicators
Perceived transparency	Awareness of funding sources, budget information
Infrastructure adequacy	Reported school upgrades, access to teaching resources
Participation in governance	Involvement in planning, consultations
Educational outcomes	Perceived impact on student performance, access
Construct	Operational Indicators

This framework allowed for the collection of standardized data across respondents while remaining grounded in the realities of frontline education delivery. Variables were recorded on a 5-point Likert scale for closed questions, so that the Likert scale ranged from "Strongly Disagree" to "Strongly Agree"), and also included some open-ended questions for explanations of particular lived experiences.

Data Collection Procedures

A structured questionnaire was used to collect data which was circulated to schools across the region in electronic and hard copy format. Ten teachers in an adjacent area tested the instrument to ensure clarity, resulting in minor wording revisions.

As well as the original survey data, secondary data was sourced from the following datasets:

1. National Budget Projections (2021-2024)
2. MoF reports on NRF allocations
3. Ministry of Education property and operational data
4. NGSA (National Grade Six Assessment) results for Region 5 schools

This review of documents assisted in placing educators' opinions in the context of real performance and financial trends.

Tools and Data Analysis

Coding and analysis were conducted in Microsoft Excel and SPSS. The following is the analysis method used:

1. Descriptive statistics (frequencies, percentages, means).
2. Graphs; bar, pie and table visualizations.
3. Open responses were thematically summarized for interpretive insight.

Note: NVIVO software was not applied, as qualitative data were limited in number and did not undergo full coding.

Reliability and Validity

The questionnaire was scrutinized for reliability by two experts in educational policy and pre-tested in a small pre-sample. Cronbach's Alpha was used to demonstrate that

the internal consistency of the scaled items was acceptable (α = 0.81).

To guard against threats to validity, questions addressed intended study goals and secondary sources of information were used to check the veracity of reported perceptions (e.g., by comparing levels of budget awareness with actual capital allocations).

Ethical Considerations

The study conformed to the ethical principles of informed consent, voluntary participation, and confidentiality. Ethical approval was provided informally via a university-approved protocol. Anonymity of the participants was guaranteed and no personal identifiers (name, school) were obtained.

Limitations

Although the study attained a healthy regional sample, it was a study based within Region 5 only, which does restrict the generalizability to other areas in Guyana. In addition, it only used teacher perceptions, so the results may not reflect the experience of the students or community. Lastly, secondary data were used as no direct project in-situ assessment or validation was carried out.

Results

Breaking down national spending by time and allocation, it becomes apparent that between 2021-2024 more than GYD $12 billion was set aside for the improvement to rural educational buildings, infrastructure and facilities across the country and Region 5 (Mahaica-Berbice) is highlighted as one of the major beneficiaries. Oil revenues were central to these allocations, which flowed through the national budget and implemented through the Ministry of Education's Capital Program.

Below, figure 1 shows the trend of increasing the capital expenditure on region 5, for those four years. Figures show an increasing trend over the years, with allocations moving from GYD $313.5 million in 2021 up to about GYD $647 million in 2024.

The 2023 and 2024 Budget Estimates confirm that a total of GYD $1, 982, 013, 750 was allocated to Region 5 over the two years; the sum which ranks among the highest amounts which were allocated to the regions for nursery, primary and secondary education upgrades. These investments also focused on increased local financing of the program and in areas such as classroom repairs, new school blocks, and dormitory extension aimed at improving access and quality of schools serving rural and hinterland communities. [1, 2, 22].

This long-term investment profile reflects the government's policy priority to minimize the geographical divide in education through integrated, oil-financed interventions.

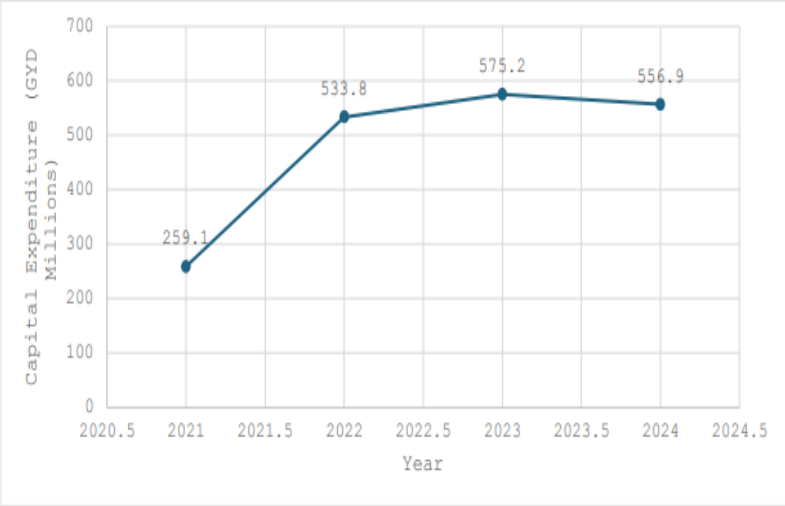

Figure 1. Region 5 Capital Expenditure on Education (2021–2024)

This figure illustrates the annual capital expenditure allocated to Region 5 (Mahaica-Berbice) for educational development from 2021 to 2024, based on data extracted from the Government of Guyana Budget Estimates (Volumes 2, 2021–2024). [1, 2, 22, 24]

Infrastructure and Access

From 2021-2024 as captured in 2024 Budget Estimates – Volume 2, various capital works were finalized or initiated in the Region 5 as part of the oil-financed rural educational infrastructure investments. Some of the highlights include, but are not limited to; the building of new classroom blocks at the Bush Lot and Mahaicony Secondary schools; improving sanitary facilities in rural schools in places such as Belladrum to Woodley Park and facilitating the expansion of dormitory spaces at the Mahaicony Secondary Complex. There was also some infrastructure support beyond the school compounds, such as bridge and feeder roads rehabilitation that improved physical access to the periphery. These actions greatly improved access and daily attendance at school, especially for those in riverine and agricultural areas, where seasonal flooding and poor transportation had previously interfered with the continuity of learning.[1, 2, 22, 24].

Figure 2 shows the variety of infrastructural improvements funded in schools through revenues from oil and gas and the reported impact on students' ability to access education obtained from the survey. The two-color system in the chart below identifies physical improvements (blue) and access-related outcomes (orange), according to the multiple responses of 260 participants.

Regarding infrastructure, the school feeding program was described the most, by 220 responders (84.6%). This was then followed by construction of ICT facilities and sanitation, which were cited by 150th respondents (57.7%). Meanwhile, investment in core academic infrastructure like libraries (15.4%) and labs (7.7%) was significantly lower. No new classrooms were constructed as indicated by any participant, pointing to a major gap between capital expansion and awareness at the school-level of any participants.

With respect to access outcomes, scholarship opportunities were the most commonly identified impact, cited by 200 (76.9%) respondents. However, differences were also found in other important access variables: dropout decline (23%), no access changes (23%), and travel access changes (3.8%). Notably, there are no subjects checked is "increased enrollment" which might suggest that while funding is being used there is not widespread experience or perception of the effects of this money on student participation.

Overall, the figure indicates a clear emphasis on support services and student well-being. But it also highlights a potential misfit between resource allocation and the structural demands of rural schools — most notably in terms of adding classroom space or improving transportation. The shockingly low awareness of actual reach improvements begs questions about transparency of outlays and the quality of information brought to bear between policymakers and school-based constituents.

It strengthens the call for better transparency, more participative approaches to planning and finances linked to results that can be used, most especially in rural areas where such development gaps are frequently even greater.

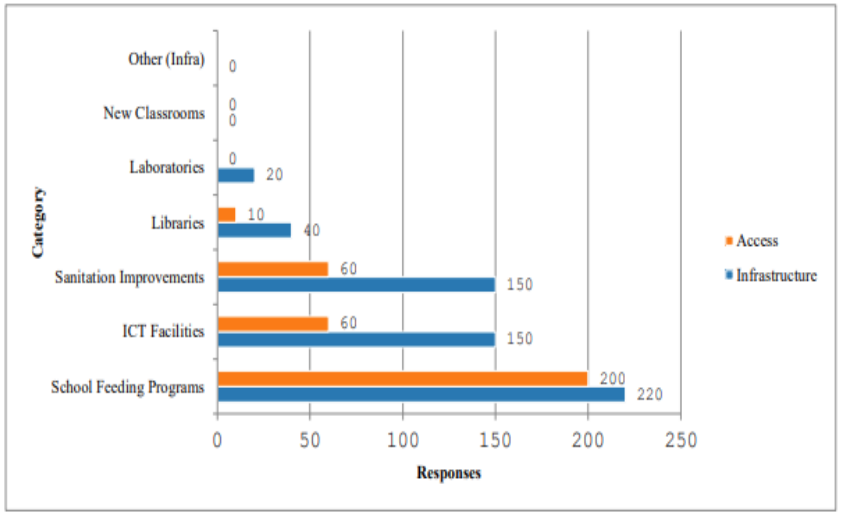

Figure 2. Field Data Infrastructure vs. Access Impacts of Oil and Gas Revenue

Learning Outcomes

Data from the Ministry of Education showed that despite the infrastructural improvements the performance reports at the academic level as recorded from the National Grade Six Level left much to be desired. From 2021-2023, the mean pass rate for English and Mathematics in Region 5 only increased by 3–4%, and many schools remained below the national average. This indicates that although there has been an improvement in the physical learning environment, pedagogical qualities are still an issue. This is captured in Figure 3, below. [23].

In addition, the teachers' responses from the survey, on perception of students' enrolment over the last three years were such that most of the respondents (35%) as seen in Figure 4, said that "No Change" (Rating 3) Status, this might indicate a perception of enrolment stability even when there are National investments in education on the strength of oil and gas revenue other level.

It is interesting to note that of the 25% respondents who felt that there was a marginal improvement (Rating 4) and the 20% who thought that there was a substantial improvement (Rating 5), nearly half (45%) felt that there has been some positive change as seen in Figure 3. During the same period 20% respondents said they felt a negative change (Ratings 1 and 2 together), suggesting limited progress in some rural communities (or that a more rigorous enrolment process is taking place in some socio-economic conditions in the programme's target areas).

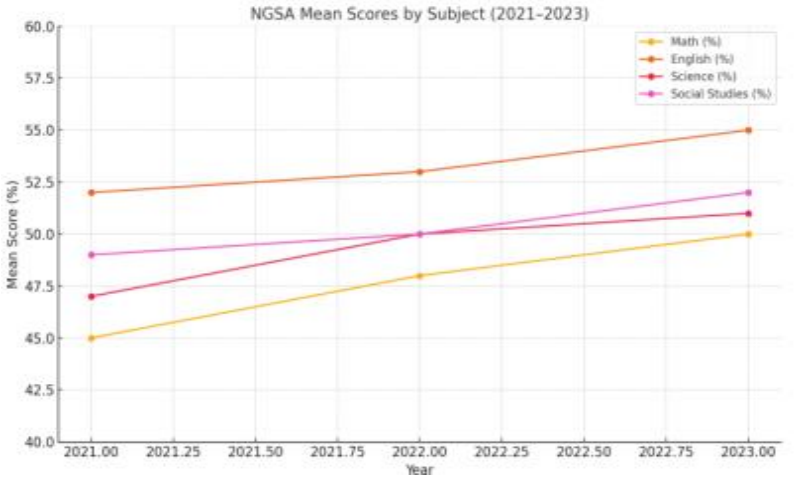

Figure 3. Average NGSA Pass Rates– Region 5 (2021–2023)

This chart illustrates marginal improvements in average pass rates at the National Grade Six Assessment (NGSA) in Region 5 over the three-year period. Despite infrastructure upgrades, academic outcomes remain below the national average, indicating persistent pedagogical challenges. [23]

The distribution indicates an overall level but varied perception of enrollment trends and suggests that additional examination of the visibility and regional equity of oil-funded interventions is warranted. These results underscore the value of breaking down education outcomes by region to ensure that rural investments are not just effective, but also visible to teachers in the field.

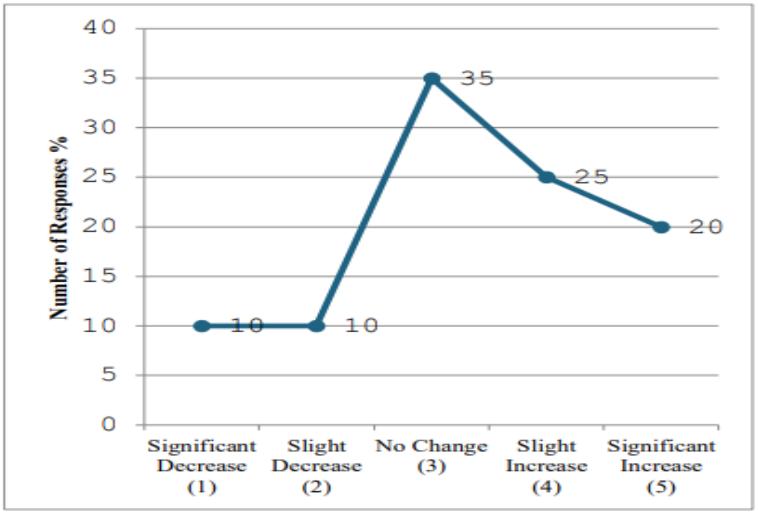

Figure 4. Field Data: Enrollment Change Rating: Line Graph Illustrates Teachers' Perceptions of Enrollment Trends

Perceived Changes in Quality of Education

The responses in below Figure 5 highlight the most commonly perceived areas of educational quality improvement resulting from oil and gas revenue allocations. The two most frequently cited changes were *better school infrastructure* (200 responses) and *higher student performance* (180 responses), suggesting that teachers associate physical upgrades with improved student outcomes. Additionally, *enhanced teaching materials* (160 responses) and *more student support programs* (80 responses) were recognized as critical contributors to this improvement.

However, areas such as *improved teacher training and professional development* (20) and *introduction of new technology* (25) received significantly fewer responses. This may indicate a disparity between investments in infrastructure and direct investments in teacher capacity-building and innovation, despite broader discourse on technology in education. Interestingly, 60 respondents still observed *no noticeable change*, highlighting that the impact of oil revenues may be unevenly distributed or slow to materialize across all rural schools.

Stakeholder Insights

71 percent of teachers surveyed said schools had undergone renovations or received utilities.

Just 32% knew that oil revenue is tied to the funding.

64% said they were uninformed or not included in decisions over the allocation of capital priorities.

58% of teachers said the general learning environment was either "much improved but still challenging."

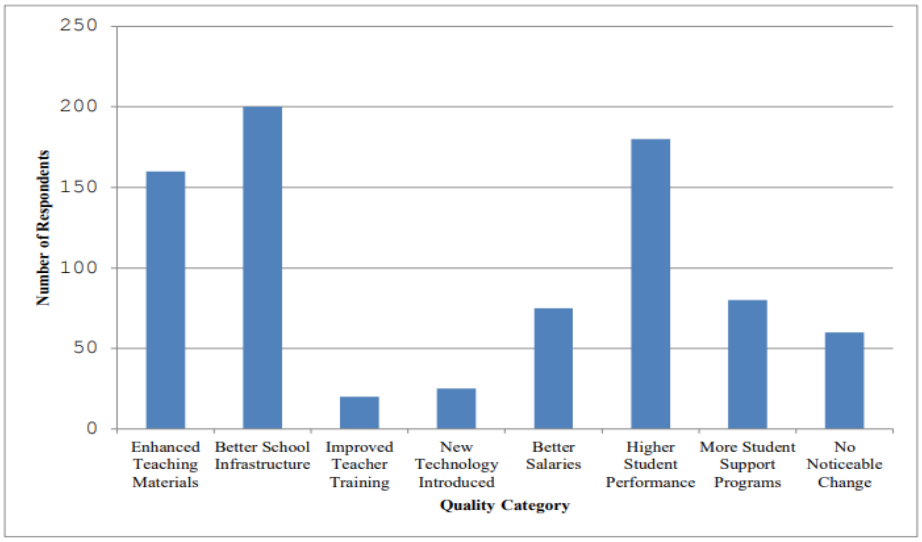

Figure 5. Field Data -Perceived Changes in Quality of Education Due to Oil and Gas Revenue

Discussion

The results of this study validate the fact that although oil related allocations are suggestive of the political will to enhance rural education, systemic governance deficiencies exert tremendous constraints over their transformative power in Region 5. These results are remarkably consistent with the global literature on the "resource curse" and the governance woes that are such a strong feature of resource-rich developing nations [8, 6].

Governance and Implementation Gaps

While Region No. 5 received an impressive allocation of just over GYD $1.9 billion for 2021 from an expected disbursement of resources until 2024, the sluggish implementation (contractor delays, project over-runs and poor technical oversight), illustrates the Rajkumar and Swaroop (2007) theory of the "low absorptive capacity" of subnational systems. This implementation deficit indicates a gulf between macro-level fiscal policy aspirations and micro-level delivery structures which is replicated in other oil-exporting countries such as Nigeria and Venezuela [25, 13].

This mismatch is also a manifestation of the "macro-micro schism" described in Mehlum, Moene, and Torvik (2006), where high public outlays do not result in significant improvements in human development because of weak institutions. For Guyana, the Good Governance Framework in general, and its dimensions of participation and accountability in particular, are not sufficiently operationalized at the regional level [11].

Equity and Visibility of Investments

The collected infrastructure and access data also indicate that, even where it was available, little of the money was made known to educators when it was spent on school improvements. Under a third of the teachers who were canvassed even realized that their school construction projects derived from oil money and more than 60 per cent said they had no participation in planning capital works. This opaqueness and absence of local voice is similar to the claim of Kolstad and Wiig (2009) that resource allocation opacity undermines citizen oversight and reduces developmental effectiveness [14].

Furthermore, the lack of report space in the core academic infrastructure, including the libraries and science laboratories, indicates a disconnect between the focus of investment and the pedagogical concerns. And although support services such as school feeding were welcomed, these alone may not lead to sustained learning gains.

Learning Outcomes vs. Physical Improvements

These marginal (3–4%) increases in NGSA English and Math pass rates from 2021 to 2023 indicate that the physical, infrastructure improvements have not yet contributed to significant, meaningful educational changes. This verifies Birdsall and Subramanian's (2004) warning that with the resource blessing can come a diminished sense of urgency for addressing the underlying drivers of learning – namely: teacher effectiveness, curriculum pertinence, and student support systems [10],

The disparity between investment and academic performance underlines the need for the vast sums of money to be joined by focused interventions in the means of teaching and of learning. Compared to the structural channel of re-investment (Mehlum et al., 2006) used in Norway, Guyana's current approach seems to be more through the infrastructure than instructional [11].

Stakeholder Perception and Local Ownership

The stakeholder results indicate that something more fundamental such as being disconnected from the planning and governance process is taking place. Teachers knew little about links between oil revenue and the budget (32%) and experienced a sense of disempowerment in the budget (64%). It is the absence of this nexus that devalues local ownership, local accountability, and local sustainability. As highlighted in the World Bank (2018) model, service equality in states with resources depends on civic and open planning and participation in budget formulation [15].

Synthesis and Implications

Overall, the results support the main argument in the literature that fiscal input is not enough. Without similar enhancements of governance, participation, and instructional quality, oil funded efforts will degenerate into monuments of investment with no substance. If Guyana is to transcend the resource curse, it must take up a more wholesome, indigenous-based, and learning oriented strategy toward educational development.

Conclusion

This study has analyzed the distribution and effects of oil-funded investment in education in Guyana's Region 5 (Mahaica-Berbice) for the period 2021–2024. The results show that despite significant financial investments made into improving school infrastructure and access, the inputs have not translated into commensurate improvements in learning outcomes or systemic equity. The similar patterns of growth evidenced reflect broader literature on the 'resource curse' where enhanced state fiscal capacity made possible by natural resources has not translated into transformative social outcomes because of weak institutions, fragmented governance, and limited community participation.

The research reveals that schools did benefit from infrastructure investments, including the building of new classrooms, dormitory expansions and sanitation improvements. Yet, there are still some crucial challenges: the majority of teachers still do not know the source of this money, pedagogic performance (proxied by NGSA performance) has not been great, and core academic infrastructure (e.g. laboratories, libraries) has been paid scarcely any attention. What is more, the limited extent of stakeholder involvement in project planning and implementation, despite relying on the ideals of Good Governance Framework in terms of transparency, local ownership and accountability, are disturbing.

In sum, the evidence suggests that, although oil-related revenues are large in absolute terms, they must be used through participative, pedagogically responsive and long-term strategies informed mechanisms of institutional capacity development. In their absence, however, capital spending may simply entrench

cosmetic advances without resolving the structural deficits that have contributed to rural education s disadvantage in Guyana. The paper concludes that there will be a need for strategic policy coherence, regional inclusivity and a meaningful involvement of stakeholders if the country is to transform resource wealth into sustainable educational transformation.

Recommendations

From the analysis of oil-financed education infrastructure investment in Region 5, the following recommendations are suggested for improving the efficiency, equity and long run impact of such intervention.

Strengthen Local Implementation Capacity

Regional education offices must be better resourced in terms of project management, monitoring procurement, and the provision of technical support to ensure that capital works are delivered on time, and with quality. This entails training of district engineers, education officers and contractors to help eliminate delays in implementation and standard low quality projects.

Align Investments with Pedagogical Outcomes

It is not enough for infrastructure simply to be stimulated; something must happen to support the teaching and learning cause. This needs to be complemented by teacher training, updating curricula to fit 21st century needs and the regular provision of teaching and ICT materials. Investment should mean something in terms of learning.

Enhance Stakeholder Participation and Transparency

The planning and budgeting process should be more open, more inclusive by incorporating school management committees, teachers, PTAs and community leaders in a structured manner to design and monitor capital works. This will allow for greater local ownership - better alignment with mates including local, and of course, enhanced accountability.

Entrench Equity Audits and Needs-Based Allocation

A structured equity audit process needs to be implemented to ensure that underserved or geographically isolated locations (i.e. riverine and Indigenous areas) are not exposed to social injustice in the resource distribution. Data-based, demand-driven budgeting has to become the norm and not the rarity.

Design Outcome Based Monitoring & Evaluation (M&E) System

Oil revenue-financed interventions must be accountable to ongoing, transparent review and reporting standards. Longer term allocations should also be informed by performance indicators including enrollment trends, student performance, teacher capacity and infrastructure usability. The effectiveness of the latter can be enhanced by incorporating results-based financing modalities, as advocated by the World Bank (2018).

Improve Communication About Funding Sources

Less than one-third of teachers surveyed were aware that oil revenues were funding improvements in their schools. The Ministry of Education and Ministry of Finance should launch targeted information campaigns to raise awareness of the NRF and its use in education, to foster trust and legitimacy in public spending.

Formulate a Long-Term National Education Infrastructure Strategy

An inclusive, publicly accessible education infrastructure strategic plan that will apply beyond Region 5 must be formulated so that all oil-funded education development projects, are coherent, equitable, sustainable and address to investment adequately.

Acknowledgement

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Conflict of Interest

The author declares no conflict of interest in the preparation or execution of this research.

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Dietary Adherence and its Impact on Glycemic Control among Type 2 Diabetes Patients at Tema General Hospital, Ghana

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Abstract

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder with rising prevalence worldwide, particularly in developing countries like Ghana. Dietary adherence is a crucial component of diabetes management and glycemic control. This study aimed to assess the level of dietary adherence and its association with glycemic control among adults with T2DM attending the Tema General Hospital (TGM). A cross-sectional study was conducted among 140 T2DM patients recruit Hospital (e diabetic clinic using convenience sampling. Data were collected using structured questionnaires and laboratory assessments (fasting blood glucose and HbA1c). Descriptive statistics summarized the demographic and clinical characteristics. Chi-square tests and logistic regression models were used to examine associations between dietary adherence and glycemic control. Among the participants, 60% achieved good glycemic control (HbA1c <7%). Although 74% of participants demonstrated good dietary knowledge, only 69% had been referred to a dietician. Patients with good dietary adherence were 12.3 times more likely to achieve optimal glycemic control compared to those with poor adherence (adjusted odds ratio [aOR] = 12.33, 95% CI: 3.64–41.75, p <0.001). Referral to a dietician significantly increased the likelihood of good glycemic control (aOR = 4.20, 95% CI: 1.47–12.01, p =0.007). Dietary adherence and dietician referral are significant predictors of glycemic control among adults with T2DM. Strengthening dietary counseling and patient education should be prioritized to improve diabetes outcomes.

Keywords: *Dietary Adherence, Dietician Referral, Glycemic Control, Type 2 Diabetes.*

Introduction

Diabetes mellitus (DM) is a serious, chronic metabolic disorder that arises either when the pancreas fails to produce sufficient insulin, the hormone regulating blood glucose, or when the body cannot effectively utilize the insulin produced [1]. As one of the four priority noncommunicable diseases (NCDs) identified by global health authorities, diabetes represents a growing public health concern. Hyperglycemia, the hallmark of diabetes, leads to classic symptoms such as frequent urination, excessive thirst, increased hunger, and weight loss [2]. The lack or ineffective action of insulin results in elevated blood glucose levels, which define the diabetic state [3].

The World Health Organization classifies diabetes into three main types: type 1 diabetes, type 2 diabetes, and gestational diabetes mellitus [4]. Type 1 diabetes, caused by autoimmune destruction of pancreatic beta cells, has a sudden onset and requires lifelong insulin therapy (International Diabetes Federation, 2015) [2]. While the exact causes of type 1 diabetes remain unknown, environmental, genetic, and dietary factors are implicated [5]. Type 2 diabetes, also known as non-insulin-dependent or adult-onset diabetes, is the most common form and is primarily linked to sedentary lifestyles, obesity, and aging [4, 6]. Gestational diabetes, a temporary condition during pregnancy, increases the risk

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of developing type 2 diabetes later in life and contributes to pregnancy complications [4, 7].

Type 2 diabetes often presents subtly, with symptoms like thirst, blurred vision, fatigue, slow-healing wounds, and neuropathic sensations in the extremities [10]. If undiagnosed or poorly managed, it can lead to severe complications, including cardiovascular disease, stroke, renal failure, blindness, and limb amputation [8]. Alarmingly, over 50% of individuals with diabetes remain unaware of their condition until complications develop [10].

Globally, diabetes contributes significantly to premature mortality, accounting for approximately 5% of deaths and projected to rise by 50% over the next decade, with 80% of these deaths occurring in low- and middle-income countries [7, 9]. In 2014, 422 million people were living with diabetes, a figure that increased to 425 million in 2017 and is expected to rise to 629 million by 2045 [10].

Sub-Saharan Africa faces a dual burden of infectious and noncommunicable diseases, with an estimated diabetes prevalence of 16% [12]. In Africa, 14A million adults were living with type 2 diabetes in 2017, resulting in over 298,000 deaths (6% of all deaths), and the number is expected to double by 2045 [10]. Ghana, specifically, reported a prevalence of 4% in 2017, with projections estimating nearly one million cases by 2045.[10].

The risk factors for type 2 diabetes include unhealthy diets, physical inactivity, obesity, aging, ethnicity, and family history. Glycemic control, achieved through lifestyle modification such as adherence to dietary plans, cessation of smoking, and regular physical activity, is central to diabetes management [3]. Effective dietary management reduces the risk of complications such as diabetic retinopathy, hypertension, stroke, kidney failure, peripheral arterial disease, and amputations [13, 14]. However, despite available evidence, managing diabetes remains a major challenge, particularly in resource-constrained settings like Ghana [15].

Materials and Methodology

Study Design

A descriptive cross-sectional study design was used with quantitative methods to determine how adherence to dietary recommendations affects glycemic control in adults with type 2 diabetes mellitus. Dietary adherence implies the process of following a diet plan by means of self-monitoring, maintaining, and preventing relapses [16]. Diet adherence is facilitated by antecedents which comprise motivation, understanding the dietary recommendations, developing appropriate health beliefs, self-efficacy, setting achievable goals, and receiving social support.

Study Area and Site

The study was conducted at the Tema West Municipal (Tema General Hospital). The Municipal Assembly was carved from the Tema Metropolitan Assembly on March, 2018 and was established with Legislative Instrument (LI) 2317. The Municipal Assembly shares boundaries with Krowor Municipality to the West, Adentan to the North –West, Kpone to the North, Ashaiman Municipality to the North - East, and the Tema to the East, with the Gulf of Guinea sharing the south-eastern boundaries [11]. Community 2 is the District capital of the Tema West Municipal Assembly and is located at the south eastern part of the Municipality, and lies close to the coast. The location of the Municipality makes it economically viable in relation to the many Companies and Industries existing in the area. The total population of the Municipality was 125,046 according to the 2010 Population and Housing Census. This is made up of 48.2% male and 51.8%. female [11].

Study Population

Both male and female adult patients with type 2 diabetic mellitus seeking healthcare at

the diabetic clinic at Tema General Hospital were enrolled in this study. T2DM patients were identified by using patients' folders where medical physicians have confirmed diagnosis of the condition using consistently high Fasting Blood Sugar (FBS) results greater or equal to 126 mg/dL (7.0 mmol/L) and RBS results greater or equal to 200 mg/dL (11.1 mmol/L).

Inclusion Criteria

Participants were included in the study if they met the following criteria:

1. Adults aged 30 years or older with a confirmed diagnosis of type 2 diabetes mellitus (T2DM).
2. Provided written informed consent for participation.
3. Had documented glycated hemoglobin (HbA1c) test results or three consecutive fasting blood glucose (FBS) measurements obtained within the three months preceding the study.

Exclusion Criteria

Participants were excluded from the study if they met any of the following criteria:

1. Presence of cognitive impairment that precluded the ability to provide informed consent.
2. Pregnant women diagnosed with diabetes.
3. Non-ambulatory patients with type 2 diabetes mellitus.

Sampling Collection and Preparation

After a fasting period of 8 to 14 hours or overnight, peripheral venous blood samples were collected from consenting participants for the determination of Fasting Blood Glucose and HbA1c. The samples were collected into an evacuated EDTA-coated specimen for HbA1c.

Results

Background Characteristics of Study Participants

A total of 140 participants participated in the study with females being the majority (71%). The mean age of the participants was 52.26 ± 11.84 years with a minimum age of 30 years and maximum age of 78 years. About half (50.7%) of all study participants were married. Christians constituted a greater majority of the study participants (91.4%).

Findings on disease condition show that most study participants (78%) had lived with T2DM for over 2 years. While 69% of participants reported they had hypertension, 28% reported no disease complication. Other details on participant's sociodemographic and economic characteristics are shown in Table.1.

Table 1. Background Characteristics of Study Participants (N = 140)

Variable	Category	Number (%)
Age in Years	30–39	22 (15.71)
	40–49	21 (15.00)
	50–59	57 (40.71)
	60–69	32 (22.86)
	70 & Above	8 (5.71)
Sex	Male	32 (22.86)
	Female	108 (77.14)
Marital Status	Married	71 (50.71)
	Single	12 (8.57)
	Separated	27 (19.29)
	Widow/Widower	30 (21.43)

Level of Education	No formal education	39 (27.86)
	Elementary	48 (34.29)
	JHS	24 (17.14)
	SHS Education	15 (10.71)
	Tertiary Education	14 (10.00)
Religion	Christianity	128 (91.43)
	Muslim	12 (8.57)
Occupation	Managers	5 (3.57)
	Professional/Skilled	33 (23.57)
	Retired	21 (15.00)
	Agricultural	2 (1.43)
	Service and Sales	65 (46.43)
	Unemployed	14 (10.00)
Estimated Income Level	< Gh₵200	87 (62.14)
	Gh₵200 – Gh₵499	38 (27.14)
	Gh₵500 – Gh₵999	12 (8.57)
	Gh₵1,000 – Gh₵1,999	3 (2.14)
Duration of Disease	Within a year	50 (35.71)
	2 to 5 years	63 (45.00)
	5 to 9 years	15 (10.71)
	10 to 19 years	8 (5.71)
	20 years and Above	4 (2.86)
Disease Complications	Neuropathy (Nerve disease)	4 (2.86)
	No disease complications	40 (28.57)
	Hypertension (High BP)	96 (68.57)

Glycemic Control Among People with T2DM Presenting at the TGH

The study examined glycemic control among study participants. In all, 60% of study participants had good glycemic control indicated by glycosylated haemoglobin (HbA1c) or mean fasting blood sugar (FBS) less than 7.0% or 7.0mml/L respectively. Good glycemic control <7% and poor glycemic control >8%.

Association between Background Characteristics and Glycemic Control among People with T2DM Presenting at the TGH

The study examined the association between socio-economic characteristic and the outcome of interest (glycemic control) among study participants. A chi-square analysis was run comparing each socio-economic characteristic with glycemic control. The results are in Table

2. below. The analysis shows that, none of the socio-economic variables were significantly associated with glycemic control.

Table 2. Association between Background Characteristics and Glycemic Control among People with T2DM presenting at the TGH

Variable	Good Glycemic Control (%)	Poor Glycemic Control (%)	Chi-Square	P-Value
Age in Years			6.19	0.185
30–39	16 (19.05)	6 (10.71)		
40–49	15 (17.86)	6 (10.71)		
50–59	28 (33.33)	29 (51.79)		
60 & above	25 (29.76)	15 (26.78)		
Sex			0.01	0.935
Male	19 (22.62)	13 (23.21)		
Female	65 (77.38)	43 (76.79)		
Marital Status			1.18	0.758
Married	40 (47.62)	31 (55.36)		
Single/Separated/Widow/Widower	44 (52.28)	25 (53.57)		
Level of Education			2.51	0.643
No formal education	24 (28.57)	15 (26.79)		
Elementary/JHS	44 (52.39)	28 (50.00)		
SHS/Tertiary	16 (19.04)	13 (23.21)		
Religion			1.16	0.280
Christianity	75 (89.29)	52 (94.55)		
Muslim	9 (10.71)	3 (5.45)		
Occupation			1.59	0.901
Managers/Professional/Skilled	23 (27.38)	15 (26.79)		
Retired/Unemployed	22 (26.19)	13 (23.21)		
Agricultural	1 (1.19)	1 (1.79)		
Service and Sales	38 (45.24)	27 (48.21)		

Association between lifestyle Factors and Glycemic Control among People with T2DM Presenting at the TGH

The study collected information on lifestyle factors such as tobacco smoking, alcohol consumption, and utilization of dietetic services, medication and physical activity. From the analysis, none of the study participants smoked tobacco and 81% of them did not consume alcohol at all.

With regards to dietetic services, 69% of participants reported to have been referred to a dietician since they were diagnosed. However, 26% of those who saw a dietician reported that they sometimes miss appointment with their dietician. More than half (55%) of the study participants reported high adherence to medication with only 10% reporting low medication adherence. Over half of the study participants (51%) were found to be physically inactive.

To determine the association between relevant lifestyle characteristic and glycemic control, X2 statistics was explored comparing

each of the lifestyle variable with glycemic control. Results in Table 3. shows that only 'referred to a dietician after diagnosis' (X2 (1) = 26.630, p<0.0001) was significantly associated with glycemic control. All other factors (smoking, frequency of alcohol consumption, miss dietician appointment, and last visit to a dietician, medication adherence and physical activity) were not significantly associated with glycemic control.

Table 3. Association between Lifestyle Factors and Glycemic Control among People with T2DM Presenting at the TGH

Variable	Good Glycemic Control (%)	Poor Glycemic Control (%)	Chi-Square	P-Value
Smoking				
Yes	0 (0.00)	0 (0.00)		
No	84 (100.00)	56 (100.00)		
Frequency of Alcohol Consumption			2.26	0.322
Every Day	0 (0.00)	0 (0.00)		
< 3 times a week	4 (4.76)	1 (1.79)		
Few times in a month/year	10 (11.90)	11 (19.64)		
Not at all	70 (83.33)	44 (78.57)		
Referred to a Dietician After Diagnosis			26.63	<0.0001
Yes	72 (85.71)	25 (44.64)		
No	12 (14.29)	31 (55.36)		
Miss Dietician Appointments			0.53	0.463
Yes	29 (40.28)	8 (32.00)		
No	43 (59.72)	17 (68.00)		
Last Visit to the Dietician			5.25	0.154
One month ago	6 (8.33)	5 (20.00)		
Two months ago	9 (12.50)	6 (24.00)		
More than three months	14 (19.44)	4 (16.00)		
More than six months	43 (59.72)	10 (40.00)		
Medication Adherence			0.33	0.848
High	44 (52.38)	32 (57.14)		
Medium	31 (36.90)	19 (33.93)		
Low	9 (10.71)	5 (8.93)		

Knowledge on Dietary Recommendations for T2DM Among People with T2DM Presenting at the TGM

The study assessed the knowledge of participants on dietary recommendations for the management of T2DM. With regards to the total knowledge scores, the results show that 66% of study participants had good dietary knowledge. Details of participants' knowledge on dietary recommendations are presented in Table 4.

All study participants knew that fried foods are high in fat but only a half (51%) knew that not all fats and oils increase blood cholesterol levels. More than 80% of participants answered

'No' when asked the question 'Fruit juice can be drunk freely with little effect on BGL' but 11% had no knowledge on the effect of consumption of fruit juice on blood glucose. Although 97% of participants knew that Starchy foods raise blood glucose levels, about 60% of them believed that sugary foods require more insulin than starchy foods regardless of Carbohydrate content.

Table 4. Knowledge on Dietary Recommendations for T2DM among People with T2DM Presenting at the TGH

Variables	**Yes (%)**	**No (%)**	**Don't Know (%)**
Restricting salt reduces blood pressure	123 (87.86%)	4 (2.86%)	13 (9.29%)
Sugary foods raise BGL	131 (93.57%)	4 (2.86%)	5 (3.57%)
Fried foods are high in fat	140 (100%)	0 (0.0%)	0 (0.0%)
Pastry/cakes are high in fat	107 (76.43%)	9 (6.43%)	24 (17.14%)
Diabetic products can be eaten freely without weight gain	12 (8.57%)	52 (37.14%)	76 (54.29%)
Starchy foods raise BGL	136 (97.14%)	0 (0.0%)	4 (2.86%)
It is not possible to eat too much protein	34 (24.29%)	47 (33.57%)	59 (42.14%)
Any amount of fresh fruit can be eaten with little effect on BGL	26 (18.57%)	110 (78.57%)	4 (2.86%)
Fruit juice can be drunk freely with little effect on BGL	10 (7.14%)	114 (81.43%)	16 (11.43%)
Alcohol-free wines/lagers have no effect on BGL	22 (15.71%)	53 (37.86%)	65 (46.43%)
Cheese/biscuits are less fattening than cake	20 (14.29%)	23 (16.43%)	97 (69.29%)
Margarines/spreads have less energy than butter	51 (36.43%)	15 (10.71%)	74 (52.86%)
Protein raises BGL	58 (41.43%)	37 (26.43%)	45 (32.14%)
People with diabetes need to avoid foods containing any sugar	73 (52.14%)	63 (45.00%)	4 (2.86%)
All fats and oils increase cholesterol levels	72 (51.43%)	18 (12.86%)	50 (35.71%)
Full-fat foods affect BGL more than low-fat foods	121 (86.43%)	2 (1.43%)	17 (12.14%)
Sugary foods require more insulin than starchy foods regardless of CHO content	80 (57.14%)	2 (1.43%)	58 (41.43%)

Dietary Adherence Among People with T2DM Presenting at the TGH

Frequency of intake of the food in the various food groups are shown in Table 5. None of the study participant reported consumption of sweets as dessert over the last month. Less than 50% of the participants reported eating a portion of vegetables more than five times to everyday in a week with about 33% eating vegetables once a week or less often over the last month. However, with fruit consumption, only 22% of participants reported to eating a

portion of fruit more than five times to everyday in a week with about 50% of respondent consuming fruits less often in a month. Majority of study participants (76%) never consumed sugary drinks over the last month and 70% of participants never ate 'fast foods' like fried rice, pizza or burgers over the last month. With regards to the total dietary adherence, the results show that 69% of study participants adhered to dietary recommendations.

Table 5. Food Frequency and Consumption Behavior among People with T2DM Presenting at the TGH

Foods / Dietary Behaviors	**Never or Very Rarely**	**Once a Week or Less**	**2–4 Times a Week**	**5–6 Times to Everyday**
Eat a portion of vegetables	3 (2.14)	46 (32.86)	28 (20.00)	63 (45.00)
Eat a portion of fruit	20 (14.29)	69 (49.29)	20 (14.29)	31 (22.14)
Eat a cake, a sweet pastry	90 (64.29)	2 (1.43)	46 (32.86)	2 (1.43)
Sugary Drinks	106 (75.71)	18 (12.86)	14 (10.00)	2 (1.43)
Full-Fat Spread	92 (65.71)	3 (2.14)	43 (30.71)	2 (1.43)
Full Fat Milk	93 (66.43)	6 (4.29)	33 (23.57)	8 (5.71)
Skimmed Milk	115 (82.14)	8 (5.71)	15 (10.71)	2 (1.43)
Non-Dairy Milk	125 (89.29)	4 (2.86)	3 (2.14)	8 (5.71)
Processed Meat	84 (60.00)	28 (20.00)	26 (18.57)	2 (1.43)
Salty Foods	116 (87.86)	13 (9.29)	11 (7.86)	0 (0.00)
Salty Pastry	82 (58.57)	28 (20.00)	27 (19.29)	3 (2.14)
*Fast Foods	98 (70.00)	21 (15.00)	21 (15.00)	0 (0.00)
Eat some sweets or a bar of chocolate	127 (91.43)	1 (0.71)	10 (7.14)	2 (1.43)
Eat sweets for dessert, apart from fruit	140 (100)	0 (0.00)	0 (0.00)	0 (0.00)
*Eat Oily fish	23 (16.43)	24 (17.14)	46 (32.86)	47 (33.57)
Have 3 or more regular meals in a day	39 (27.86)	24 (17.14)	15 (10.71)	62 (44.29)
Eat breakfast within about 2 hours of waking	41 (29.29)	22 (15.71)	17 (12.14)	60 (42.86)
Snack on high-fat/sugar foods between meals	91 (65.00)	24 (17.14)	12 (8.57)	13 (9.29)
Eat a portion of bread like 1 slice of bread	17 (12.14)	14 (10.00)	23 (16.43)	86 (61.43)
Choose higher fibre breads like wheat bread	8 (5.71)	29 (20.71)	7 (5.00)	96 (68.57)
Eat a bowl of breakfast cereal like porridge	35 (25.00)	18 (12.86)	16 (11.43)	71 (50.71)
Choose higher fibre cereals like oats	35 (25.00)	15 (10.71)	14 (10.00)	76 (54.29)

**Fast foods: fried rice, pizza or noodles # Oily fish: fresh or tinned salmon, sardine*

Factors Associated with Good Glycemic Control among People with T2DM Presenting at the TGH

At the bivariate level, no significant association was observed between socio-demographic characteristics (age, sex, marital status, education and occupation), alcohol consumption, medication adherence, physical activity and good glycemic control (p>0.05). Dietary adherence, referral to a dietician after being diagnosed with diabetes and perceived family support were found to be significantly associated with glycemic control (p<0.05). Respondents with good dietary adherence were 19.8 times likely to have good glycemic control as compared with respondents with poor dietary adherence (UOR=19.8, 95% CI: 7.67, 51.06, p<0.001) and the association was significant. Additionally, respondents referred to a dietician after being diagnosed with diabetes were 7.43 times more likely to have good glycemic control compared with those who were not referred (UOR=7.43, 95%CI: 3.32, 16.67; p<0.001). Respondents with high perceived family support were about six times more likely to have good glycemic control than respondents with low perceived family support (UOR=5.95, 95%CI: 2.83, 12.49; p<0.0001).

After controlling for the effect of socio-demographic characteristics (age, sex, marital status, education, occupation and monthly income), alcohol consumption, medication adherence, physical activity, referred to a dietician after diagnosis and family support in the adjusted model, dietary adherence was significantly associated with good glycemic control (p<0.0001). The odds of having good glycemic control was 12.3 times greater among respondents with good dietary adherence compared with those with poor dietary adherence (aOR=12.33, 95%CI: 3.64, 41.75; p<0.001).

After controlling for the effect of socio-demographic characteristics, alcohol consumption, medication adherence and physical activity, a significant association was also observed between referral to a dietician and good glycemic control (p=0.007). Respondents, referred to a dietician after being diagnosed with diabetes were 4.2 times more likely to have good glycemic control compared with those who were not referred (aOR=4.20, 95%CI: 1.47, 12.01; p=0.007). Although high perceived family support was significantly associated with good glycemic control in the crude analysis, its significance disappeared after adjusting for the effect of socio-demographic characteristics and other variables in the adjusted model (aOR=2.05, 95%CI: 0.72, 5.82; p=0.177). Results are shown in Table 6.

Table 6. Logistic Regression Model of Factors Associated with Good Glycemic Control Among People with T2DM Presenting at the TGH.

Variables	UOR	95% CI	p-value	aOR	95% CI	p-value
Age	0.98	0.95, 1.02	0.409	1.01	0.95, 1.05	0.793
Sex (Ref= Male)						
Female	1.03	0.46, 2.31	0.935	0.81	0.24, 2.76	0.737
Marital Status (Ref= Not married)						
Married	0.73	0.37, 1.44	0.370	0.87	0.32, 2.42	0.802
Education (Ref= No formal education)						
Basic education	0.98	0.44, 2.18	0.965	0.72	0.22, 2.33	0.585
SHS & above	0.76	0.28, 2.04	0.598	0.67	0.14, 3.15	0.651
Occupation (Ref= Unemployed)						
Employed	0.85	0.38, 1.87	0.690	1.17	0.35, 3.86	0.788
Alcohol Consumption (Ref= Yes)						
No	1.36	0.57, 3.21	0.479	2.43	0.69, 8.56	0.166

Referred to a dietician (Ref= No)						
Yes	7.43	3.32, 16.67	<0.0001	4.20	1.47, 12.01	0.007
Medication Adherence (Ref= Low)						
Medium	0.91	0.26, 3.11	0.876	0.54	0.08, 3.50	0.522
High	0.76	0.23, 2.49	0.656	0.43	0.07, 2.50	0.350
Physical Activity (Ref= Low)						
High	1.75	0.38, 1.47	0.408	0.70	0.27, 1.81	0.464
Dietary adherence (Ref = Poor)						
Good	19.8	7.67, 51.06	<0.0001	12.33	3.64, 41.75	<0.0001
Perceived Family Support (Ref= Low)						
High Support	5.95	2.83, 12.49	<0.0001	2.05	0.72, 5.82	0.177

Discussion

This study explored the relationship between dietary adherence and glycemic control among adults with type 2 diabetes mellitus (T2DM) at Tema General Hospital (TGH). The findings revealed that 60% of participants achieved good glycemic control, which aligns with findings from similar studies in Ghana [22] and Kinshasa [12], highlighting the growing effectiveness of diabetes management interventions in urban health facilities.

A significant proportion (66%) of respondents demonstrated good dietary knowledge, particularly regarding the effects of sugar and starch on blood glucose levels. However, gaps were evident in areas such as fat and cholesterol content in foods, similar to findings in Ireland [17]. This suggests a need to intensify education around dietary fats and cholesterol to improve comprehensive dietary literacy.

In terms of adherence, 69% of respondents followed dietary recommendations—a rate consistent with other studies in Nigeria [18] and higher than findings from Ethiopia [19]. This could be attributed to high referral rates to dieticians (69%) and regular access to nutritional counselling at TGH. Moreover, this suggests that professional dietary guidance significantly enhances adherence.

The study found that referral to a dietician was significantly associated with good glycemic control ($p < 0.0001$), reinforcing earlier research [20, 21]. These results underline the importance of structured nutritional care in diabetes management and the need for physician-dietician collaboration.

Although 55% of participants adhered to medication and 81% abstained from alcohol, these factors were not significantly associated with glycemic control. Similarly, physical activity levels were low (only 49% were active), possibly due to environmental constraints and comorbidities such as hypertension, reflecting trends noted in other studies [23, 24].

These results collectively highlight that while medication and general lifestyle factors matter, dietary adherence and timely referral to a dietician are the most influential determinants of glycemic outcomes in this setting.

Conclusion

The study concludes that dietary adherence and referral to a dietician significantly influence glycemic control among T2DM patients at TGH. Despite good general knowledge and positive medication adherence rates, only these two factors emerged as significant predictors. The findings affirm that nutrition plays a central role in diabetes management and support the rejection of the null hypothesis. Therefore, there is a statistically significant association between

dietary adherence and glycemic control in this population.

Recommendation

1. Educational sessions on clinic days should focus on deepening understanding of fats, oils, and balanced diets, and target all patients regardless of their perceived knowledge level.
2. Healthcare providers should integrate dietary adherence assessments into routine reviews to promptly identify patients at risk of poor control.
3. Hospital management must enforce and monitor strict compliance with referral protocols between physicians and dieticians to improve patient outcomes.
4. Structured collaboration between dieticians, nurses, and physicians should be institutionalized to offer comprehensive diabetes care.
5. Interventions such as patient counselling and community programs should be developed to tackle physical inactivity, especially among those with hypertension or other comorbidities.

Conflict of Interest

There is no conflict of interest.

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Examining the Influence of Strategic Leadership on Organizational Growth in Megachurches in the USA: A Critical Literature Review

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Abstract

This article presents a critical literature review examining the influence of strategic leadership on the organizational growth of megachurches in the United States. Strategic leadership is a pivotal force in the success and expansion of organizations; yet, a significant research gap exists regarding its specific application within the unique context of large religious nonprofits. This study synthesizes and analyzes existing scholarly works to explore the nuanced relationship between key strategic leadership practices—strategic vision, objective setting, strategy crafting, implementation, and performance evaluation—and the multifaceted growth of megachurch organizations. Adopting a qualitative approach guided by a hermeneutic research philosophy, this review employs a thematic analysis of academic literature to identify core themes, theoretical underpinnings, and emerging patterns. The findings reveal that megachurch growth is a complex phenomenon that extends beyond numerical increases to encompass spiritual maturity, service expansion, and community impact. The leader's vision profoundly shapes the adoption of business principles within a spiritual framework and the effective management of unique resources. The study concludes that strategic leadership is a critical determinant of megachurch vitality and sustainability, offering practical insights for leaders and identifying key areas for future scholarly inquiry.

Keywords: *Church Growth, Leadership Theory, Megachurch, Organizational Growth, Pastoral, Strategic Leadership.*

Introduction

Strategic leadership is widely recognized as a crucial driver of success and expansion across various organizational types [1, 2]. Within the United States' religious landscape, megachurches—Protestant congregations with a regular weekly attendance of 2,000 or more—represent a significant and influential organizational phenomenon [3, 4]. These institutions have not only demonstrated remarkable growth in an era where many traditional denominations face declining attendance, but they have also become powerful influencers of public opinion and societal views due to their vast resources and sizable followings [3, 5]. The ability of these complex organizations to thrive is intricately linked to the leadership provided by their pastors and executive teams [6].

This research addresses a significant gap in the academic literature regarding the specific dynamics of strategic leadership within megachurch settings [7, 8]. This gap is not just a void in knowledge, but a crucial area that needs to be filled to understand the unique strategies and processes that successful leaders employ to foster organizational growth. The core components of strategic leadership—encompassing the vision, decision-making, and management practices of top leaders—are acknowledged as critical; yet, the mechanisms of their influence on growth remain under-theorized and under-examined in this specific context. Existing

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knowledge provides a limited understanding of how strategic principles, often developed in corporate settings, are adapted and implemented within these unique, value-driven environments [9, 27]. This limitation hinders both academic theory and the practical development of effective leadership within one of the most vital segments of contemporary American religion.

The primary objective of this study is to critically examine and elucidate the influence of strategic leadership practices on the multifaceted dimensions of organizational growth within the specific context of megachurches in the United States, employing a critical literature approach [12]. This is achieved by pursuing several specific objectives: (1) to understand the influence of strategic vision; (2) to ascertain the role of setting specific objectives; (3) to determine the impact of crafting a strategy; (4) to understand the process of implementing strategy; and (5) to ascertain the influence of evaluating performance on the organizational growth of megachurches [10]. The novelty of this work lies in its synthesis of a fragmented body of literature through a robust theoretical framework, integrating Strategic Leadership Theory, Upper Echelons Theory, the Resource-Based View, and others to create a holistic model [1, 6]. By systematically analyzing and deconstructing existing research, this article aims to contribute to leadership studies and the sociology of religion, while offering valuable, evidence-based insights for practitioners navigating the complexities of leading large, nonprofit organizations [5, 11, 32].

Materials and Methods

This study employed a qualitative research approach, specifically a critical literature review, to conduct an in-depth examination of the relationship between strategic leadership and organizational growth in US megachurches [13]. A qualitative methodology was deemed most appropriate due to its strength in exploring complex and nuanced phenomena, as well as synthesizing diverse perspectives from existing scholarly work to produce a rich and holistic understanding [14, 15]. The research was guided by a hermeneutic philosophy, a method of interpretation that emphasizes the in-depth interpretation of textual data to uncover underlying meanings, assumptions, and patterns. This philosophy was chosen for its suitability in understanding and interpreting the complex and nuanced data found in the literature on strategic leadership in megachurches.

Research Design and Data Source

The primary research design employed a critical literature review [12, 16]. This method involves a systematic process of identifying, evaluating, and synthesizing existing knowledge on a topic. Still, it goes beyond mere summary to actively engage with the literature, question its assumptions, and identify power dynamics or biases. The data for the study consisted exclusively of secondary sources, including peer-reviewed academic journal articles, scholarly books, published dissertations, and credible industry reports [17]. The subjects of the study were the texts themselves—the arguments, theories, and empirical findings presented by other researchers [18].

Data Collection and Processing

A systematic literature search was conducted across major academic databases, including Google Scholar, EBSCOhost, JSTOR, and ProQuest [19]. Search terms included combinations of "megachurch," "strategic leadership," "organizational growth," "church growth," and "large congregations," utilizing Boolean operators to refine the results [19]. Strict inclusion and exclusion criteria governed the selection of literature [16]. Inclusion criteria specified: peer-reviewed scholarly publications, texts published in English, and studies focusing on megachurches within the USA that directly addressed the core constructs [4, 20]. Non-scholarly sources, non-English texts, and literature

focused on contexts outside the US were excluded [4]. A particular emphasis was placed on literature from the last two decades to ensure currency. To organize the collected data, a Literature Matrix was developed. This tool enabled the systematic extraction and comparison of key information across sources, including theoretical frameworks, methodologies, findings, and limitations. Throughout the process, Concept Maps were used as a visual tool to illustrate relationships between concepts and identify emerging themes. Concept Maps are a visual representation of the relationships between different concepts, allowing for a deeper level of analysis and synthesis of the literature.

Data Analysis

The core analytical technique employed was a comprehensive thematic analysis, guided by the hermeneutic and critical lens of the research design [12]. This iterative process involved several stages: (1) **Familiarization**, through intensive reading of the selected literature; (2) **Generating Initial Codes**, by systematically identifying patterns and features relevant to the research questions; (3) **Searching for Themes**, by collating codes into potential overarching themes that captured significant patterns in the data [22]; (4) **Reviewing Themes**, by refining them against the dataset for coherence and distinctiveness [22]; (5) **Defining and Naming Themes**, to articulate the essence of each theme; and (6) **Producing the Report**, by synthesizing the analysis into a coherent narrative supported by compelling examples from the literature. This process involved not only summarizing but also critically interpreting the findings in the context of the study's theoretical framework, identifying gaps, contradictions, and dominant narratives within the existing body of knowledge [12]. The analysis involved extracting both qualitative insights and quantitative statistical data reported in the reviewed studies, such as descriptive statistics on megachurch operations and demographics, to provide a comprehensive picture of the field.

Results

The thematic analysis of the literature revealed several key themes regarding the influence of strategic leadership on the growth of megachurches. These results integrate qualitative insights with statistical data reported in the source materials, providing a comprehensive picture of the phenomenon.

Reported Statistical Context of U.S. Megachurches

The literature provides a clear statistical backdrop for understanding the scale and characteristics of the organizations under review. A megachurch is typically defined as a Protestant congregation with a sustained weekly attendance of 2,000 or more individuals [3, 4]. These organizations operate on a significant scale; for instance, the average budget of a megachurch in 2019 was reported to be $7 million [3]. Leadership characteristics are also statistically documented: the average age of a lead pastor in a U.S. megachurch is 53, with an average tenure of 15 years in their position [3]. Furthermore, demographic trends within these churches show a notable increase in multiracial congregations, reflecting an adaptation to broader societal shifts [3]. These statistics underscore the complexity and significant resource base that necessitate strategic, rather than purely administrative, leadership.

The Primacy of Strategic and Visionary Leadership

A dominant theme across the literature is the critical role of the senior leader in establishing and communicating a compelling strategic vision. This extends beyond simple management, requiring leaders to anticipate future trends, maintain flexibility, and empower others to achieve the organization's goals [1, 6, 25]. Visionary leadership is consistently highlighted as pivotal for navigating dynamic environments and driving growth [20, 26]. This vision often creates a "dramatic web" that offers meaning and purpose, resonating with the congregation

to attract newcomers and retain existing members. The leader's ability to articulate this vision is framed not just as a task, but as the central mechanism through which strategic direction is established and maintained [28].

The Multifaceted Nature of Organizational Growth

The analysis shows that organizational growth in megachurches is understood as a multidimensional concept. It extends far beyond numerical metrics, such as weekly attendance and financial contributions [29]. The literature describes growth as also encompassing the spiritual maturity of the congregation [20, 30], the expansion of services and ministries (e.g., youth outreach, community service) [3, 30], the development of multisite campuses [4], and an increase in overall community impact [3, 26]. Leaders are often evaluated, and evaluate themselves, against a balanced scorecard of objectives that includes both quantitative and qualitative measures [30, 31]. This result suggests that effective strategic leadership in this context should prioritize holistic development, rather than merely numerical expansion.

Adaptation of Corporate Strategy in a Spiritual Context

A significant pattern identified is the application of principles from the corporate world to the church's operational model [1, 27]. This includes formal processes for setting specific objectives, crafting detailed strategies, implementing them systematically, and evaluating performance [10]. Megachurch leaders are found to leverage strategic tools and management models to enhance organizational effectiveness [9]. For example, the use of multisite expansion is a common growth strategy borrowed from business franchising models [4]. However, this adaptation is not a simple transfer. The results show that successful leaders must integrate these business principles with the church's core spiritual mission and ethical values in a sophisticated manner, a process that requires navigating the tension between missional faithfulness and operational efficiency.

The Strategic Management of Culture and Resources

The literature emphasizes that strategy is implemented through organizational culture [21, 26, 30]. Strategic leaders play a crucial role in intentionally shaping and maintaining a mission-aligned culture characterized by shared norms, values, and beliefs. This becomes increasingly complex and vital as the organization scales. Concurrently, the results highlight the importance of resource management. In line with the Resource-Based View (RBV), megachurches are conceptualized as bundles of unique resources, including the "human capital" of a charismatic pastor, a large volunteer base, significant financial assets, and strong community networks. A key finding is that growth is driven by the leader's ability to identify, cultivate, and leverage these valuable, rare, and inimitable resources to achieve a "competitive advantage" in the religious marketplace.

The Influence of Leadership Characteristics and Context

The background and characteristics of the senior leader and their top management team are found to significantly influence strategic choices and outcomes. Factors such as a leader's tenure, education, and prior career experiences shape their cognitive frameworks and values, which in turn dictate their strategic direction and risk tolerance. The findings also strongly support a contingency perspective, indicating that there is no one-size-fits-all approach to leadership [2]. Effective leadership is contingent upon the fit between the leader's style, the organization's stage of development, and the specific demands of the external environment. Leaders must be adept at diagnosing their context and adapting their strategies accordingly to sustain growth.

Discussion

The results of this critical literature review provide a multifaceted understanding of how strategic leadership influences megachurch growth, serving as a bridge between established organizational theories and the realities of a unique non-profit context [5, 12]. The discussion here interprets the key findings by connecting them to the theoretical framework that guided the study [10].

The primacy of visionary leadership, identified as a core theme, aligns directly with Strategic Leadership Theory (SLT) and Upper Echelons Theory (UET) [1, 6]. SLT posits that a leader's primary role is to set long-term direction and make consequential decisions, which is embodied in the finding that a compelling vision is the central mechanism for growth [1, 6, 25]. UET further explains this by suggesting that the content and delivery of this vision are profoundly shaped by the leader's personal values, experiences, and cognitive base. The documented 15-year average tenure of lead pastors [3] suggests a high degree of stability, which, through a UET lens, could imply a prolonged period during which a single leader's vision shapes the organization. This long tenure might foster deep cultural integration but could also present challenges for adaptability and succession planning, a critical issue highlighted by Organizational Growth Theory (OGT).

The finding that megachurch growth is a multifaceted phenomenon challenges simplistic, purely numerical definitions and supports a more holistic view, aligning with a balanced scorecard approach [30]. This broad definition of success, encompassing spiritual and community impact alongside attendance figures, highlights the unique nature of these non-profit entities [29]. The significant financial resources, such as the average budget of $7 million [3], create the capacity for this diverse impact, but also intensify the need for sophisticated strategic planning and performance evaluation, as identified in the results [10]. The application of corporate strategic processes—objective setting, strategy crafting, implementation, and evaluation—can be understood as a response to this complexity. This finding is illuminated by Institutional Theory, which suggests that organizations adopt practices deemed legitimate and effective within their environment to ensure survival and growth. In the contemporary U.S., data-driven, strategic management has become an institutionalized norm, and megachurches appear to be mimicking these practices from the corporate sector to manage their large-scale operations effectively [9].

The results concerning the management of culture and resources strongly support the Resource-Based View (RBV) of the firm. RBV conceptualizes an organization as a unique bundle of resources and argues that sustained advantage comes from leveraging those that are valuable, rare, inimitable, and non-substitutable (VRIN). The finding that pastor quality, strong community networks, and unique ministry approaches are key drivers of growth is a direct reflection of RBV. Strategic leaders in this context are not just spiritual guides but also stewards and developers of these critical, often intangible, assets. Their success depends on crafting strategies that leverage these internal strengths [6].

Finally, the influence of leadership characteristics and context confirms the propositions of Contingency Theory [2]. The finding that effectiveness depends on the fit between leadership style and the situation refutes the notion of a "one best way" to lead a megachurch. A leadership approach that works in a rapidly growing, entrepreneurial church at one stage of development (per OGT) may fail in a more mature, established institution facing different challenges. This underscores the necessity for leaders to possess high adaptive competency and the managerial discretion to adjust strategies in response to both internal and external changes, a key tenet of SLT [1, 6].

A crucial outcome of this discussion is the identification of research gaps. While the literature confirms what is already known (i.e., that strategic leadership matters), it is less clear on *how* it achieves this. There is a need for more granular research on the specific mechanisms of leadership influence on growth, the development of leadership competencies tailored to this unique context, and the long-term impacts of digital transformation on strategy and growth [2, 32]. This review synthesizes what is known, but its greater contribution may lie in highlighting these clear paths for future inquiry [6].

Conclusion

This critical literature review confirms that strategic leadership is a significant and multifaceted driver of organizational growth in U.S. megachurches [2, 6]. The study systematically synthesized a diverse body of literature to demonstrate that the influence of leadership extends beyond charismatic personality to encompass a deliberate and strategic process [1, 4, 6]. The key components of this process—formulating a compelling vision, setting clear objectives, crafting and implementing adaptive strategies, and evaluating performance—are integral to navigating the complexities of leading large, value-driven organizations [10].

The findings demonstrate that successful megachurch growth is not merely numerical, but holistic, encompassing spiritual development, ministry expansion, and community engagement [3, 30]. This growth is contingent upon leaders who can skillfully integrate established business principles within a spiritual framework, manage and leverage unique organizational resources, and adapt their strategies to fit their specific context and stage of development [9]. By framing these findings within established organizational theories, such as Strategic Leadership Theory, the Resource-Based View, and Contingency Theory, this study provides a robust conceptual model for understanding the phenomenon [6, 10].

Theoretically, this research contributes to synthesizing a fragmented field and applying established leadership theories to the unique non-profit context of megachurches [5, 11]. Practically, it offers valuable insights for leaders of megachurches and other large non-profits by outlining the documented links between strategic practices and growth outcomes. Societally, it contributes to a more informed public understanding of the organizational dynamics that fuel these influential institutions [3, 5]. Ultimately, by identifying specific gaps in the current body of research, this dissertation provides a clear direction for further scholarly inquiry into this important and evolving area of study [2, 6].

Conflict of Interest

The author declares no conflict of interest.

Ethical Approval

This study is a critical literature review based on previously published data and did not require ethical approval.

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Prevalence of Malnutrition among Children Under 5 Years of Age in Chukudum Hospital, Budi County, South Sudan

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Abstract

South Sudan was faced with a lot of geo-political issues which some had impacted on children health resulting in poor nutritional status. This research study is to find out the prevalence of malnutrition among children aged 6-59 months sampled in Chukudum hospital, Budi County. The study used descriptive cross- sectional study design which involved 222 children sampled amongst children age 6-59 months in Chukudum hospital. The purposive sampling technique has been used for this study in which any mother or caretaker who comes with a child for health services in the hospital were included. The questionnaires were designed to gather information about prevalence of Malnutrition. The data was collected was analyzed using the SPSS 25 statistical package. Most of the mothers or caretakers were between the ages of 20-25 years who were interviewed during the study. 167(75.2%) of the respondents stopped their children from breastfeeding after two years. 143(64.4%) of the respondents feed their children on vegetables while 164(73.9%) of the respondents feeds their children twice a day.124 (55.9%) of the respondents earned incomes of 5000-10000 SSP per month. 115(51.8%) of the respondents said they don't produce enough food to eat. 89 (40.1%) of the children present signs and symptoms of dry, loose skin. The prevalence of wasting (16.6%) stunted (2.7%) and underweight (7.7%) among the children 6-59 months.

Keywords: *Breastfeeding, Malnutrition, Stunted, Underweight, Wasted.*

Introduction

Malnutrition is a situation of nutrition in which there is excess or inadequate nutrients consumption that can result in negative impact for the effective functioning of the human body and clinical outcome [1]. Prevalence of malnutrition is more of sub-acute in children from 6-59 months in which there are different stages with varying degree with under- or over nutrition and inflammatory activity that led to changes in body tissues and reduced normal functioning. Malnutrition is the imbalances between nutrients requirements and intakes in which it can result to accumulative deficits of energy, protein or micronutrients which in long run can negatively affect the growth and development of children [2].

Globally there are various forms of malnutrition which include but not limited to; Under nutrition which comprised of wasting, stunting, underweight and deficiencies in Vitamins and minerals and this make children more vulnerable to infection resulting to death. Low weight-for-height is sometimes referring to as wasted which indicates severe weight loss because of inadequate food intake or infectious diseases like diarrhea which affect the weight leading to weight lost and most of the children who are wasted has high risk of death but if medical assistant is seek early, can be treated.

Low height-for-age is also known as stunting; and this mostly result from persistent or frequent under nutrition couple with socioeconomic conditions, poor nutrition or

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improper infant and preschool children eating habit and care in live. The situation of stunting can affect the physical and mental potential of children hence affecting their capability to perform in lives. Sometimes children can have low weight-for-age which is also known as underweight, and this type of children can be stunted or wasted or both.

There was strategies and guidelines laid down by World Health Organization to tackle global malnutrition cases in the midst of children5-59 months of age in order to prevent and manage wasting, obesity and edema [3]. This achievement is very important for the issue of malnutrition which affect majority of the children worldwide every year. Before the last two years, approximately 37 million children age 5-59 months are not meeting their required weight for height and millions were expected to be overweight or obese and nearly half of the deaths among children age 5-59 months are linked to under nutrition [3]. Most of malnutrition situation occurred in developing countries and Asia that has long lasting economic, social and developmental medical impacts on individual families, communities and countries [3].

The United Nation General Assemble has dedicated 2016-2025 as the year for United Nations Decade of Action on Nutrition and it has given unprecedented opportunities for countries to address all forms of Malnutrition globally [4]. It set a time frame for the implementation of the commitment made during the past conference on nutrition for the purposes of achieving the targets and food-related non-communicable diseases by a decade as well achieving the Agenda of Sustainable Development Goals by 2030 specifically Sustainable Development goal 2 (eliminate hunger, achieve food safety and improve diet and encourage sustainable Farming) and Sustainable Development Goal 3 (ensure fitness and promote welfare for all at all ages).

Women who are not feeding well during the time of their pregnancy will deliver children with low birth weight and hence will affect the physical and mental health of the children as they grow up. For example in Burkina Faso 29 region were in emergency Phase 2 to Phase 3 situation of hunger in the last quarter of 2019 which was the highest period for reported cases of malnutrition. It is estimated thousands of children less than five years will suffer from acute malnutrition during 2020 based on the results of the national nutritional survey [5].

With the relative peace in South Sudan, Malnutrition among children from 6-59 months would have improved but however from 2013-2014, humanitarian partners through the IPC projected 480,000-1.17 millions children to suffered from different categories of malnutrition ranging from Severe Acute Malnutrition to Moderate Acute Malnutrition. In Eastern Equatorial State, an estimated 560,000 people (52.6% of the State population) were facing emergency crisis classification phase 3 or worse acute food insecurity in August 2019.7 Budi County is classified in Emergency crisis phase 4 while Ikotos, Kapoeta South, Lopa/Lafon, Magwi and Torit counties are classified in emergency Crisis Phase 3. In Budi County, survey conducted by partners [6] indicates the malnutrition prevalence is beyond the Global Acute Malnutrition (GAM) WHO emergency threshold of 15% and this occurred because of low livestock ownership at 31% of the population coupled with delayed rainfall, poor market access and high food prices are contributing to Emergency (IPC Phase 4) acute food insecurity outcomes. During the time of the survey in 2022, Budi County Malnutrition prevalent rate is 17.5% [6]. This situation aggravated the situation of malnutrition within under five years children in Budi County since they are not having enough food which can provide nutrient for them as well as for the mothers. Despites Government and partners' commitment to

fight hunger to reduce malnutrition among children, there still a lot of constraint faced, and Budi County children still have issues of malnutrition due to various challenges like the unreliable rainfall which affect the harvest of the farms.

Objective

To assess the prevalence of malnutrition among children age of 6-59 months in Chukudum Hospital, Budi County, 2024.

Specific Objectives

1. To determine the causes of malnutrition among children aged 6-59 months.
2. To find out the common types of malnutrition among children aged 6-59.
3. To determine the impacts of malnutrition among children aged 6-59 months.

Statement of the Problem

Malnutrition is one of the health condition that is very common in South Sudan, and it causes high morbidity and mortality among children from 6-59 months. It affects many children in different part of the country, and it is more prevalence in Eastern Equatorial state estimated at around 17%. Therefore, it is important to carry out a research on the occurrence of Malnutrition in children less than five years in Chukudum Hospital, Budi County which is the main referral hospital in the County.

Purpose/Justification of the Study

There is high prevalence of malnutrition among children under the age of 6-59 months causing high morbidity and mortality rates among children. Therefore, I intend to identify the possible causes, type of malnutrition among the children and the effect of malnutrition in Budi County.

Research Questions

1. What are the common causes of Malnutrition among children aged 6-59 months?
2. What are the types of malnutrition occurring in Budi County.
3. What are the negative impacts of malnutrition on the growth and development of children 6-59 months?

Hypothesis Testing

Malnutrition is highly prevalent and causing high morbidity and mortality among children from the age of 6-59 months in Budi County, South Sudan.

Significance of the Study

The importance of this study is to get a better understanding of how to reduce the occurrences of cases of malnutrition which in turn reduced the effect of children physical and mental development in the county. Because reducing the prevalence of malnutrition cases will improve the health standard and the quality of life of children from age of 6-59 months. The findings from this study will be used to inform policy makers to adapt policies and practice in the country which can help improve the malnutrition status of children 6-59 months.

Methodology

Description of the Site

The study was conducted in Chukudum Hospital which is the main referral hospital in Budi County. The County has 7 Payam (Kimatong, Lotukei, Komiri, Loudo, Lauro, Ngarich and Nagishot). The County has two ecological zones of lowland and highland and the highland run from north to south towards boarder with Kapoeta County. The inhabitant of Budi County is the Didinga and Buya people and Buya people made up of around 20-30% of the population of the County while the Didinga are around 70-80% of the total population. By 2005 estimates population of Budi County range from 128,385-155,847and Buya occupy the lowland of Northern part of Budi County (Kimatong and Ngarich Payam) while the remaining Payams of the Southern

part are settled by the Didinga. Both the Didinga and Buya people are Agro-pastoralist and their main crops are Sorghum, Maize, Bulrush millet, Potatoes, Sesame and beans. These crops are produced in small scale for home consumption while some are sold for buying some items like clothes and soap from the market in Chukudum. Buya people measures their wealth with number of cattle they have while Didinga measures their wealth with cattle and granaries of grains. Livestock plays central roles for both Buya and Didinga during initiation and marriage where they are slaughter for food or exchange for gifts during the occasion.

Study Design and Sampling Method

This study used descriptive cross- sectional study design which involved 222 children sampled amongst children from the months of 6-59 seeking health care services in Chukudum Hospital. A set of questionnaires were developed to carry out the assessment whereby the mothers or the caretakers are administered questions regarding the prevalence of malnutrition in Children. The questions take like around 15-25 minutes and were conducted after seeking the consent of the mothers or caretakers of the child. The sample size was calculated using the formula for calculating sample size for cross sectional study. The current rate of Malnutrition among children under 5 years of age in Budi County is around 17.5% according to health survey by Humanitarians respond [7].

The following formula can be use.

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where n = Sample size,

Z = Statistic for a level of confidence (1.96 for 95% confidence level),

P = Expected prevalence.

d = Random error.

Where

P=17.5%

d=5%

Cl=95%

$$n = \frac{(1.96 * 1.96) * 0.175(1-0.175)}{0.05 * 0.05}$$

$$n = \frac{3.8416 * 0.175(1-0.175)}{0.0025}$$

$n = \mathbf{222}$

Ethical Clearance

The ethical clearance for this study was granted from the National Ministry of Health directorate for research and ethics Republic of South Sudan and endorsed by Budi County Health Director. The Chukudum hospital administrator was then notified by the County Health Director to allow the data collection to take place in the hospital as stipulated in the letter from the National Ministry of Health directorate of Research and ethics. During the conduct of the questionnaires, the participants who were involves in this study are inform about the confidentiality of keeping the information secret and the process is voluntary. Their consent was sought and anyone who participated accepts it willingly during the process of the study.

Ethical Consideration

The data collected is treated with confidentiality and non-judgmental by the research team to avoid bias and give grantee to the mothers/caregiver of the children that the data collected will not expose their children health status. There was no taking of names of the children whose detail are in the medical record but only code numbers are used so that to keep their identity secret from anyone.

Data Analysis

The data was collected using questionnaires, tabulated and later analyzed using the SPSS 25 statistical package

Results

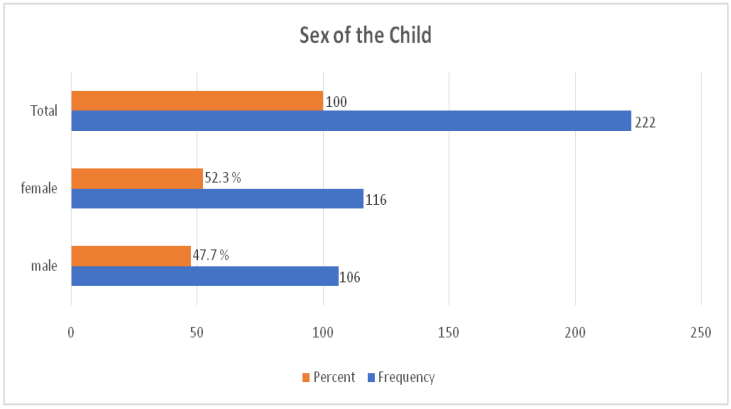

Figure 1. Distribution of Gender Characteristic of the Children

According to figure1, the gender of the children based on the finding, 116 (52.3 %) of the children were female, while (47.7%) of the children were male. The majority of the respondent's children were female according to the finding.

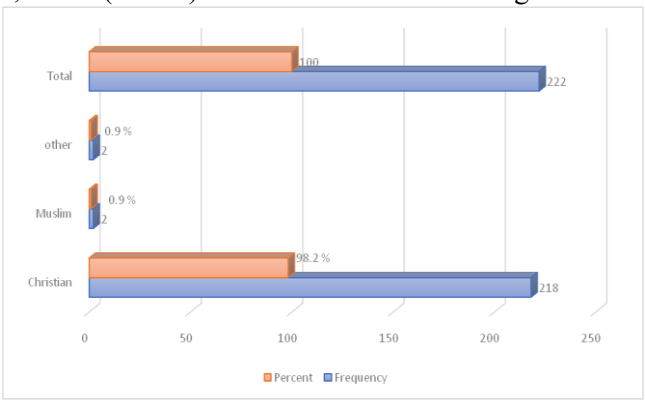

Figure 2. Distribution of Religion of the Respondents

The figure show the majority of the respondents in this study were christian with precentage of 218(98.2%) and followed by muslim 2(0.9%) and laslty 2(0.9%) of respondents were others . Therefore the majority of the chilren belongs to the family who are christian.

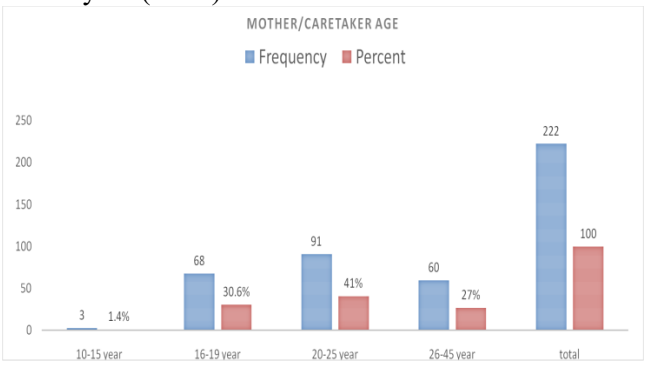

Figure 3. Distribution of Age for Mothers or Caretakers

The figure show the mothers or caretakers age of the respondents, based on the finding, 91(41.0%) of the respondents were between 20-25 year while 68(30.6%) of the respondents were from age 16-19 year followed by 60(27.0%) were between age 26-45 years and

lastly 3 (1.4 %) of the respondents from age 10-15 year. Therefore, the majority of the mothers or caretakers were between the age of 20-25 years.

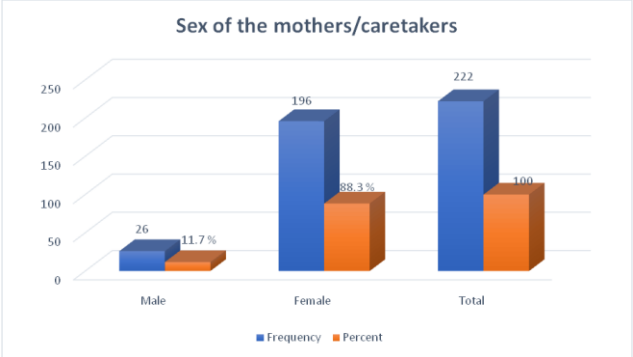

Figure 4. Distribution of Gender of the Mothers or Caretakers

This figure shows the gender of the mother or caretaker of the children during the study. From the finding, 196 (98.3%) of the respondent were mothers or female during the time of the interview while 26(1.7%) of the respondent were male who adult who brought the children to the hospital.

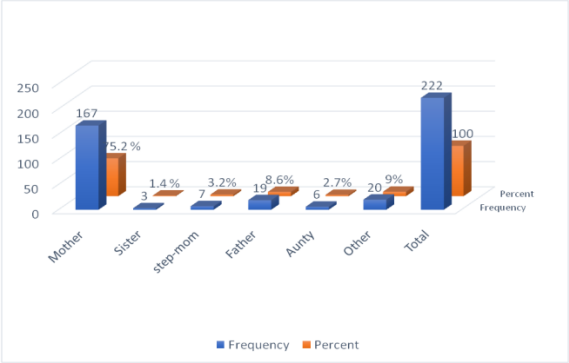

Figure 5. Relationship between the Child and the Respondents

According to the figure, 167(75.2%) of the respondents were mothers of the children, while 20(9.0%) of the respondents were others and followed by 19(8.6%) of the respondents were father of the children,7(3.2%) were step-mothers,6(2.7 %) were the aunty of the children and lastly 3(1.4%) of the respondents were brought to the hospital by their sisters .Therefore majority of the children were brought to the hospital during the time of the study by their mothers.

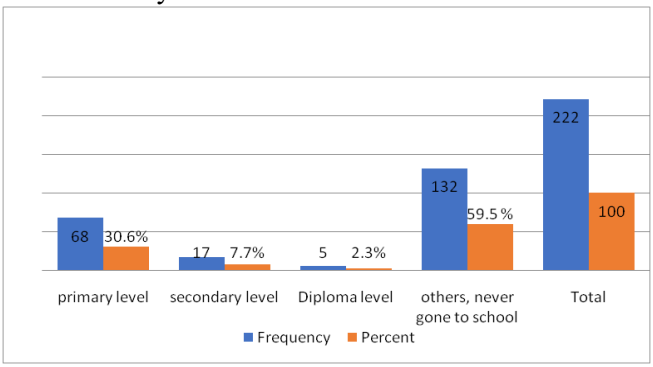

Figure 6. Educational Level of the Mothers or Caretakers

The figure regard the caretakers or mothers' educational level, 132 (59.5%) of the respondent did not go to school, 68 (30.6%) obtained primary level, whereas 17(7.7%)

were secondary level and 5 (2.3%) reached diploma level of education.

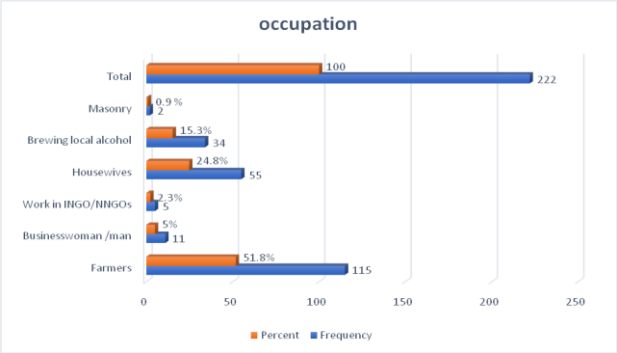

Figure 7. Show the Occupation of the Respondents

The figure show 115(51.8%) of the respondents are farmers,34 (15.3%) respondents are earning through brewing local alcohol, 55(24.8%) respondents are housewives,11(5%) of the respondents are businesswomen/men,5(2.3%) of the respondents work in International or national organizations, 2(.9%) respondents are doing masonry work and only 5(2.3%) of the mothers or caretakers are employed while majority 115(51.8%) are peasant farmers who live by cultivating as their main sources of livelihood.

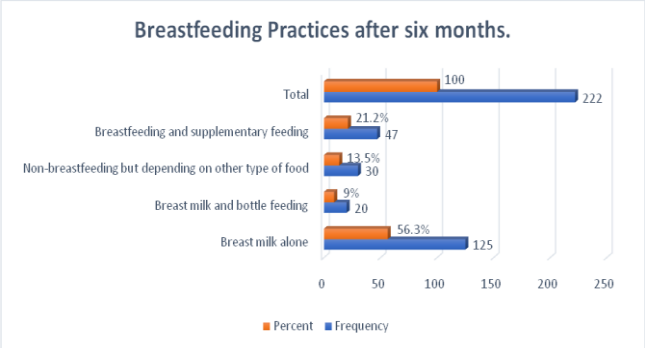

Figure 8. Distribution of Breastfeeding Practices after Six Months

Regarding the breastfeeding habit of the children, the finding show that 125(56.3%) of the respondents feeds their babies with breast milk only, while 47(21.2%) of the respondents feed their babies with breast milk and others supplementary feedings. And 30(13.5%) of the respondents feeds their babies with others type of food and lastly 20(9.0%) of the respondents feeds their babies with breast milk and bottle feeding. Therefore, many of the respondents give their children only breast milk during six months however in situation of maternal death during delivery, the baby must be fed on supplementary feeding.

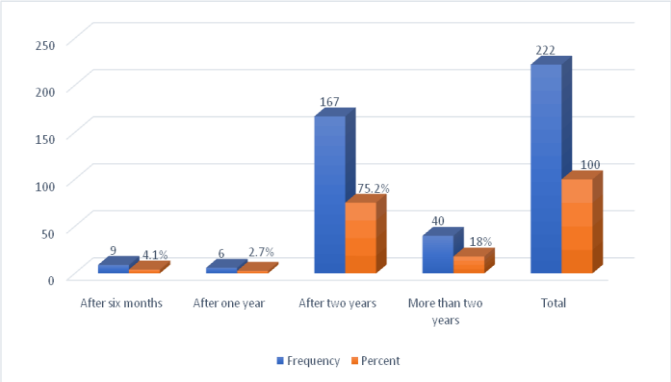

Figure 9. Weaning Time of the Children

This figure show the time for weaning of the children, 167(75.2%) of the respondents stopped their children from breastfeeding after two years and 40(18.0%) of the respondents stopped their children from breastfeeding after more than two years, 9(4.1%) of the respondents stopped their children from breastfeeding after six months and lastly 6(2.7%) of the respondents stopped their children after one year. Therefore, majority of respondents stopped their children from breastfeeding after two years.

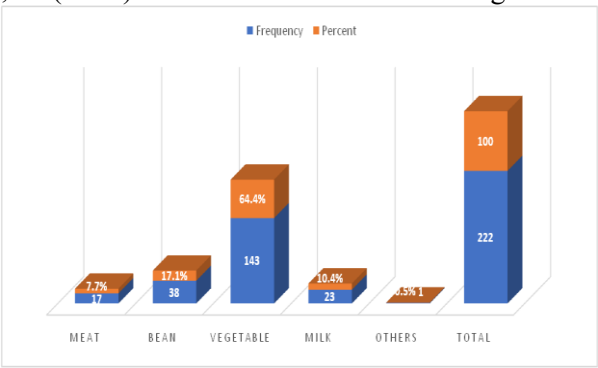

Figure 10. Type of Food Children Eat

The figure show the type of food the children eat, 143(64.4%) of the respondents feed their children on vegetables, 38(17.1%) of the respondents give their children bean, while 23(10.4%) of the respondents give their children milk and17(7.7%) of the respondents give their children meat and lastly 1(5%) of the respondents give their children others food type after six months. Therefore, majority of the respondents feed their children on vegetables.

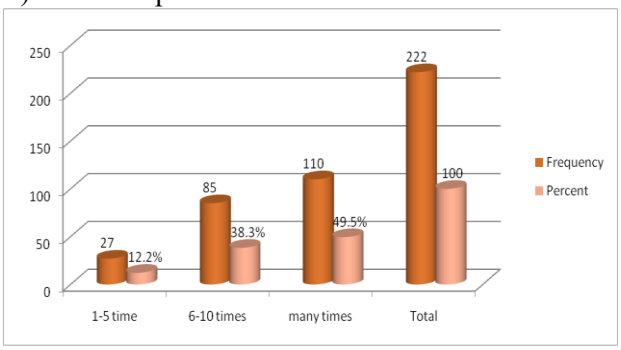

Figure 11. Breastfeeding Practices for the Children in a Day

This finding showthat 110(49.5%) of the respondents breastfeeds their children many times a day, 85(38.3%) of the respondents feeds their children 6-10 times a day and lastly 27(12.2%) of the respondents feed their children 1-5 times a day. Therefore, majority of the respondents feeds their children many times a day.

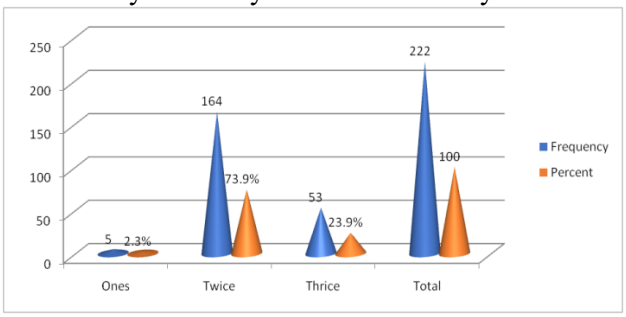

Figure 12. Frequency of Children Eating Food in a Day

The finding showed that 164(73.9%) of the respondents feeds their children twice a day, 53(23.9%) of the respondents feeds their children thrice a day and lastly 5(2.3%) of the respondents feed their children once a day. Therefore, most of the respondents feed their children twice a day.

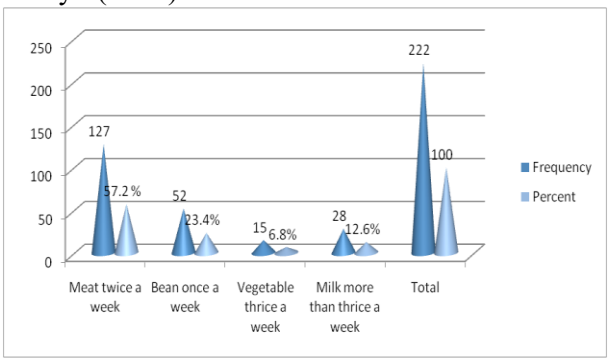

Figure 13. Children Eating Habit in a Week

The figure Show the number of times the children eat different type of food per week. The finding showed that 127(57.2%) of the respondents give their children meat twice in a week and 52(23.4%) of the respondents give their children bean once in a week while 28(12.6%) of the respondents give their children milk more than thrice in a week and lastly 15(6.8%) of the respondents give their children vegetables thrice in a week. Therefore, most of the respondents feed their children on milk and vegetable according to this study.

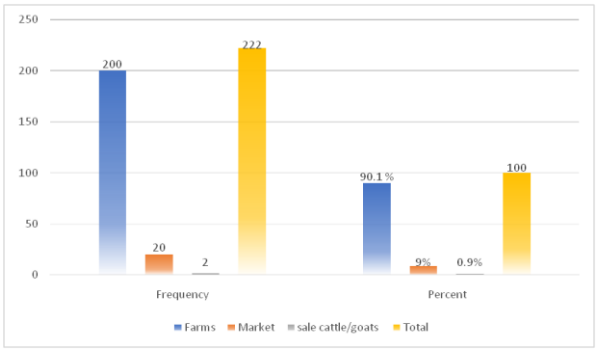

Figure 14. Access to Food

The figure show 200 (90.1%) of the respondents gets their food from the farm, while 20(9%) of the respondents do small scale retail business in the market so that they can afford food and 2(0.9%) of the respondents' sale cattle like goats or cows so that they can buy food item from the market.

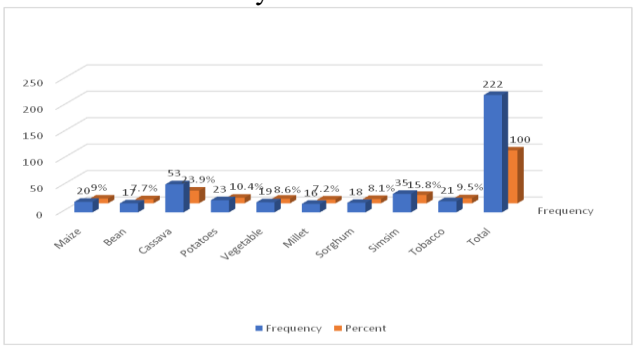

Figure 15. Type of Crops Grown

The study found out that 53(23.9%) of the respondents grow only cassava, 35(15.8%) of the respondents grow sesame, while 23(10.4%) grow potatoes, 21(9.5%) of the respondents plant tobacco, 20(9.0%) of the respondents grow maize only, 19(8.6%) of the respondents plant only vegetables,18(8.1%) of the respondents grow sorghum,17(7.7%) of the respondents plant bean and lastly16(7.2%) of the respondents grow millet. Therefore, majority of the people grow cassava according to the respondents for this study.

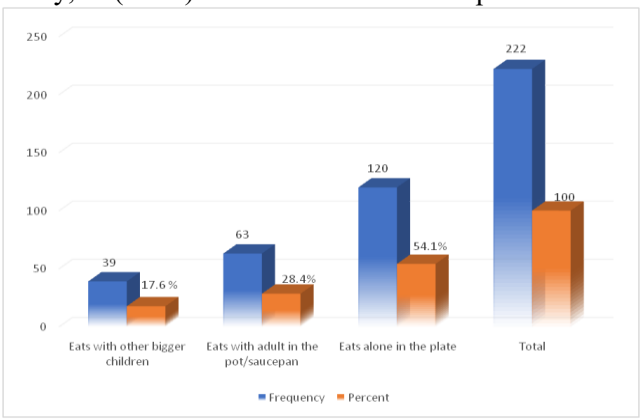

Figure 16. Feeding Method of the Children

According to figure above, itshows the way the respondents feed their children, the finding indicate that 120(54.1%) of the respondents feed their children by giving them food in the plate, 63(28.4%) of the respondents make their children eat with adults in a plate while 39(17.6%) households' children under five years eats with the bigger children.

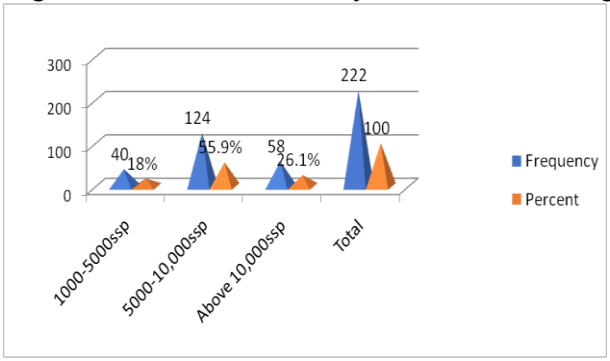

Figure 17. The Estimate Distribution of Monthly Income of the Respondents

The finding showthat124 (55.9%) of the respondents earned incomes of 5000-10000 SSP per a month, 58 (26.1%) of the respondents earned more than 10000 SSP per month and lastly 40 (18.0%) of the respondents earned 1000-5000 SSP per month. Therefore, majority of the respondents earned from 5000-10000 SSP per a month.

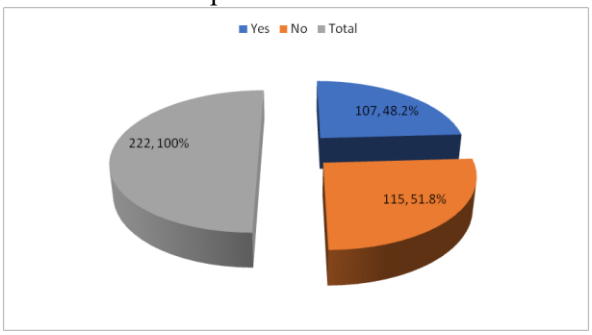

Figure 18. Availability of Food to Feed the Family and Sale

Regarding food security, 115 (51.8%) of the respondents said they don't produce enough food to eat and sale while less than half 107(48.2%) of the respondents can produce enough food both for home consumption and for sale. Therefore, many of the respondents don't have enough food for the family and for sale.

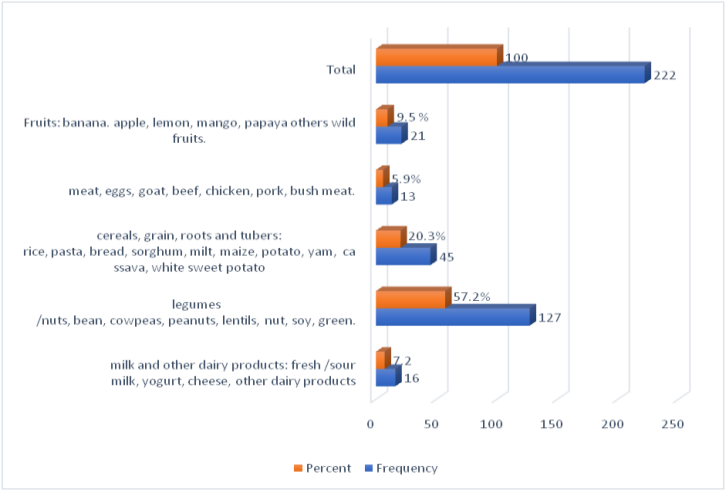

Figure 19. Access to Food Types in the Last 4 Weeks

The finding shows that 127(57.2%) of the respondents feed their children on milk and other dairy fresh food products. While 45(20.3%) of the respondents feed on bread and sorghum (vegetable), 21(9.5%) of the respondents eats banana and others wild fruits, 16(7.2%) of the respondents were milk and other product and lastly 13(5.9%) of the respondents were meat, fish, and egg. Therefore, majority of the respondents feed their children on milk and other dairy fresh food product.

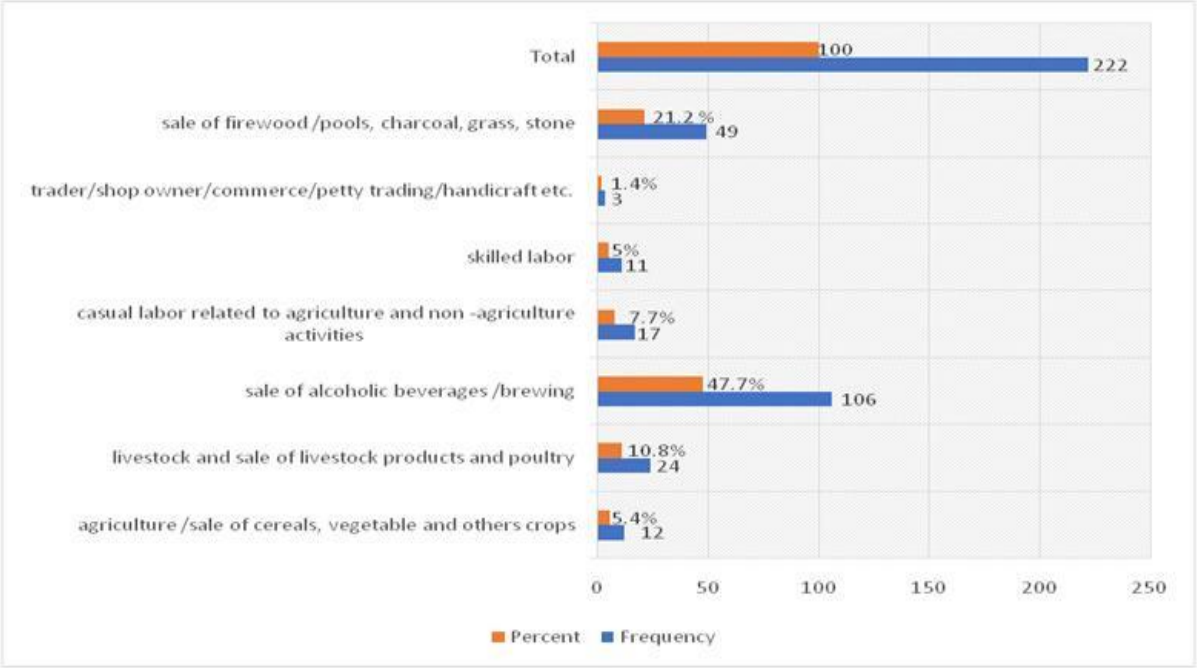

Figure 20. Distribution of Activities in the Last 6 Months

This figure show the kind of main activities the family member were engaged in the last six months, based on the finding, 106(47.7%) of the respondents were involved in sale of alcohol while 49(21.2%) of the respondents were involved in sale of firewood ,pools ,charcoal, and 24(10.8%)of the respondents were involved in sale of the livestock product and 17(7.7%) of the respondents were on agricultural and non agriculture activities, while 12(5.4%) of the respondents were involved in agriculture /sale cereals and 11(5.0%) of the respondents were skill labor, lastly 3(1.4%) of the respondents were trader and shops owner/ commerce. Therefore, most of the respondents during this research said they sale alcoholic drinks to earn some income.

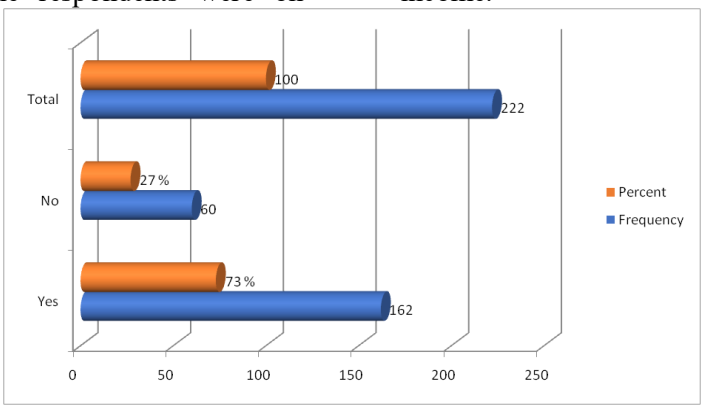

Figure 21. Distribution of Access to Farmland

According to the finding in figure 21, the family members have farmland based on respondents 162(73.0%) of the result showed that they have enough farmland while 60(27.0%) of the respondents said they don't have enough land for farming. Therefore, majority of the respondents said they have farms land for cultivation.

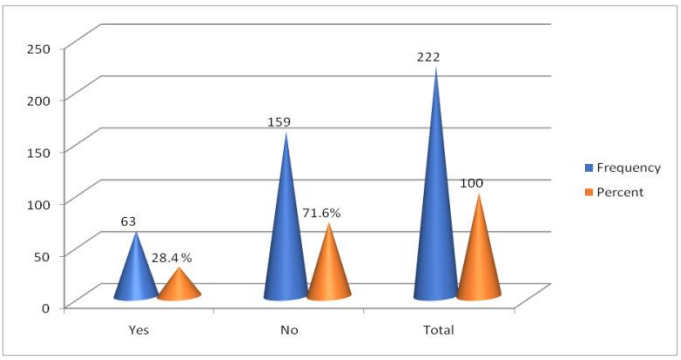

Figure 22. Availability of Money to Buy Food in the Last 3 Months

According to the finding from figure 22 above, 63(28.4%) respondents said they have enough food in the last three months, based on the finding, 159 (71.6%) of the respondents said they don't have enough food in the last three months. Therefore, most of the respondents during the research said they don't have money to buy enough food to feed their family members in the last three months.

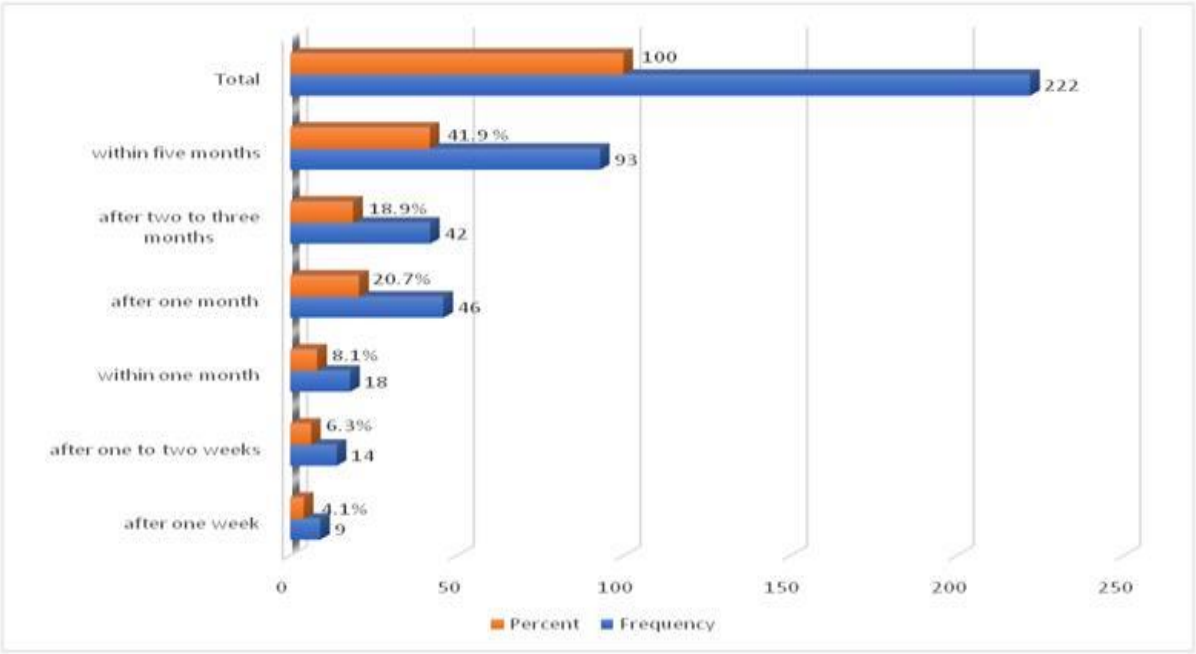

Figure 23. The First Time the Child Felt Sick

Based on the finding from the above figure, 93 (41.9%) respondents said their children felt sick within five months after delivery,46 (20.7 %) of the respondents said that their children felt sick after one month, 42(18.9%) of the respondents were after two to three month and while 18(8.1%) of the respondents said their children felt sick within one month,14(6.3%) were after one to two week and lastly 9(4.1%) of the respondents said their children felt sick after one week and majority 191(86.0%) of this respondent said they take their children to the hospital when they fall sick. Therefore, majority respondent said their children felt sick within five months.

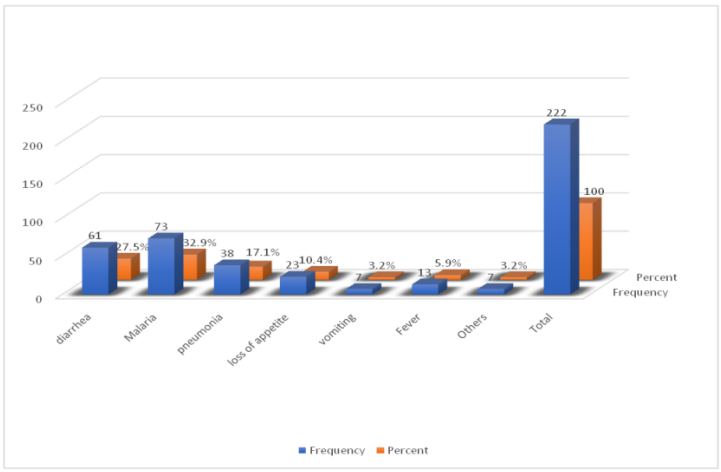

Figure 24. Common Sickness the Children Suffered from in the Last Six Months

According to figure showed above, the common sickness the children were suffering from in the last six months based on the finding, 73(32.9%) of the children suffered from malaria, 61(27.5%) of the children suffered from diarrhea and while 38(17.1%) of the finding were pneumonia, followed by 23(10.4%) of the finding were loss of appetite, 13(5.9%) were fever and 7(3.2%) of the finding were vomiting. Therefore, majority of the children suffered from malaria in the last six months according to the respondent interviewed.

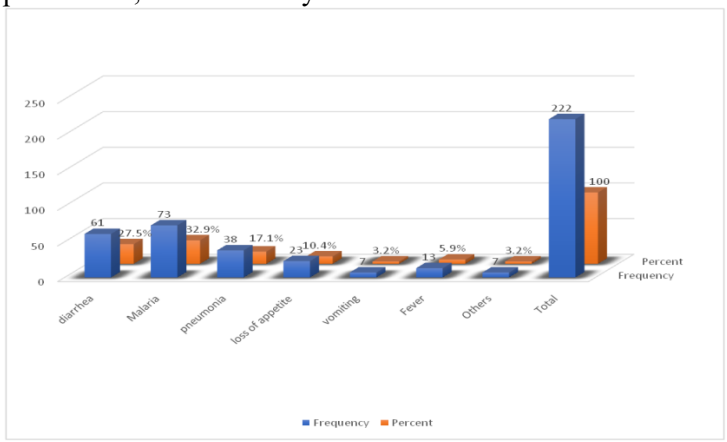

Figure 25. Sign and Symptom of Kwashiorkor and Marasmus

This figure show 89 (40.1%) of the children present signs and symptoms of dry, loose skin, 65 (29.3%) of the children shows signs and symptoms of lethargy and weakness, 21(9.5%) of the children showed sign of oedema, 16(7.2%) of the children showed signs and symptoms of stunted, 15(6.8%) of the children as if they are older, 11(5.0%) of the children have brittle hair and lastly 5(2.3%)of the finding showed visible wasting of fat and muscle. Therefore, majority of children in this research have dry, loose skin as per visible appearing during the interview.

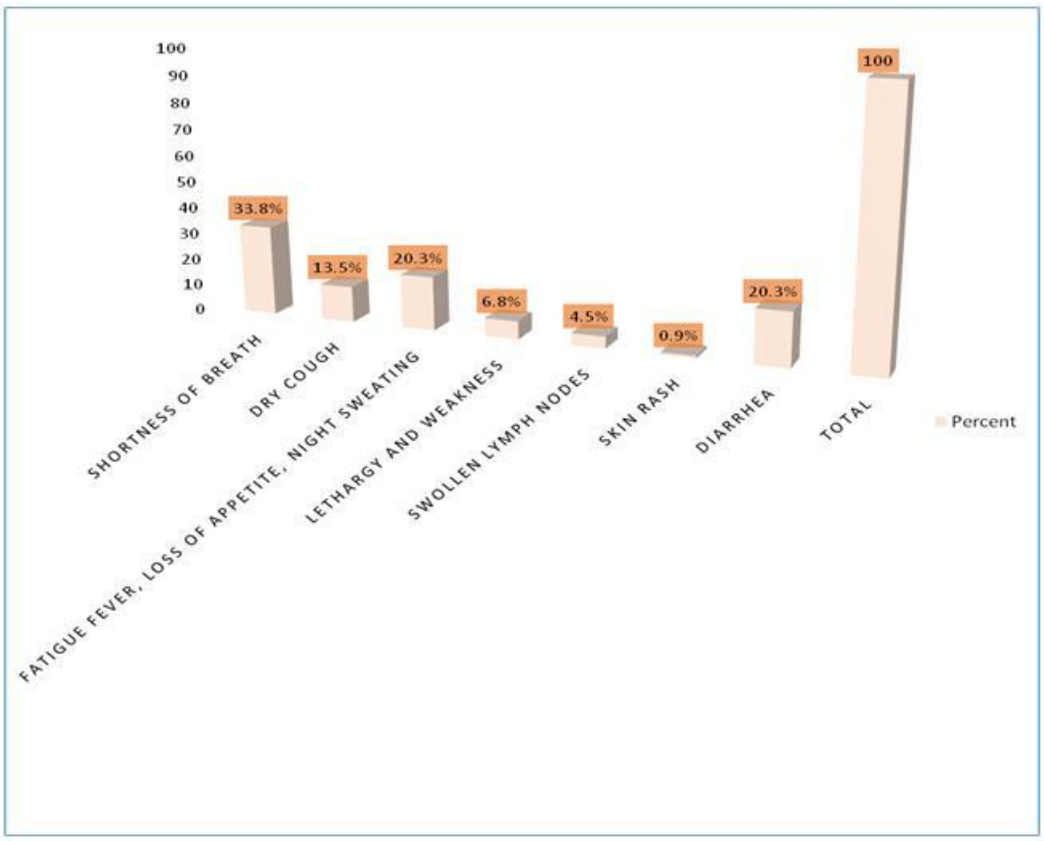

Figure 26. Sign and Symptom for Co-morbidity

According to the figure above, it show the sign and symptoms of co-morbidity children developed, based on the respondents, 75(33.8%) of the respondents said their children developed shortness of breath,45(20.3%) of the respondents said their children developed fatigue, fever, loss of appetite and diarrhea, while 30(13.5) of the respondents said their children have developed dry cough and 15(6.8%) children had lethargy and weakness, 10(4.5%) children have swollen lymph nodes and lastly 2(9%)children have skin rash. Therefore, majority of respondents said their children developed shortness of breath.

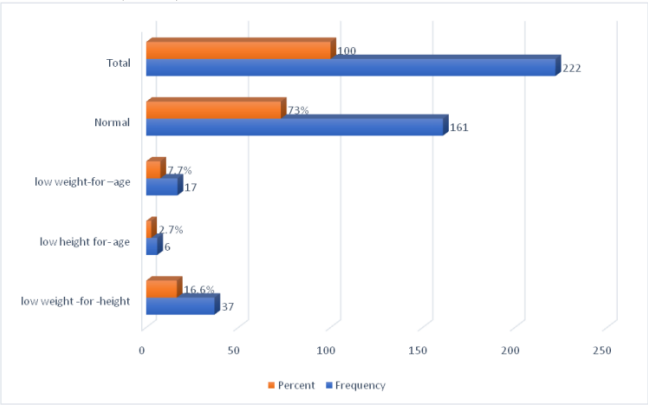

Figure 27. Domain for Z-Score of the Children

The figure show 161(73%) of the children showed normal weight, 37(16.6%) of the children have low weight-for-height, while 6(2.7%) have low height-for-age and lastly, 17(7.7%) have low weight-for-age. From this finding, majority of the children who were

brought to the hospital during the study have normal weight.

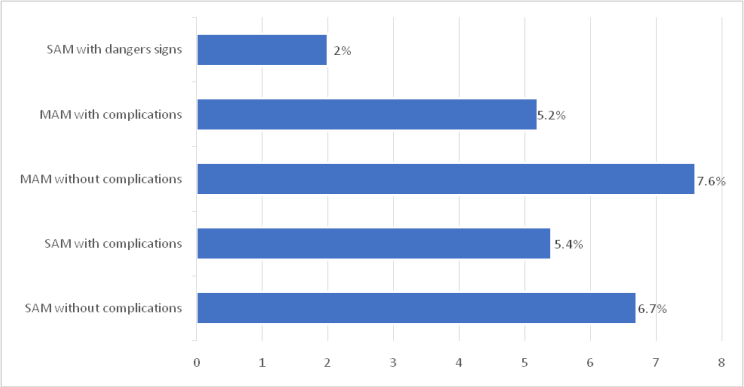

Figure 28. Malnutrition Category

From the 27% malnourished children in figure 28 above, 3(5.4%) children were in category of SAM with complications. The complications include Anemia, Hypoglycemia, loss of appetite, oedema and dehydration.4 (6.7%) of the children were in category of SAM without complications and they have signs and symptoms of Marasmus and 1(2%) of the children showed dangers signs like convulsion, vomiting and lethargy. These children were admitted in pediatric ward for the management of the complications. While 3(5.2%) of the children were in the category of MAM with complications and these children were admitted in OTP for the management of the case like malaria and ears infections. Lastly 5 (7.6%) of the children were having MAM without complication and they were in OTP department in the hospital to get RUTF.

Discussion

This study general objective is to find out the prevalence of malnutrition among children under the age of five years. From the finding, the prevalence rate of malnutrition is 27% (wasting 16.6%, underweight 7.7%, stunted 2.7% and overweight 0%) and this result has great difference with study about prevalence of under nutrition among children age 5-59 months in Babylon, Iraq among 230 children which found out the malnutrition rate 14.3%[8]. The finding from this study disagreed with study conducted in Pakistan among 3964 children under five years of age which indicated the prevalence rate of stunted at 16.2%. This difference can be attributed to different economic situation in these countries however comparably all the countries are developing nations[9].

A study conducted in India suggested that parental awareness on safe and nutritious food preparation and handling play a greater role in determining a child nutritional welfare[9]. It went further asserted that mothers independence in the community level also have positive contribution in which they can be aware of proper food handling. A study carried out in India found out that children aged 13-24 were 81.8% stunted,45.5% underweight and 18.2% wasted was high among children 37-48 months [10]. From this study, children aged 11-25 months made up of(46%) compared to other age groups. This showed that children more than one year of age are more likely to suffer from malnutrition compared to those less than one year.

A study conducted in Ethiopia showed that there was concurrent prevalent of stunting and anemia among the children under five years of age where 23.9% of the children were anemic[11]. This showed significant association between anemia and stunting which was so common and can be expected among this age group of the children, the

underweight children under five years of age accounted for 6 percent however study conducted found out that underweight were 15.6%,wasting 9% which is higher than the national figure of 8%.This different can be explained by changes in increased underweight children number compare to previous years which is expected from deteriorating breastfeeding practices, increasing food insecurity and poverty rates in Ethiopia[12].

The findings from this study correspond to research conducted in Jinja Main referral hospital to find out the prevalence and factors associated with malnutrition under five years of age which found malnutrition rate to be 16% among children under five years of age however this study disagreed with study conducted in Khartoum State in Sudan in which MAUC indicate showed 20.9% children under five years of age are poorly nourished[13].

In another study about the risk and prevalence of malaria, malnutrition and anemia in children under five years of age in Nigeria, it established that the occurrence rates are 55.5%,41.2%, and 54.0% for malaria, malnutrition and anemia respectively. Prevalence for stunting, underweight, and wasting were 39.2%, 11.2%, and 0.04%, respectively. This study highlighted that malnutrition does not occur in isolation but amid other health concerns[14].

In some African culture, male children are given more nutritious food compare to the female children because they believed that male children will live to carry on with the family name while females will be given out in marriage, thus placing the female child at high nutritional risk. This report also indicated that more than quarters of the male children at a household were first given food before their female counterpart. Furthermore, there was report that showed moderate wasted children are high with 4.1% who were between the ages of 6-11 months compare to lower rate among children age in 48-59 months1.1%. In the same study, more than 65.7% of the children were female children who are wasted than boys' counterpart among the age of 5-59 months[15].

The government of South Sudan engaged in a coordinated program with UNICEF to scale-up nutrition programs to reduce the prevalence of malnutrition. This effort was designed to employ "lessons learned" during the first half of the decade and make modifications in the delivery and maintenance of nutrition programs. There were effort made to bring together treatment protocols and centralizing programs that simplify a given protocols since there were decline in health facilities and professional, digitizing records and combining nutrition screening in the rapid response mechanisms, and introduction of cognitive development sessions for children [16].

Adequate dietary group should comprise of various group of food in the daily diet. A study conducted in Cambodia found out that children who did not received adequate diet diversity were 5 times more likely to be underweight and this indicated the relationship between this study in which majority of the mothers or caretakers mostly feed their children on vegetable compared to other variety of food [17].

Causes of Malnutrition

This study has found out that majority of the caretakers / mothers of the children have enough land for cultivation and yet most of them don't have enough food to eat and sale however they are depending on farming as a way of survival. With climate change affecting many parts of the globe, South Sudan and Budi County is hard hit with little rain in the last three years consecutively which affected the yield of crops for individual household level of food security hence resulting to inadequate supply of required nutrients for the young infant and children. According to study conducted by International Food Policy

Research Institute (IFPR on climate change in Sub-Saharan African, predicts constant higher temperature and mix precipitation changes for the 2050 period which leads to lower yield and growth retardation in crops resulting in higher food prices in the markets and therefore fewer people affording to buy hence reducing calories availability and increasing child malnutrition in Sub -Saharan Africa [18].Agricultural production and good nutrition are affected by impacts of climate change. Even a slight change in temperature can affect the weather condition. A study carried out in over 40 developing countries showed that climate change directly or indirectly influence the decline in agricultural production and may as a result increase the number of people suffering from hunger each year [19].In Sub Saharan African, extreme weather conditions like drought, insect infestation can diminished the productivity of many crops species thereby exacerbating the impact of malnutrition[20].

In this study, the prevalence rate of malnutrition among the children under five years of age included wasted represent the majority (16.6%), stunted (2.7%) and while underweight (7.7%). This indicate these children who are wasted may either died because of severe malnutrition or couple with some infection if the mothers or caretakers does not follow closely with health care advice.

The study found out that most of the children suffered from malaria frequently compared to other type of sickness. This showed the mothers or caretakers need to know the important of sleeping under treated net so that the children cannot get infection from mosquitoes at night.

Food insecurity usually results from inability of individual to purchase enough food and sometimes not because of lack of food itself but because of poor roads network, scarcity of food in market and poor family level income are some of the factors that promote food insecurity among the population [21]. Sometimes families depend on importation of food especially when there is food scarcity in their counties or countries. Many people especially the poorer populations are affected by price fluctuation and in situation when the prices of food are lower, farmers may produce less food products which may not be proportional to the demand of the consumers and hence results to food scarcity in the markets[22].

Education can affect the child's health through direct transfer of health information from one generation to another; through the ability to promptly detect illness, treatments administered and through educated mothers raise the awareness for children health and household with higher income, live in better neighborhood, get higher paid jobs which directly or indirectly influence child survival and health [23].

The community level factors such as area of residence and its environmental risks factors would determine nutritional status of the children including availability of health facilities for the diagnosis and treatment of cases of malnutrition in the community, shared community and cultural belief would either increase or reduce the risks of malnutrition among children among age 5-59 months. There were external factors that influence food availability, accessibility and utilization is highly influenced by politics, ideology, pandemics, economics, WASH and climate[24].

Low level of education among the mothers or caretakers might have played a role in the malnutrition of the children. It has been observed that in most developing countries, the dietary practices in a population experiencing food insecurity tend to meet their energy needs but do not provide sufficient nutrients needed by the children to promote health and prevent infection. Children whose parents are educated up to tertiary level are more likely to have nutritious diet irrespective

of income level due to their increased knowledge level on basic child nutrition. Malnutrition is one of the economic problems that resulted due to household level poverty that comes as family structure were disturbed and ignorance of the mothers for healthy ways of lives for children under five years of age.

Type of Malnutrition

From this study finding, undernutrition is the leading cause of malnutrition among the children enrolled in this study where they showed signs and symptoms of Protein Energy Malnutrition (PEM) and it manifest itself in the following ways:

Wasting: This study finding showed 37(16.6%) of the children who were brought to the OTP and SC are wasted. This means they are too thin for their age and height and is also known as low weight- for- height is usually indicate severe weight lost because the person did not have enough food to eat or has undergone prolonged infection from communicable diseases like diarrhea which cause them to lose weight.

Stunting: This is sometimes known as low height-for-age 6(2.7%) which is because of chronic or recurrent undernutrition and is associated with poor socioeconomic conditions, inappropriate infant and young child feeding practices and frequent illness and this hold children back from obtaining their physical and cognitive potential.

Underweight: This is also known as low weight-for-age 17(7.7%) when the child weight less compared to a child age supposed to have and this child can be wasted, stunted or both.

Micronutrient deficiencies: These micronutrients include vitamins, Iodine, iron, Zinc which are playing a great role essential for health, development, growth and enable the body to use other nutrients as well. From the study, some of the children were anemic and these are mainly because of iron deficiencies in the children or there are iron inhibitors which make the absorption of mineral in the gut very slow.

Effects of Malnutrition

Increase number of malnourished children mortality rate among the under five years of age. In many countries, it has been observed that children mortality arises from the synergistic impacts of effect on undernutrition and infection. Children who are severely malnourished are susceptible to impaired cognitive growth and development which consequently affect them later in life as they grow up.

Developmental delay in congenital factors and behavior, a study conducted in India by Medical council team showed there was delay among the malnourished children who were severely exposed to malnutrition cases in the area of motor development and vision, language and socialization with other children and this affect their school achievement hence behavioral problem.

Malnutrition can have profound consequences, beginning with a compromised immune system that increases children's susceptibility to infections. Additionally, malnutrition increases risk of communicable diseases. The immediate causes contributing to malnutrition and high mortality in under five-year children are inadequate dietary intake and recurrent episodes of diarrheal and respiratory diseases. The situation gets worse due to poor sanitation, inadequate hygiene, and inadequate feeding practices. Further, socio-cultural practices such as limited focus on supplementary feeding, delayed initiation of complementary feeding and poverty constitute significant causal factors contributing to malnutrition. Addressing malnutrition is paramount to ensuring healthy growth in children.

There were iron deficiencies which lead to anemia among the children identified who are stunted and wasted during the study. This result in deficiencies in oxygen absorption in

the blood and impaired mental development among the children under five years that compromises the immune system exposing them easily infection from infectious diseases resulting to death.

Conclusion

In general, malnutrition has greater negative impact among children age 5-59 months in Budi County is so evidence and this has profound effects on the physical and mental health of the children. Mothers or caregivers of these children need a support in nutritional education, food hygiene and livelihood so that they can overcome the challenges of malnutrition among the children. There is need for integrated approach from Primary health care provider to the community as gateway so that there will be early detection and treatment by screening the children for malnutrition cases and referral of cases which need treatment to the main hospital.

Recommendations

Following the finding from this study, the following recommendations can be drawn for the stakeholders.

1. The State MoH and County health department should follow and implement the social and behavioral change policy interventions to improve nutritional knowledge and skills of the mothers or caregivers of the children that lead to nutritious food preparation and hygienic food handling.
2. The State MoH and Budi County health department should plan and implement integrated health services delivery to widen the coverage to provide micronutrients supplementation to the children during immunization campaigns.
3. The Budi County health department and implementing partners should encourage mothers or caretakers in the remote villages to take their children to health facilities earlier for proper diagnosis and treatment to avoid complication of malnutrition
4. The Budi County health department and implementing partners should have a coordinated strategic intervention to train Boma Health workers (BHW) to assess the nutritional status of the children and refer them to the health facilities for proper management before they develop complication.
5. The local Government through the County Director for agriculture to encourage communities to adapt to climate change practices such as planting early yielding crops as strategy to improve food security and livelihood to avert hunger and reduce malnutrition among children under five years.
6. The Budi County health department and implementing partners to ensure implementation of routine awareness raising at village level to promote appropriate breastfeeding and complementary feeding practices targeting mothers of children under five.
7. During routine immunization, Mothers should be taught on the frequency for feeding their children since growing children need enough food for growth and to meet their energy needs for the day.
8. The State Ministry of Agriculture and its implementing partners (FAO) should leverage programs to improve dietary diversity and supporting the scaling-up of FS&L programs to improve children's access to nutritious and diverse complementary foods hence improve the availability of and access to the nutrient-dense foods that children need to grow up healthy.
9. The State Ministry of Gender and Social welfare should come up with strategies that can empower and give rights to the caretakers or mothers of the children to improve the status and increase their household decision-making process

particularly on the issue of health care for children.

10. The local government at the county level in Budi should encourage the community members to own and utilized the available arable land for cultivation so that they can produce enough food.
11. The county health department and its implementing partners should have routine outreach in the villages in which they will screen children for malnutrition cases and give them the ready-to-use-therapeutic foods.

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Conflict of Interest

The author hereby declared that there is no conflict of interest in this study.

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Assessment of Dyslipidemia and its Associated Risk Factors among Individuals with Diabetes Mellitus at Tamale Teaching Hospital, Ghana

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Abstract

Diabetes mellitus is a major global public health concern, frequently accompanied by dyslipidemia an abnormal lipid profile that significantly increases the risk of cardiovascular complications. This study aimed to determine the prevalence of dyslipidemia and its associated factors among diabetic patients at Tamale Teaching Hospital in Ghana. A hospital-based cross-sectional study was conducted among 43 diabetic patients receiving care at Tamale Teaching Hospital. Data on sociodemographic characteristics, anthropometric measurements, fasting blood glucose (FBG), and lipid profiles were collected. Statistical analysis included descriptive statistics, chi-square tests, and independent sample t-tests to assess associations. The mean age of participants was 57.33±10.77 years, with 83.70% being female. Dyslipidemia was present in 51.16% of participants. Significant differences were found in total cholesterol (TC), low-density lipoprotein (LDL), triglycerides (TG), and very low-density lipoprotein (VLDL) between dyslipidemic and non-dyslipidemic groups ($p < 0.01$). Higher FBG levels (≥7.1 mmol/L) were associated with significantly increased TG and VLDL and reduced high-density lipoprotein (HDL) levels. A shorter duration of diabetes correlated with higher TG and VLDL. Overweight individuals showed significantly elevated TG and VLDL levels. Dyslipidemia is highly prevalent among diabetic patients in Tamale. Abnormal lipid profiles, especially elevated TG and VLDL, are significantly associated with poor glycemic control, shorter duration of diabetes, and higher BMI. Regular lipid monitoring and targeted interventions are recommended to minimize cardiovascular risk in this population.

Keywords: *Cardiovascular Risk, Diabetes Mellitus, Dyslipidemia, Fasting Blood Glucose, Ghana, Lipid Profile, Tamale.*

Introduction

Dyslipidemia refers to abnormal levels of plasma lipids and lipoproteins, including elevated concentrations of low-density lipoprotein cholesterol (LDL-C), total cholesterol (TC), and triglycerides, as well as reduced levels of high-density lipoprotein cholesterol (HDL-C) [1]. It is a recognized risk factor for atherosclerosis and cardiovascular diseases and is frequently observed in individuals with diabetes mellitus [2].

Type 2 diabetes mellitus (T2DM) is a metabolic disorder primarily characterized by chronic hyperglycemia resulting from insulin resistance and/or a relative deficiency in insulin secretion. While individuals with T2DM typically do not require exogenous insulin for management at diagnosis, the underlying pathophysiology varies, with the relative contributions of insulin resistance and beta-cell dysfunction differing between individuals and potentially changing over time [3]. Consequently, effective treatment strategies must adopt a multifaceted approach targeting both insulin resistance and pancreatic insufficiency.

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There is a well-established association between dyslipidemia and diabetes. Diabetic dyslipidemia is typically marked by elevated triglycerides and reduced HDL-C, rather than markedly increased LDL-C levels [4]. Although LDL-C is a well-known contributor to cardiovascular disease, its severe elevation is less common among diabetic patients. Nevertheless, the lipid abnormalities seen in T2DM often in the context of insulin resistance contribute significantly to the increased risk of atherosclerotic cardiovascular disease observed in this population [5].

Globally, the burden of diabetes continues to rise at an alarming rate. In 2019, an estimated 463 million individuals were living with diabetes, a figure projected to reach 642 million by 2040. Over 90% of these cases are classified as type 2 diabetes mellitus [6]. T2DM is frequently associated with metabolic syndrome (MetS), a cluster of interrelated metabolic abnormalities including dyslipidemia, hyperglycemia, and hypertension. MetS significantly increases the risk of cardiovascular events and is characterized by impaired cellular uptake of glucose, elevated blood pressure, and abnormal lipid profiles.

Despite the global significance of dyslipidemia in diabetes management, data on its prevalence and determinants in sub-Saharan African populations remain limited. In particular, there is a lack of comprehensive studies examining how socio-demographic, anthropometric, and behavioral factors influence lipid profiles in rural African settings. Therefore, the present study aims to assess the relationship between these factors and cholesterol levels in the population of Tamale, Ghana [7]. Improved understanding of these associations could support more effective prevention and management strategies tailored to the unique characteristics of African populations.

Materials and Methods

Study Design and Population

This descriptive cross-sectional study was conducted at the Tamale Teaching Hospital 60 adult participants with suspected or confirmed diabetes mellitus were consecutively recruited from the out-patient clinic after providing written informed consent.

Data Collection

A researcher-designed semi-structured questionnaire was administered to obtain socio-demographic characteristics (age, sex, marital status, education, occupation, monthly income) and lifestyle factors (smoking, alcohol intake, physical activity), as well as the duration of diabetes. Physical activity was defined as ≥30 min of moderate-intensity exercise that produced light perspiration or a noticeable increase in heart rate. Alcohol consumption was defined as ingestion of ≥1 standard bottle of alcoholic beverage per week. Participants who smoked ≥1 cigarette per day were classified as smokers.

Specimen Collection and Laboratory Analyses

Following an overnight fast of at least 10 h, 10 mL of venous blood was drawn aseptically from each participant into a fluoride-oxalate tube and a serum-separator tube (SST). SST samples were centrifuged at 3000 × *g* for 5 min, and sera were aliquoted and stored at 2–8 °C pending analysis. Fasting plasma glucose (FPG) was measured immediately in fluoride-oxalate specimens. Serum lipid profile and liver function parameters were quantified on a COBAS c311 automated chemistry analyser (Roche Diagnostics, Mannheim, Germany) according to the manufacturer's instructions.

Inclusion Criteria

Adults (≥18 years) with clinically diagnosed diabetes mellitus or abnormal fasting/random

blood glucose levels who provided informed consent.

Exclusion Criteria

Individuals receiving lipid-lowering therapy or with documented cardiovascular disease, chronic liver disease, or chronic kidney disease were excluded.

Results

Demographic and Clinical Characteristics of Study Participants

Table 1 summarizes the demographic and lifestyle characteristics of the study population, which included 43 participants. Of these, 7 (16.3%) were male and 36 (83.7%) were female. The mean age was 57.33 years (SD ±10.77). Regarding marital status, 35 participants (61.4%) were married, and 23 (53.5%) were employed; however, these distributions were not statistically significant.

A majority of the participants, 27 (62.8%), had no formal education. The median duration of diabetes among the participants was 5 years (interquartile range: 2–5–7 years), which was also not statistically significant.

Upon stratification by dyslipidemia status, 22 participants (51.16%) had dyslipidemia, while 21 (48.84%) did not. The average age of participants with dyslipidemia (58.64 years) was slightly higher than that of those without dyslipidemia (55.95 years), but this difference was not statistically significant (p = 0.423).

Marital status and employment were evenly distributed across the dyslipidemia and no dyslipidemia groups, with no significant differences observed. Additionally, a slightly higher proportion of participants with dyslipidemia did not engage in regular exercise compared to those without dyslipidemia, but this difference was also not statistically significant (p = 0.663).

Table 1. Demographic and Clinical Characteristics of Study Participants

Variable	**Total (n=43)**	**Dyslipidemia (n=22)**	**No Dyslipidemia (n=21)**	**P-Value**
Age (Years)	57.33±10.77	58.64±9.66	55.9±11.91	0.423
Sex				
Male	7(16.30)	4(18.20)	3(14.30)	0.729
Female	36(83.70)	18(81.80)	18(85.70)	
Marital Status				
Married	35(61.40)	19(86.40)	16(76.20)	0.637
Single	2(4.70)	1(4.50)	1(4.80)	
Widowed	6(14.00)	2(9.10)	4(19.00)	
Employment Status				
Unemployed	20(46.50)	10(45.50)	10(47.60)	0.887
Employed	23(53.50)	12(54.50)	11(52.40)	
Education				
None	27(62.80)	14(63.6)	13(61.90)	0.636
Primary	2(4.70)	0(0.00)	2(9.50)	
JHS	5(11.60)	3(13.60)	2(9.50)	
Secondary	3(7.00)	2(9.10)	1(4.80)	
Tertiary	6(14.00)	3(13.60)	3(14.30)	
Duration (Years)	5(2-5-7)	4(2-4-6)	5(3-5-8)	0.202
Smoking				
No	43(100.0)	22(100.0)	21(100.0)	-

Alcohol				
Yes	1(2.30)	0(0.00)	1(4.80)	0.300
No	42(97.70)	22(100.00)	20(95.20)	
Exercise				
Yes	17(39.50)	8(36.40)	9(42.90)	0.663
No	26(60.50)	14(63.60)	12(57.10)	

Anthropometric, Blood Glucose and Blood Pressure of Study Population

Table.2 shows the anthropometric, blood glucose and blood pressure of the studied population. The average weight of the population was 64.36(SD±10.72) with an average height of 1.62(SD±0.07) but were not statistically significant. The average fasting blood glucose of the studied population was 7.41(SD±2.59) of which was not statistically significant. When the data was stratified into dyslipidemia and no dyslipidemia, there were slight differences in weight, BMI, fasting blood sugar (FBS), and blood pressure, none of these differences were statistically significant. The majority of participants had a high FBS and normal BMI, with a slightly higher prevalence of overweight individuals in the dyslipidemia group.

Table 2. Anthropometric, Blood Glucose and Blood Pressure of Study Population

Variable	**Total (n=43)**	**Dyslipidemia (n=22)**	**No Dyslipidemia (n=21)**	**P-Value**
Weight (Kg)	64.36±10.72	66.27±10.79	62.36±10.54	0.236
Height (m)	1.62±0.07	1.61±0.06	1.63±0.08	0.519
BMI (kg/m²)	24.78±4.37	22.82±4.63	23.69±3.89	0.108
BMI Cat				
Normal	24(55.80)	10(45.50)	14(66.70)	0.161
Overweight	19(44.20)	12(54.50)	7(33.30)	
FBS (mmol/L)	7.41±2.59	7.47±2.18	7.34±3.01	0.873
FBS Cat				
Normal	15(34.90)	6(27.30)	9(42.90)	0.284
High	28(65.10)	16(72.70)	12(57.10)	
SBP (mmHg)	126.65±15.26	124.73±15.52	128.67±15.08	0.404
DBP (mmHg)	72.49±1.19	72.27±9.66	72.71±10.95	0.889
Elevated BP (mmHg)				
Yes	10(23.30)	4(18.20)	6(28.60)	0.420
No	33(76.70)	18(81.80)	15(71.40)	

N= Number of participant; BMI = Body mass index; Kg/m^2 = kilogram per meter square; mm/Hg=Millimeter of mercury; BP=Blood pressure; FBS=Fasting blood sugar; SBP=Systolic blood pressure; DBP=Diastolic blood pressure BMI is presented in mean ± standard deviation and compared using independent sample T- test. Categorical data were presented as frequencies with corresponding percentages and compared using Pearson Chi square P<0.05 was considered statically significant.

Lipid Parameters Comparison between Study Participants

Table .3 highlights the various lipid profile parameters compared between individuals with dyslipidemia (n=22) and those without dyslipidemia (n=21) for a total of 43 participants. Significant differences in TC ($p < 0.001$), LDL ($p < 0.001$), TG ($p = 0.006$) and VLDL ($p = 0.006$) exist between dyslipidemic and non-dyslipidemic individuals, with higher mean levels of TG, and high prevalence of high TC, LDL, and VLDL in the dyslipidemic group. HDL levels were generally higher in the dyslipidemic group.

Table 3. Lipid Parameters Comparison between Study Participants

Variable	Total (n=43)	Dyslipidemia (n=22)	No Dyslipidemia (n=21)	P-Value
TG (mmol/L)	1.095±0.68	1.370±0.81	0.8081±0.34	0.006
TC (mmol/L)	5.026±1.53	5.9636±1.55	4.0443±0.64	<0.001
HDL (mmol/L)	1.717±0.47	2.0073±0.48	1.4129±0.18	<0.001
LDL (mmol/L)	2.845±0.99	3.4005±1.06	2.2643±0.45	<0.001
VLDL (mmol/L)	0.498±0.31	0.6232±0.37	0.3681±0.16	0.006
TG Categories				
Normal	38(88.4)	17(77.3)	21(100.0)	0.020
High	5(11.6)	5(22.7)	0(0.0)	
TC Categories				
Normal	25(58.1)	4(18.2)	21(100.0)	<0.001
High	18(41.9)	18(81.8)	0(0.0)	
HDL Categories				
Low	1(2.3)	1(4.5)	0(0.0)	0.323
Normal	42(97.7)	21(95.5)	21(100.0)	
LDL Categories				
Normal	19(44.2)	4(18.2)	15(71.4)	<0.001
High	24(55.8)	18(81.8)	6(28.6)	
VLDL Categories				
Normal	38(88.4)	17(77.3)	21(100.0)	0.020
High	5(11.6)	5(22.7)	0(0.0)	

N= Number of participant; BMI = Body mass index; Kg/m^2 = kilogram per meter square; TG= Triglyceride; TC=Total cholesterol; HDL=High density lipoprotein; LDL=Low density lipoprotein; VLDL=Very low-density lipoprotein. Lipid parameters were presented in mean ± standard deviation and compared using independent sample T- test. Categorical data (all the categories) were presented as frequencies with corresponding percentages and compared using Pearson Chi square P<0.05 was considered statically significant.

Lipid Parameters Comparison with Duration among Diabetics

Table.4 shows variables Compared by Dyslipidemia Duration (<5 years vs. ≥5 years). Participants with dyslipidemia for ≥5 years tend to have a lower BMI and greater height compared to those with a shorter duration. Those with a longer duration of dyslipidemia had significantly lower TG and VLDL levels.

Table 4. Lipid Parameters Comparison with Duration among Diabetics

Variables	<5 (n=21)	≥5 (n=22)	P-Value
Age (Years)	56.90±11.34	57.73±10.45	0.806
Weight (Kg)	67.41±13.14	61.46±6.88	0.075
Height (m)	1.59±0.07	1.65±0.06	0.007
BMI (kg/m²)	26.51±5.27	23.13±2.42	0.012
FBS (mmol/L)	7.99±3.19	6.86±1.73	0.160
SBP (mmHg)	131.14±14.71	122.36±14.83	0.058
DBP (mmHg)	73.86±12.34	7.18±7.68	0.402
TG (mmol/L)	1.39±0.84	0.81±0.28	0.006
TC (mmol/L)	5.48±1.64	4.59±1.31	0.059
HDL (mmol/L)	1.88±0.51	1.56±0.37	0.027
LDL (mmol/L)	3.03±1.03	2.67±0.94	0.231
VLDL (mmol/L)	0.63±0.38	0.37±0.13	0.006
TC/HDL	2.91±0.31	2.92±0.22	0.978
TG/HDL	0.72±0.33	0.55±0.24	0.059

N= Number of participant; BMI = Body mass index; Kg/m^2 = kilogram per meter square; mm/Hg=Millimeter of mercury; BP=Blood pressure; FBS=Fasting blood sugar; SBP=Systolic blood pressure; DBP=Diastolic blood pressure; TG= Triglyceride; TC=Total cholesterol; HDL=High density lipoprotein; LDL=Low density lipoprotein; VLDL=Very low-density lipoprotein. BMI and Lipid parameters were presented in mean ± standard deviation and compared using independent sample T- test. P<0.05 was considered statically significant.

Lipid Parameters Comparison with Fasting Blood Sugar among Diabetics

Table 4.5 shows variables Compared by Fasting Blood Sugar (<7.1 vs. ≥7.1 mmol/L). Participants with higher FBS (≥7.1 mmol/L) had significantly higher TG and VLDL levels and lower HDL levels, which are associated with increased cardiovascular risk. There was a slightly increased in the BMI and blood pressure of participants with greater fasting blood sugar levels but were not statistically significant.

Table 5. Lipid Parameters Comparison with Fasting Blood Sugar among Diabetics

Variables	<7.1 (n=21)	≥7.1 (n=22)	P-Value
Age (Years)	57.14±11.46	57.50±10.33	0.915
Weight (Kg)	63.07±13.00	65.59±8.09	0.454
Height (m)	1.61±0.02	1.63±0.08	0.328
BMI (kg/m²)	24.53±5.19	25.01±3.52	0.726
SBP (mmHg)	123.57±14.72	129.59±15.51	0.199
DBP (mmHg)	70.43±10.48	74.45±9.74	0.200
TG (mmol/L)	0.81±0.32	1.37±0.82	0.005
TC (mmol/L)	4.58±1.08	5.45±1.79	0.060
HDL (mmol/L)	1.57±0.31	1.86±0.55	0.046
LDL (mmol/L)	2.64±0.77	3.04±1.16	0.187

VLDL (mmol/L)	0.37±0.15	0.62±0.37	0.005
TC/HDL	2.90±0.21	2.92±0.31	0.720
TG/HDL	0.53±0.24	0.73±0.32	0.027

N= Number of participant; BMI = Body mass index; Kg/m^2 = kilogram per meter square; mm/Hg=Millimeter of mercury; BP=Blood pressure; FBS=Fasting blood sugar; SBP=Systolic blood pressure; DBP=Diastolic blood pressure; TG= Triglyceride; TC=Total cholesterol; HDL=High density lipoprotein; LDL=Low density lipoprotein; VLDL=Very low-density lipoprotein. BMI and Lipid parameters were presented in mean ± standard deviation and compared using independent sample T- test. P<0.05 was considered statically significant.

Lipid Parameters Comparison with BMI Classes among Diabetics

Table.6 shows variables Compared by BMI (Normal vs. Overweight). Overweight participants had significantly higher TG and VLDL levels compared to those with a normal BMI. Most of the other variables were not statistically significant.

Table 6. Lipid Parameters Comparison with bmi Classes among Diabetics

Variables	**Normal (n=24)**	**Overweight (n=19)**	**P-Value**
Age (Years)	55.50±11.31	59.63±9.86	0.832
FBS (kg/m²)	6.79±1.76	8.19±3.24	0.116
SBP (mmHg)	124.83±15.84	128.95±14.58	0.711
DBP (mmHg)	72.00±10.08	73.11±10.57	0.660
TG (mmol/)	0.92±0.41	1.31±0.88	0.005
TC (mmol/L)	4.90±1.54	5.18±1.54	0.992
HDL (mmol/L)	1.64±0.42	1.82±0.52	0.319
LDL (mmol/L)	2.85±1.06	2.84±0.94	0.846
VLDL (mmol/L)	0.42±0.19	0.59±0.40	0.005
TC/HDL	2.96±0.23	2.86±0.31	0.283
TG/HDL	0.58±0.24	0.69±0.36	0.204

N= Number of participant; BMI = Body mass index; Kg/m^2 = kilogram per meter square; mm/Hg=Millimeter of mercury; BP=Blood pressure; FBS=Fasting blood sugar; SBP=Systolic blood pressure; DBP=Diastolic blood pressure; TG= Triglyceride; TC=Total cholesterol; HDL=High density lipoprotein; LDL=Low density lipoprotein; VLDL=Very low-density lipoprotein. BMI and Lipid parameters were presented in mean ± standard deviation and compared using independent sample T- test. P<0.05 was considered statically significant

Discussion

Dyslipidemia, characterized by abnormal lipid profiles such as elevated triglycerides, reduced high-density lipoprotein (HDL) cholesterol, and/or increased low-density lipoprotein (LDL) cholesterol, is a major risk factor for cardiovascular disease [8]. Understanding the key contributing factors to dyslipidemia is crucial for effective prevention and management strategies. This study aimed to examine the relationship between lipid parameters (triglycerides, very low-density lipoprotein [VLDL], HDL, and LDL cholesterol) and various demographic, clinical, and lifestyle factors among a sample of diabetic individuals.

In this study, there was no statistically significant association between sex and the presence of dyslipidemia. This may be due to the limited sample size. These findings are consistent with those of [9], who also reported no significant sex-related differences in

dyslipidemia prevalence in a cross-sectional study in India. However, contrary evidence exists. A meta-analysis by [10] found that women had significantly higher odds of developing dyslipidemia, potentially due to hormonal fluctuations, particularly during menopause, that negatively affect lipid metabolism.

Alcohol consumption was reported by only one participant without dyslipidemia, and no statistically significant difference in alcohol intake was found between groups. Moderate alcohol consumption has been linked to improved lipid profiles, including lower triglycerides and higher HDL cholesterol [11]. Conversely, heavy alcohol intake can impair lipid metabolism and increase the risk of dyslipidemia [12], highlighted that while light-to-moderate drinkers typically exhibit favorable lipid levels, abstainers and heavy drinkers often present with less desirable lipid profiles.

Regarding physical activity, exercise was reported by 9 participants without dyslipidemia and 8 with dyslipidemia, with no statistically significant difference between groups. Although regular physical activity is widely recognized as beneficial for lipid profiles, the relationship may be influenced by exercise type, intensity, and duration [13]. found that moderate-intensity exercise had a more favorable effect on lipid levels compared to high-intensity workouts. Similarly, a meta-analysis by [14] indicated that aerobic exercise significantly reduced LDL cholesterol and triglycerides while increasing HDL cholesterol.

Participants classified as overweight showed elevated triglyceride and VLDL levels. This aligns with findings by [15], who demonstrated that overweight or obese individuals had significantly higher levels of triglycerides and VLDL compared to those with normal BMI [16]. further corroborated this relationship across different populations, showing a consistent positive association between increased BMI and adverse lipid profiles.

However, some studies provide contrasting evidence. For instance, [17] and [18], found no significant association between BMI and triglyceride or VLDL levels in specific populations, such as African Americans and individuals with type 2 diabetes in Pakistan. These discrepancies may be due to ethnic or genetic differences, underlying health conditions, or other confounding factors influencing lipid metabolism.

Elevated fasting blood sugar levels were associated with increased triglyceride and VLDL levels, consistent with previous research [19], reported that patients with higher fasting glucose exhibited significantly elevated triglycerides. Similarly, [20] and [21] found that the triglyceride-to-HDL ratio was positively correlated with FBS levels and was a common feature in individuals with type 2 diabetes.

Interestingly, participants with higher FBS in this study also exhibited slightly higher HDL levels, which contrasts with some literature. [22] noted that insulin resistance and hyperglycemia are typically associated with reduced HDL cholesterol. These differences may reflect individual variability in glycemic control, metabolic adaptation, or other modifying factors such as medication use.

This study found that individuals with shorter durations of diabetes exhibited higher triglyceride and VLDL levels and higher HDL levels. This may reflect the limited time for these individuals to adopt effective lifestyle changes or receive adequate treatment.[23] observed that individuals with a longer history of diabetes often had improved lipid profiles, likely due to accumulated health education, lifestyle interventions, or pharmacological management.

However, other studies report conflicting results. For instance, [24] observed that longer duration of dyslipidemia was associated with increased triglyceride levels, possibly due to cumulative metabolic damage and impaired lipid clearance. Meanwhile,[25] found no

significant reduction in HDL levels over time, and [26] reported no definitive association between VLDL and disease duration. These inconsistencies suggest that lipid parameters may be more influenced by ongoing management strategies than by the duration of diabetes alone.

Conclusion

Overall, this study highlights the complex interplay between demographic, lifestyle, and clinical factors in influencing lipid abnormalities among diabetic individuals. While some trends align with existing literature, others diverge, potentially due to the sample size or population-specific characteristics. These findings underscore the need for individualized assessment and management of dyslipidemia in diabetic populations and suggest areas for further research in larger and more diverse cohorts.

Limitation

1. The total number of participants (n = 43) was relatively small, which may limit the generalizability of the findings. A small sample reduces statistical power, making it more difficult to detect significant associations between variables.
2. The cross-sectional nature of the study limits the ability to infer causality. While associations between variables were observed, the directionality and long-term effects of these relationships cannot be determined.
3. Certain variables, such as alcohol consumption and physical activity, were self-reported, which may be subject to recall bias or social desirability bias. Participants may underreport unhealthy behaviors or overreport healthy ones.
4. Diet plays a critical role in lipid metabolism; however, dietary habits were not assessed in this study. The absence of this data limits the understanding of how nutrition may have influenced lipid profiles in the participants.
5. The study was conducted at a single location, potentially introducing regional bias. The findings may not be representative of other populations or settings, especially those with different socioeconomic, genetic, or lifestyle backgrounds.

Conflict of Interest

There is no conflict of interest.

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Oil Revenue, Governance, and Rural Educational Equity in Guyana: Stakeholder Perceptions and Policy Implications

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Abstract

This article examines the governance, equity, and impact of oil-funded educational investments between 2021 and 2024 on educators of the Region 5 (Mahaica-Berbice) of Guyana. Data was gathered from 260 educators in Region 5 using a cross-sectional quantitative descriptive survey design and stratified sampling. Perceptions of governance, equity, and transparency of oil-funded education reforms were assessed using structured questionnaires, and SPSS was used for analysis. Cross-sectional survey results indicate mixed messages—half observing infrastructure upgrades and funding increases, but most worried about the inequitable distribution of resources, the absence of transparent guidelines, and being excluded from the planning process. Just 18% were part of any decision making related to the use of oil revenue in education. A heatmap analysis demonstrated there was a strong consensus that timely funding, increased teacher salaries and more stakeholder inclusion were necessary changes. Although there are visible investments, results reveal a mismatch between national oil revenue strategies and school-level realities. The research finds that without participatory governance, equity-grounded planning and alignment between fiscal inputs and pedagogical mandates, radical aspirations remain out of reach. Suggested mechanisms include stakeholder participation, transparency and equity-based budgeting with the aim of translating oil wealth into sustainable educational development.

Keywords: *Development Policy, Educational Equity, Governance, Guyana, Oil Revenue, Public Finance, Region 5, Resource Allocation, Rural Education, Stakeholder Perceptions, Teacher Participation, Transparency.*

Introduction

The course of public finances in oil-booming Guyana has brought forth both hope and concern. Guyana has stepped onto the world's stage as a nascent oil producer with the start-up of its Liza Phase 1 project, which is expected to produce 120,000-220,000 barrels of oil per day (ExxonMobil, 2019). Indeed, as we so often see in resource rich developing countries, this new resource wealth is tempered with concern over governance, transparency, and equitable distribution—issues that are often condensed in the idea of the "resource curse" [1]. But within that framework, education does not just become a developmental necessity, it also becomes an important barometer with which to gauge how oil is being managed as a resource to address the long-standing structural injustices.

Since the creation of the Natural Resource Fund (NRF) in 2020, large oil inflows to the budget have provided unwonted fiscal space for public investment. Education was among the key sectors listed for priority allotments and budget considerations, with a thrust on rural/hinterland infrastructure development [2]. From 2021 to 2024, national budgets showed

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significant increases in capital spending for construction of schools, rehabilitation, expansion of dormitories and ancillary facilities towards increasing access and equity in under-served areas [3].

Region 5 (Mahaica-Berbice), a largely rural administrative region, was one of the biggest winners in this oil-powered development spree. This work included new science laboratories, classroom blocks, sanitation facilities, and infrastructure projects for indigenous and farming communities. But even as money poured in and great progress occurred on the ground, and there are mixed views. Ministry of Education and Regional Education Office reports cited repeated problems including project delays, underperformance by contractors, disruptions in the supply chain, and insufficient engagement of stakeholders in planning and monitoring [4]

This study takes place amidst these changing conditions. It looks at how primary makers - including teachers, headteachers - perceive quality, governance and equity reforms in the petroleum subsidized educational system. It aims to connect the macro-level goals of the national oil-revenue agenda with the micro-level dynamics of rural education supplies. In this way, the paper adds to broader scholarship on the governance of resources by focusing on local experiences and perceptions and provides evidence as to whether Guyana's petroleum wealth is leading to something more than infrastructure advancements but also educational transformations that are sustainable and inclusive.

Context

With the start of oil production (in 2019) and the operation of the Resource Fund (2020), Guyana has ushered in a new fiscal reality that is characterized by rapid growth of revenues and as well as unprecedented public sector transformation [5, 6]. Education-historically underfunded, especially in rural and hinterland areas-is one of the sectors being targeted for investment, In oil-financed development, education is one of the sectors being targeted for investment [7, 3]. Over 2021-2024, successive national budgets ramped up capital allocation for education, addressing school infrastructure, teacher incentives and larger outreach to sources of learning [8].

As mentioned, Region 5 (Mahaica-Berbice), with a heavy agricultural focus and coastal as well as hinterland populations, has significantly benefited from the investments in water management. But national audits, regional education offices and community consultations have reported spotty implementation. [9, 3]. Enduring challenges – including limited stakeholder participation, slow implementation of projects and a disconnect between infrastructure priorities and pedagogical needs – have resisted the transformative potential of oil-funded interventions.

At this juncture, where financial constraints are not a barrier, it is critical to understand how the incentives of educators on the ground are shaped and play out in this new generation of reforms. [1, 10]. Their views provide an important perspective to assess the effectiveness of the education sector initiatives financed by oil and the education investment regime at large. It is in this context that stakeholder experiences are both an indicator and a potential driver for enhancing transparency, accountability and inclusiveness in the Guyana education system. [11, 12].

Problem Statement

Rural communities including those in Region Five stand especially vulnerable to unequal application. Local villages do not lack education, but the application is inconsistent. Infrastructure expenditure appears to be on the rise, however, educators at the face of things claim minimal involvement in planning, delayed implementation and little transparency in who gets to make decisions. These missing links of governance and coordination have, in

turn, undercut the transformative potential of oil-sanctioned interventions in education.

Existing Solutions and Limitations

National initiatives have concentrated much attention on capital infrastructure: the building of schools, the extension of dormitories, the provision of learning spaces. These efforts helped to address some physical barriers, but they remain top-down in design and a significant lack of bottom-up community-based planning, participatory monitoring and decentralized education governance. There are limited structures that facilitate the incorporation of feedback from teachers and school administrators into investment decisions, which hampers responsiveness and long-term impact.

Best Existing Practice

Pilot initiatives such as participatory school boards and community audit approaches at certain locations appear to hold the potential for increased accountability. But these are sporadic and are not as much institutionalized or scaled. There is no established national model or mechanism that integrates financial inputs, community attitudes, and governance outcomes.

Objectives

This study aims to:

1. Examine how stakeholders perceive the strategic use of oil revenues in Region 5 for the education sector from 2021 -2024.
2. Determine the attitude and involvement of teachers in oil-funded education projects.
3. Determine governance issues and institutional blockades that are inhibiting implementation.
4. Advise on policy changes needed to make oil revenue management more equitable, transparent and sustainable.

Achievements and Contributions

This research adds empirical findings from more than 260 frontline educators to and combines data from budgets and infrastructure to provide a bottom-up perspective on Guyana's educational transformation. It connects the chasm from macro-policy aspirations to micro-level context, and offers a governance-sensitive framework analyzing the effectiveness of public spending in education.

Literature Review

Oil-rich developing countries' ability to translate natural resources into durable social development is not simply a function of the resources collected, but of the quality of governance, level of institutional coherence, and extent citizen participation underpinning the allocation of resources [13, 1]. Education is an excellent litmus test of whether oil revenues are being turned into inclusive public goods more generally. It's not just the physical infrastructure of education, it's the commitment to human capital, the system and long term societal commitment. As urged by UNESCO 2014, "Education is a basic human right and central to achieving other rights. It is essential for human development, reducing poverty, and promoting individual and collective well-being." [14]. As a policy, education has the potential both to make and to break any social structure as it influences almost every household and can potentially facilitate social and economic mobility making it an exact translation of state capacity and intentions to deliver equity through resource redistribution. Birdsall & Subramanian (2004) argue that resource-rich governments often prioritize visible infrastructure or politically expedient projects rather than systemic investments in institutions like education [15]. In resource-rich developing countries, education is also politically sensitive, reflecting investments that more closely follow elite priorities or electoral arithmetic rather than the needs of communities.

Comparative Country Cases

Cross-national experiences reveal divergent trajectories. In Norway, as cited by Mehlum, Moene, & Torvik (2006) strong institutions, forward-looking planning, and a publicly scrutinized sovereign wealth fund have resulted in oil revenues used to back inclusive investment in education, especially in disadvantaged areas [16]. Nigeria's education system, meanwhile, has long been bedeviled by its opaque budgeting, contract fraud and regional discrepancies. For instance, the Universal Basic Education Commission (UBEC) in Nigeria, according to Oduro (2012) has been subjecting to numerous audits on the abuse of oil money received as education grants, resulting in inadequate classrooms, lack of qualified teachers, [17]. Another warning of the risk of lurching from expansion to contraction is Venezuela, a country where for years the flood of oil money enabled school after school to spring up under Chávez, only to see them degenerate into a blot on trust and results as the economy turned down and the curriculum became politicised according to Suleman & Ennin (2024) [18]. These two divergent cases highlight the importance of institutional capacity and policy responsibility, rather than the simple presence of resources, to turn oil wealth into structural public goods.

Stakeholder Engagement and Policy Impact

The discourse also highlights the fact that schools that are well-funded do not necessary produce success in education, and that successful reform could vary depending on the degree of participation of individuals and community in the reform process. If teachers, parents, local leaders are brought into the process of making policy then reforms gain in legitimacy, are more likely to be implemented effectively, and tend not to generate backlash. And in numerous resource-endowed nations, national policy-makers take a technocratic or centralised view of education planning, sidelining more consultative processes that can lead to ownership and relevance as noted by Kolstad & Wiig (2009) [19]. The World Bank, (2018) has empirical evidence from Ghana, Uganda, and Indonesia indicate that opaque budget allocations, lack of information sharing, and weak lines of communication erode trust in government and diminish investment and impact [20]. The lack of participatory mechanisms also speaks to more fundamental structural factors, such as in country allocation of resources in favor of cities and existing political control of appointment in educational positions and of procurement contract. If schools are constructed with no input from the teachers who work in them or the communities they're supposed to serve, they can become symbols not of social development but of public resources misplaced.

Research Gap

Despite increased international work on oil revenue governance and education policy, there are few studies that provide contextual empirical evidence on stakeholder perspectives in the newly resource-based countries such as Guyana. Most existing research focuses on a macroeconomic perspective and on national policy context, leaving an important gap in our knowledge about how sub-national actors – and educators in particular – articulate, interpret and shape the distribution and implementation of oil-financed education policies. Recent education reforms in Guyana have been characterized by ambitious capital works dictated by central government priorities. Yet there's scarce public evidence of regional consultation processes or school-level participatory planning. This is part of a larger critique of the top-down governance tendency that focuses on political visibility and infrastructure provision at the expense of long-term capacity-development and local responsiveness. Also, there is little evidence linking stakeholder perceptions to real infrastructure improvement and governance

processes in specific rural situational contexts (region 5).

This paper tries to address the gap by examining how rural educators take advantage of transparency, equity, and participation in the distribution and the use of oil money in the education sector in Guyana. Integrating quantitative statistics with budget analysis, the research adds a new dimension to the question of whether resource-led development approaches are leading to an inclusive and sustainable educational sector at the local level.

Theoretical Framework

The analysis in this work is guided by two intertwined theoretical frameworks, namely, the Resource Curse Theory and the Good Governance Framework, which are used to assess the governance mechanism and the developmental effect of oil revenue on education in Nigeria.

As Ross (2012) contends, the Resource Curse Theory argues that natural resource-rich nations do not achieve adequate societal development outcomes as a result of institutional vulnerability, elite capture and low incentives for accountability [1]. This can culminate in the politicization of budgeting in the education sector, investments in infrastructure without pedagogical underpinnings, and exclusion of local actors in planning and oversight.

In contrast, the Good Governance Framework (United Nations Development Programme, 1997: 3} and the World Bank (2001: 30) further elaborates a set of principals that are to guide public sector action, for instance as transparency, accountability, participation, responsiveness and equity [11, 21]. Within the education domain, such governance pillars are necessarily necessary to guarantee oil revenue is not misspent but is also equitably allocated and geared to real education needs, especially in underserved rural locations.

The Resource Curse Theory does provide some insight into structural weaknesses in Guyana's rush to oil, but it does not provide suggestions for what we should do. This is where the Good Governance Framework comes in, providing a normative set-point for averting elite capture and enhancing institutional accountability. In blending these literatures, the paper presents both diagnostic and prescriptive implications—it highlights the dangers of resource dependency, as well as what governance reforms are needed to make educational provision inclusive and sustainable.

Methodology

A quantitative descriptive survey design was used in this study to examine the perception of educators on the governance, equity and effectiveness of using oil revenues in the education sector of Guyana in Region 5 (Mahaica-Berbice). Creswell & Creswell (2018) noted that quantitative descriptive design is ideal for documenting general, measurable patterns in the target population and for allowing for the unbiased analysis of stakeholder views in terms of standardized instruments [22].

Research Design

This study aims to measure patterns of Emotional Quotient (EQ) in a population, so researchers launched a cross-sectional, descriptive and quantitative study, based in detecting general patterns amidst the population sample that may be generalizable in scope. This design according to (Babbie, 2021) makes it possible to analyze people's attitudes and experience without interference from any variable, thus providing an objective representation of educators (stakeholders) perceived oil-financed educational reforms [23].

Target Population and Sampling

The population of interest was teachers: head teachers, senior teachers and classroom teachers—employed in public nursery, primary and secondary schools in Region 5. Proportional representation by geographic

situation (coastal versus riverine) and school level was achieved using a stratified random recommendation approach. This strategy facilitated a fair distribution of all available data between remote rural and rural coastal settings.

A total of 260 teachers completed the survey. The sample size was based on regional staffing data, and it was estimated to achieve representativeness of at least 95% confidence level with a margin of error below 5% [24].

Instruments for Data Collection and Procedure

A survey tool designed for the purpose of this study was used to collect the data through the administration of a sef-administered structured questionnaire. The measure consisted of close-ended items rated on a five-point scale (1=Strongly Disagree-5=Strongly Agree) and based on four main constructs:

1. Perceptions of transparency in the use of oil revenues
2. Perceived equity in resource distribution
3. Observed infrastructural and resource improvements
4. Participation of stakeholders in planning and delivering education

Item clarity and construct alignment were validated through piloting of the questionnaire with 10 educators from a nearby administrative area. Reliability was further validated with a Cronbach's alpha = 0.82, showing strong internal consistency [25].

Fieldwork was carried out over four weeks with both paper and digital versions of the questionnaire. Data were collected by enumerators who visited teachers in non-school instructional hours to limit disruption and preserve privacy

Unit of Analysis and Variable

The teacher was the unit of analysis for this study. The main independent variable was the geographical location of the school (coast vs. inland). The dependent variables were teachers' perceptions of transparency, equity, access to resources and participation in decision making associated with education initiatives funded by oil.

Data Analysis

For the quantitative data, SPSS Version 27 was used for data analysis. Descriptive statistics (means, frequencies, percentages) were computed to describe general trends. Critical variables were broken down by school type and place of residence (coastal or interior), and cross-tabulations were used to identify patterns in educators' responses. Open ended spontaneous remarks, limited in the survey, were also organized thematically in view to provide context for their insight. Qualitative coding was not done in a traditional sense.

Ethical Considerations

The research followed the ethical considerations of voluntary consent and the right to refuse to participate, confidentiality, and anonymity. Clearance is provided from research ethics committee of Texila American University prior to starting of data collection. The respondents were made aware that they could withdraw from the study at all stages, and all answers were confidential.

Limitations of Methodology

Although the present research provides interesting quantitative information, a few limitations must be considered. The limited qualitative data restricts the ability to examine nuanced personal experiences and the context that might affect respondents' perceptions. These limitations identify gaps for mixed and more widespread geographic research.

Findings

The research findings of 260 educators in Region 5 (Mahaica—Berbice) illustrate the complex ways in which they see equity, governance and effectiveness in the question of educational investments in the period 2021 to 2024 using oil resources. Although there were a few positive signals, the great majority of

respondents were concerned about the lack of uniform implementation, minimal involvement in planning, and disparities in material and pedagogical support.

Perceived Budgetary Increases

Just over half (52%) of respondents felt that school levies had risen since Guyana incorporated oil revenues into the education sector as shown in Figure 1. These impressions were largely related to visible improvements in infrastructure (e.g., new classrooms, toilets and dormitories) and increased resources for teaching (e.g., additional teaching materials). But a full 48 percent disagreed or were not sure - suggesting that not all schools along the coast or further inland (riverine) are seen or being helped by financial improvements. On the issue of Equity in Resource Allocation, as shown in Figure 1, a similar majority (54%) disagreed with or had a neutral opinion toward resource allocation to schools being fair. Respondents from riverine areas often noted the ongoing neglect of aged schools, congested learning spaces and a slower reach of educational materials, when compared with those living along the coast. This serves to confirm that geographic isolation continues to determine access to public investment despite an increase in national education spending.

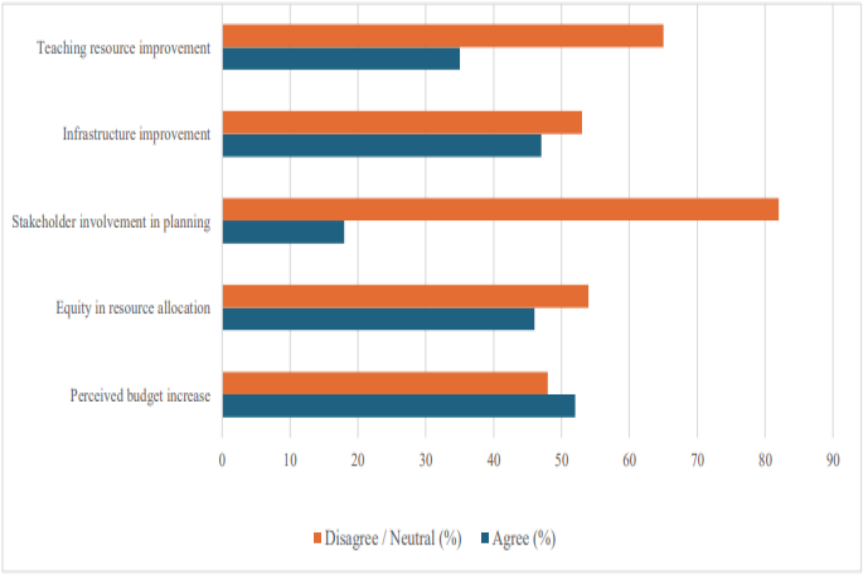

Figure 1. Field Data- Stakeholder Perceptions on Oil and Gas Revenue Perceived Budgetary Increases

Stakeholder Perceptions and Experiences

Figure 2 shows the educators' perceptions in those three most important categories (school improvement, access to education and revenue) using a 5-likert points.

School Progress - According to analysis, 8 and 17 percent of teachers also accept that oil revenue has had a positive and very positive effect on school building development and facilities. But 29 per cent sat on the fence and 12 per cent were negative; thus, reflecting a sense of cautious optimism. While some progress has been made, growing inequalities and unmet needs continue to raise concern.

Access to Education: A majority of the respondents (29%) reported they had seen no change at all, or moderate improvement (21%) and only 17% say there is broader access. Interestingly, 8% of respondents reported restricted access, with none reporting a decrease. This indicates that, while there seem to be some new opportunities (possibly related to scholarships and facility development) taking place, there is still a sense, for a good number of educators, that progress in rural communities is not uniform and/or is being delayed.

Revenue Management: Views on stewardship of the money were lukewarm. Twenty-five percent rated the practice of revenue management as "good" and 29% awarded "satisfactory, while only 8 % rated "excellent, the highest grade. A total of 21%, (19% and 2% respectively) however, were hesitant, probably having shades of doubts about the open and effective use of oil money in education.

All this suggests a tentative rather than emphatic support for oil-financed educational development, and a call to arms for more coherence, more communication and more inclusion in resource planning and distribution.

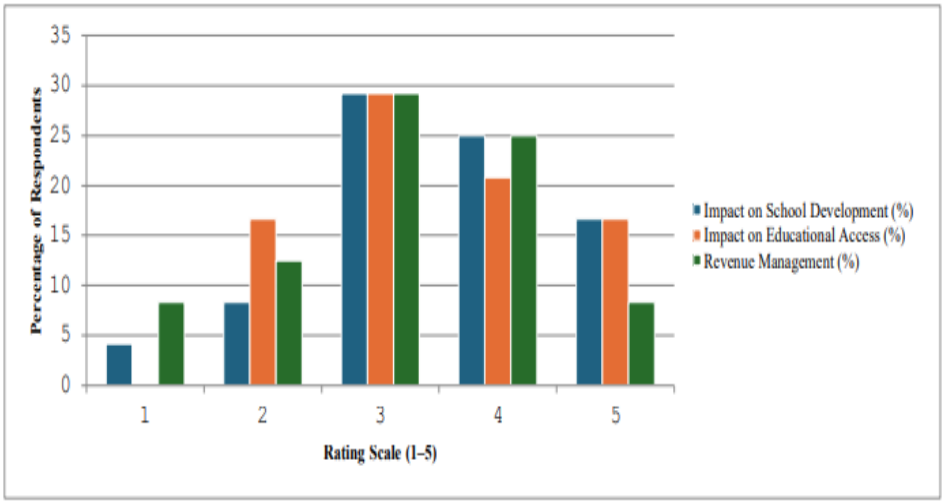

Figure 2. Field Data: Stakeholder Perceptions on Oil and Gas Revenue Allocation: This Grouped Bar Chart Compares how Respondents Rated the Impact of Oil and Gas Revenue on School Development, Educational Access, and Revenue Management

Stakeholder Involvement in Decision-Making

Figure 3 (Pie Chart) depicts the self-reporting of the role of educators in the decision-making process in relation to the allocation of oil revenue in the educational sector.

1. Only 10% participated in decisions.
2. 20% said they got somehow involved, mostly indirectly or passively.
3. A whopping 70% said they were not involved whatsoever.

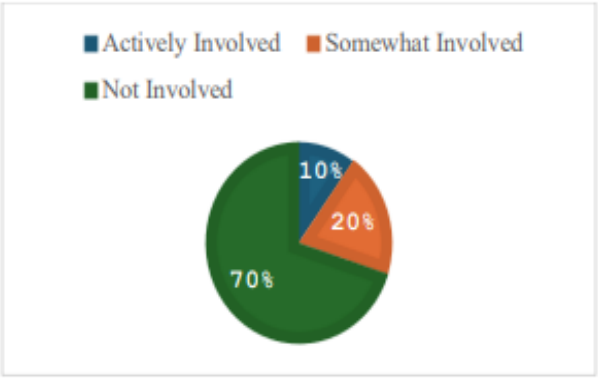

Figure 3. Field Data- Stakeholder Involvement in Decision-Making on Oil and Gas Revenue in Education

This symptom exposes a major deficit of participatory governance. The sidelining of key actors in the consultative and budgeting process raises questions about transparency, accountability, and policy responsiveness. For oil-driven educational reforms to be efficient

and economical, wide spread participation in the schools and communities must be institutionalized.

Stakeholder Priorities for Policy, Resourcing, and Planning

The below Heatmap (Figure 4) aggregates stakeholder perspectives to determine what were their priority policy questions and requirements for resources and government directions to serve oil-funded educational expansion.

Key Priorities: The proposal to "Increase teacher salary" was ranked the highest (260 responses) followed by finalization of funds with periodicity, more stakeholder representation (more than 200 responses each) and all stakeholder engaged on approach of action (197 responses).

Resource Gaps: Teacher training (220 responses) and student support activities (100 responses) were top, signaling interest in marrying the infrastructure gap with a capacity and welfare input.

Policy Preferences: While "transparency and accountability" (150 mentions) was considered important, the greater demand was for more direct stakeholder participation and more credible long-term planning - reflecting the perception that, if financial oversight is to occur, it is seen as needing to be based on participatory governance

The insights highlight the systemic requirement to ensure that resource governance resonates with the real life experiences and aspirations of teachers, especially those in underrepresented rural and hinterland communities.

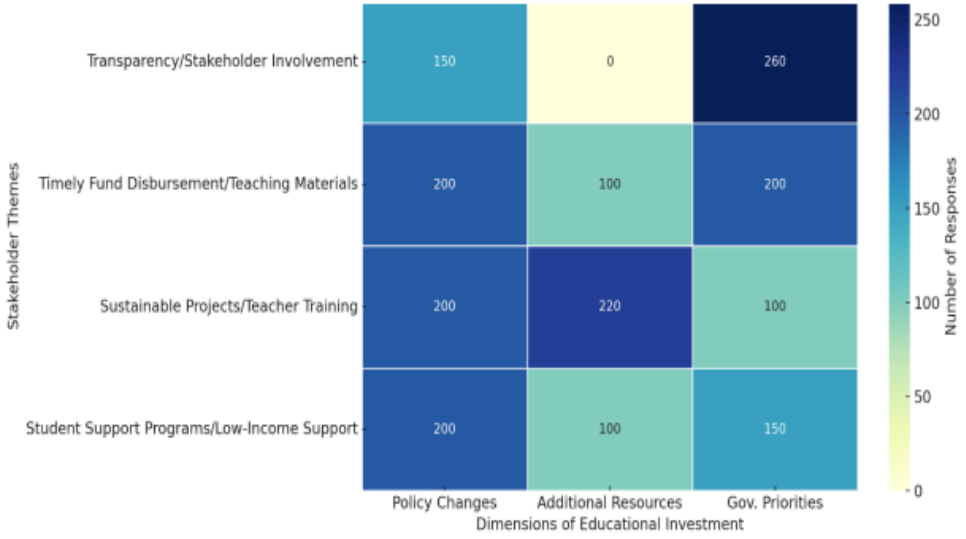

Figure 4. Field Data Heatmap of Stakeholder Responses on Policy Needs, Resource Gaps, and Funding Priorities in Rural Education

Discussion

The study findings emphasis the essential of participatory governance and equity in translating oil revenue to real educational development. Fifty-eight percent of respondents reported some strides in infrastructure and funding since the oil rush, but in a similar percentage also observed limited transparency, inadequate stakeholder participation, and imbalances in resources distribution, particularly between the coastal and interior schools.

This learning reflects larger concerns in the resource governance literature. Suleman and Ennin (2024) argue that in resource-rich conditions, top-down strategies of control marginalize those closer to the base levels of delivery, namely educators, and contribute to implementation deficits and diminished accountability. [18]. That a majority of

educators (i.e., 61% in this study) reported no participation in planning or monitoring of oil-funded projects reinforces this critique and indicates the necessity for including local voices in education policy debates.

These disaggregated results mean that only 18% of teachers had outright decision-making support Kara et al. (2022), who claim that exclusionary governance systems often undermine stakeholder confidence and the legitimacy of public investment [27]. This governance gap reflects not only a lack of understanding about how budgets are made, but also a lack of communication which results in the absence of transparency and a lack of democratic oversight.

Also, while close to half noticed infrastructure advances, 35 percent noted better teaching materials and technology. This mismatch is addressed in McGee & Gaventa's (2010) description of "hardware-heavy" interventions, in which funding is centered around physical structures rather than pedagogical capacity or community support [28]. The suggestion is that investment in capital is necessary, but not sufficiently, of improvements in human capital and teaching quality.

The heat analysis also indicates a call for better governance both across sectors and levels, with popular concerns being payment of higher teacher salaries, release of funds on time, and sustainable planning and stakeholder involvement. Remarkable, albeit transparency and accountability being favored (150 answers), even higher support was given to participatory governance—coinciding with the findings of Meier et al. (2023), who stress that involving stakeholders enhances not only project design, but also future legitimacy and fairness [26].

Lastly, the relatively neutral/ mixed ratings of Likert scale data indicate the somewhat cautiously optimistic positions of educators, with an acknowledgement of progress, but that it is not widely institutionalized. As mentioned by Birdsall and Subramanian (2004), this behavior is typical among natural resource abundant developing countries where spending increases with no corresponding increase in results, driven by institutional bottlenecks and poor governance [15].

In conclusion, this research has identified that oil receipts are contributing to the increase in capital expenditure in the education sector in Region 5, but deficits in stakeholder inclusion, incomplete and uneven application, and lack of transparency are constraining systemic change. To sidestep the education-related aspect of the "resource curse," the reforms required in Guyana pertain to the introduction of participatory governance, equity-based planning, and responsive communication in the nation's education policy framework.

Conclusion

This paper provides important perspectives on their views of oil revenues trans-positioning into education development of the frontline workers of the rural education system in Guyana. Although there was a slight majority who reported having seen increased funding and infrastructure development in the schools, the results also suggest profound misgivings about issues of transparency, of fairness, and of the lack of participation.

The marginal involvement of teachers in planning and monitoring mechanisms and the perceived inequity in the allocation of oil-funded benefits among coastal and riverain schools all suggest that long-standing governance failures persist. Although the transformative economic ability of the oil industry exists, teachers are wary—particularly in areas that continue to struggle due to infrastructure and technology deficiencies. The absence of structured consultation processes have armed a sense of consignment to the wheel, thereby, questioning the credibility and receptivity of the reformed systems.

Overall, the study indicates that the transformative potential of oil wealth in Region

5 for education has only been partly realized. Unlocking that potential will require a reset, a reset that redeems policy on education based on stakeholder engagement, underwritten by resource allocation equality frameworks and visible conversion of financial inputs to learning outputs. Failing such a governance transition, Guyana may succumb to the same inequities the oil wealth is supposed to address.

Recommendation

This work has thrown the spotlight on the sometimes confusing and fragmented views that teachers have in Region 5 about the mechanics and effect of oil-funded education programs. There is recognition that more budget is being allocated, and infrastructural improvements are being targeted, but concerns remain about the equity, transparency and long-term sustainability of these investments.

One of the key results is the gap between socioeconomic inputs and institutional facts. In spite of evidence of the flow of oil revenues into education, rural stakeholders complain about being excluded from decision-making. The continuing disparities in computer-availability, in infrastructure upkeep and teacher training also highlight the shortcomings of infrastructure-based policies. These trends suggest that there is an urgent need for governance reform which prioritize the role of participation, accountability, and the context-specificity of delivery processes.

To counter these systemic deficiencies and realize the full potential of oil revenues to enable educational transformation, the following recommendations are put forward:

Institutionalize Stakeholder Participation: Put in place formal structures to include teachers, PTAs, and district educational officers in the planning, budgeting, and appraisal of education projects. Instruments such as school-based management committees, community budget hearings, regional education councils must be institutionalized to promote transparency, local ownership and shared responsibility.

Strengthen Regional Implementation Capacity: Invest in building regional education departments technical, administrative and human resource capabilities. That includes better training on procurement, monitoring and project management in specific areas, and more power for those on the ground to tailor interventions to local conditions.

Promote transparency in the allocation of oil revenues: Require the release of disaggregated, region-specific spending reports on oil financed projects in the education sector. The reports should specify how the money gets disbursed to schools, by project category, and by geography and be publicly available in order to foster trust, minimize elite capture and bolster civic oversight.

Adopt Equity-Based Budgeting Tools: Implement equity parameters, including indices of marginalization, infrastructure shortages and teacher-student ratios, in budget formulation. This would help avoid a political allocation system that does not take teacher-student ratios requirements into account and would help redress historic imbalances and focus on underserved communities.

Associate Capital Investments with a Pedagogical Strategy: Make sure infrastructure investments come with pedagogical reform – teacher training, modernizing curricula and providing digital learning tools. In the absence of this coherence, investment in capital can become underutilized or divorced from meaningful learning.

Enhance Monitoring and Feedback Mechanisms: Socialise mechanisms for participatory and independent monitoring such as community scorecards, educator perception audits and real time feedback loops. The tools should be incorporated into annual planning cycles to enhance adaptive management and responsiveness to on-the-ground conditions.

Acknowledgement

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Conflict of Interest

The author declares no conflict of interest in the preparation or execution of this research.

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Exploring the Perception of Clinical Researchers on the use and Importance of Decentralized Clinical Trial Elements in India

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Abstract

This study aims to explore the perceptions of clinical researchers in India regarding the use and importance of decentralized clinical trial (DCT) elements and to identify associated organizational and therapeutic area-specific trends. A cross-sectional questionnaire-based survey was conducted among 112 clinical research professionals across various organizational types, including sponsor companies, contract research organizations (CROs), and academic institutions. Data was analyzed to assess the extent of DCT elements importance for its adoption and implementation in the organization based on the drug development pipeline. A statistical test was used to examine the association between organizational type and DCT elements adoption levels. The findings revealed a growing inclination toward hybrid trial models, with 78.6% of respondents indicating partial decentralization within their organizations. Only 11.6% of respondents reported a fully decentralized trial, highlighting regulatory, infrastructural, and operational constraints. A significant association was found between organizational type and DCT adoption ($p = 0.045$), suggesting that service providers and sponsor companies differ in their strategic approaches. Adoption patterns varied across therapeutic areas, with hybrid models dominating in complex conditions such as oncology and cardiovascular diseases and fully decentralized trials more common in dermatology and infectious diseases. Key enabling technologies included electronic signatures, remote source data verification, and AI-driven analytics, while infrastructure-heavy components like direct-to-patient delivery were less prioritized. DCT element adoption in India remains moderate and is primarily characterized by hybrid models. Service providers are emerging as key enablers of digital transformation, but regulatory ambiguity, gaps in digital infrastructure, and limited organizational readiness hinder broader implementation. Tailored policies, capacity-building initiatives, and therapeutic-specific strategies are essential for accelerating DCT integration.

Keywords: *Clinical Research, Decentralized Clinical Trials, DCT Elements, Hybrid Trials, India, Organizational Adoption, Therapeutic Area.*

Introduction

The clinical research industry has revolutionized with the increasing adoption and implementation of decentralized clinical trials (DCTs), which aim to use the remote elements and digital health technologies that could reduce or eliminate the patient's visit physically to the study site [1]. COVID-19 pandemic acted as a catalyst to develop and adopt this innovative trial design to meet the need for patient recruitment, patient centricity and improving trial efficiency [2]. DCT design could be 'fully decentralized clinical trials', where all activities occur outside a traditional site like electronic informed consent (eConsent), home healthcare visits, teleconsultations, mobile health applications, and wearable sensor, that are considerably recognized for their potential to make the clinical trials more inclusive and accessible [3,

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4] The patients may engage in trial-related activities in their residences or at local healthcare establishments. Remote data collection is an essential component of decentralized trials. Other design, is the 'hybrid decentralized clinical trials' or 'partial decentralized trial' that uses the combination of conventional and remote components especially on-site visits for the study assessment, in person consent or e-Consent, electronic patient reported outcomes (e-PRO), telemedicine. It has been shown that hybrid trial design maximized remote methods [5].

In a recent study conducted in 2022, data was extracted from ClinicalTrials.gov and the clinical trials implemented the four components of DCT namely: telemedicine, home healthcare (HHC), direct-to-patient (DTP), and Internet of Healthcare Things (IoHTs)/Internet of Medical Things (IoMTs) and these components were defined as follows [6, 7]:

1. Telemedicine: The evaluation of study participant could be conducted through video or phone interactions with healthcare practitioners.
2. Home healthcare (HHC): A nurse or healthcare provider provides healthcare services including medication administration and collection of blood samples, at the study participant's residence.
3. Direct-to-patient (DTP): Investigational medicinal products can be delivered and administered in an at-home setting or other study-related materials can be dispensed to the participant without visiting the trial site location.
4. Internet of Healthcare Things (IoHTs)/Internet of Medical Things (IoMTs): Application of IoMT/IoHT namely:
    - Remote healthcare monitoring means checking a study participant's health while they are at home or somewhere outside a hospital or clinic, using technology. These devices collect health data and can be transferred to the Investigator,
    - Ambient Assisted living means using smart technology to help older people or people with health problems live safely and independently at home. It uses tools like sensors, smart devices, cameras or emergency buttons or health monitors to detect any unusual activity, remind patient to take their medicines or in case of emergencies alert the patient's caretaker.
    - Healthcare solutions with smartphones and wearable devices can be used to help monitor and manage health.

Other DCT elements like use of digital media for patient recruitment and retention, virtually conducting pre-selection visits or doing remote source data verification and monitoring. Additionally, electronic consenting, use of electronic signatures, completion for questionnaires electronically are also considered component of DCT.

While countries like the United States and members of the European Union have witnessed accelerated integration of DCT elements into mainstream research, adoption in developing countries, including India, has been slower and more fragmented [8, 9]. India's large population and diverse geography, infrastructure, and digital literacy provide both distinct opportunities and challenges for the implementation of DCTs. The capacity of DCTs to overcome these barriers and access underrepresented population is particularly relevant in India's rural and semi-urban areas [10]. However, regulatory uncertainties, infrastructural limitations, and a lack of standardized frameworks pose significant barriers to widespread DCT elements adoption [11, 12].

Despite growing interest, there remains limited empirical evidence on how Indian clinical researchers perceive the use and importance of DCT elements. Understanding their perspectives is essential, as these

stakeholders play a pivotal role in designing, managing, and overseeing trials. This study seeks to fill this gap by exploring the perception among clinical researchers in India regarding adoption and implementation of DCT elements.

Methodology

A questionnaire was developed using quantitative cross-sectional design to collect the data from clinical researchers in India to explore their perception on the use and importance of decentralized clinical trial (DCT) elements.

The cross-sectional survey design enables the compilation of data at a single point in time [13].

The study population comprised of industry-affiliated personnel involved in the planning, conduct, or oversight of clinical trials.

The developed questionnaire focused on the DCT uptake trend in the organization with type of DCT design and elements used with their importance. The questionnaire was pilot-tested with 5 clinical researchers to ensure clarity, relevance, and reliability. Minor modifications were made based on their feedback. Then, the questionnaire was disseminated using google forms to around 450 clinical professionals through the professional platforms during the January to April 2025. Of which, 112 responded to the survey on time giving their valuable input. This sample size target is acceptable to meet the statistical reliability.

Participation was voluntary and the questionnaire included a consent statement informing participants of the study's purpose, ensuring voluntary participation. All responses were anonymized and used solely for research purpose. The study did not include patients and therefore was exempted from the ethics review.

Descriptive statistics were utilized to summarize the data. Inferential statistics, including chi-square tests, were employed to examine associations between organization type and DCT trends in their organization.

Results

A total of 112 clinical researchers from India participated in the survey. Among the respondents, 37.5% were employed by pharmaceutical or sponsor companies, 54.5% by service provider organizations, 6.3% by universities or research institutes, and 1.8% worked independently as consultants. Regarding organizational size, 71.4% of the participants were affiliated with large companies (more than 2,500 employees), 10.7% with midsized companies (500 to 2,500 employees), and 17.9% with small companies (up to 500 employees).

Following the COVID-19 pandemic, there has been a noticeable shift in trial conduct practices among clinical research organizations in India. As illustrated in Figure 1, 78.6% of respondents reported that their organizations now prefer a hybrid approach, combining conventional and decentralized clinical trial (DCT) elements. Additionally, 11.6% indicated full implementation of decentralized components and digital technologies in their trial operations. In contrast, 9.8% of the respondents stated that their organizations continue to rely solely on conventional methods for conducting clinical trials.

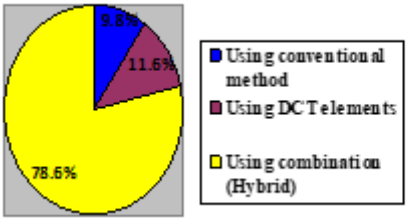

Figure 1. Post-pandemic, organization's preference of clinical trial design selection

When asked about the trend in decentralized clinical trials (DCT) over the past year, most respondents (56.8%) indicated that there had been no significant change, with an uptake of 'about the same.' However, 32.4% reported a moderate increase in the adoption of DCT elements, while a smaller proportion observed a significant increase (2.7%). On the other hand, 4.5% noted a significant decrease, and 3.6% reported a moderate decrease in DCT adoption within their organizations. Figure 2 shows a graphical representation of the DCT adoption and implementation trend in the organization during the last year.

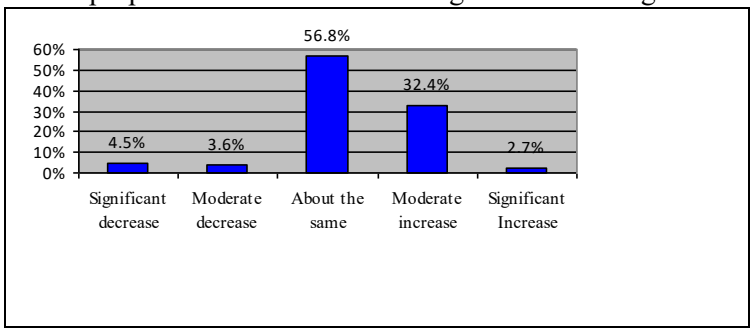

Figure 2. The Graphical Representation on Organization's Trend in Last Year in DCT Adoption and Implementation

Respondents reported involvement in a diverse range of therapeutic areas within the current drug development pipeline in the organization. Oncology emerged as the most common area, with 68.8% of clinical researchers indicating active trials in this domain. This domain was followed by metabolic and endocrine disorders (59.8%), cardiovascular diseases (58.0%), immunology & rheumatology (57.1%), and gastroenterology (51.8%). Respiratory (48.2%) and hematology (37.5%) were also frequently cited areas of ongoing research. Table 1 below represents the therapeutic indications from the ongoing trials.

Table 1. Respondent's Involvement in Ongoing Trials in the Various Therapeutic Indication

Therapeutic indication	**Ongoing trials**
Biosimilar	31.3%
Oncology	68.8%
Metabolic & Endocrine	59.8%
Cardiovascular	58.0%
Immunology and Rheumatology	57.1%
Gastroenterology	51.8%
Respiratory	48.2%
Hematology	37.5%
Infectious diseases	31.3%
Neurology	26.8%
Dermatology	25.0%
Vaccine development	18.8%
Rare diseases	15.2%
Nephrology	14.3%
Women's health	12.5%
Urology	10.7%
Cell & Gene therapy	9.8%
Critical Care	9.8%

Pediatrics	9.8%
Other	2.7%

A small proportion of respondents (2.7%) reported working in other therapeutic areas, which included ophthalmology, wound care, and herbal and traditional medicine.

The analysis of decentralized clinical trial (DCT) design adoption across various therapeutic areas revealed a clear preference for hybrid trial models, which combine both conventional and decentralized elements. Hybrid designs were predominant across most therapeutic indications, accounting for 84% of studies in cardiovascular, 81.1% in immunology and rheumatology, 77.2% in hematology, 77.3% in respiratory and 75% in gastroenterology and women's health.

Fully decentralized trials reported reasonably higher adoption in dermatology (30.6%), infectious diseases (22%), metabolic and endocrine disorders (21.8%), and the "other" category (30.8%). In contrast, traditional on-site trial designs were still the most common in certain areas like critical care (62.5%), pediatrics (46.9%), rare diseases (39.4%), and oncology/cell and gene therapy (34.5%).

The uptake of fully decentralized trials remained particularly low in certain domains, with only 3.6% in oncology, 5.3% in hematology, 6.1% in rare diseases, and 6.3% in critical care, indicating the continued dependence on traditional or hybrid approaches in these complex therapeutic areas. Table 2 summarizes the detailed breakdown in percentage of the preferred DCT design adoption and implementation according to the therapeutic indication.

Table 2. Preferred DCT Design Adoption and Implementation based on the Therapeutic Indication

Therapeutic Indication	**Traditional (On-site trial)**	**Hybrid**	**Fully decentralized clinical trial**
Biosimilar	12.5%	70.8%	16.7%
Cardiovascular	8%	84%	8%
Cell and gene therapy	34.5%	55.2%	10.3%
Critical Care	62.5%	31.3%	6.3%
Dermatology	12.2%	57.1%	30.6%
Gastroenterology	11.8%	75%	13.2%
Hematology	17.5%	77.2%	5.3%
Immunology and Rheumatology	12.2%	81.1%	6.8%
Infectious diseases	10%	68%	22%
Metabolic and Endocrine	5.1%	73.1%	21.8%
Nephrology	11.1%	69.4%	19.4%
Neurology	18%	72%	10%
Oncology	34.5%	61.9%	3.6%
Pediatrics	46.9%	40.6%	12.5%
Rare diseases	39.4%	54.5%	6.1%
Respiratory	9.1%	77.3%	13.6%
Urology	18.8%	65.6%	15.6%
Vaccine development	21.6%	56.8%	21.6%
Women's health	12.5%	75%	12.5%
Other	30.8%	38.5%	30.8%

Survey answers, shown in Figure 3, showed difference in how organization adopted specific components of DCT. Remote Source Data Verification (SDV) and remote data monitoring emerged as the most widely adopted elements, reported by 84.8% of respondents. This conclusion was followed by high adoption rates for electronic signatures (76.8%), electronic questionnaires (75%), and the use of digital media for patient recruitment (71.4%). Similarly, virtual pre-site selection visits (68.8%) and the implementation of AI/ML solutions for data analysis (66.1%) also reflected strong organizational uptake. In contrast, moderate levels of adoption were observed for e-Consent (54.5%), telemedicine (50%), Internet of Healthcare/Medical Things (IoHTs/IoMTs) (50%), and home healthcare services (46.4%). Notably, the direct-to-patient (DTP) delivery of investigational products demonstrated the lowest level of adoption, reported by only 30.4% of respondents. These findings highlight that the integration of DCT elements is not consistent, with technology-based and monitoring features being used more often than innovations that focus on patient needs.

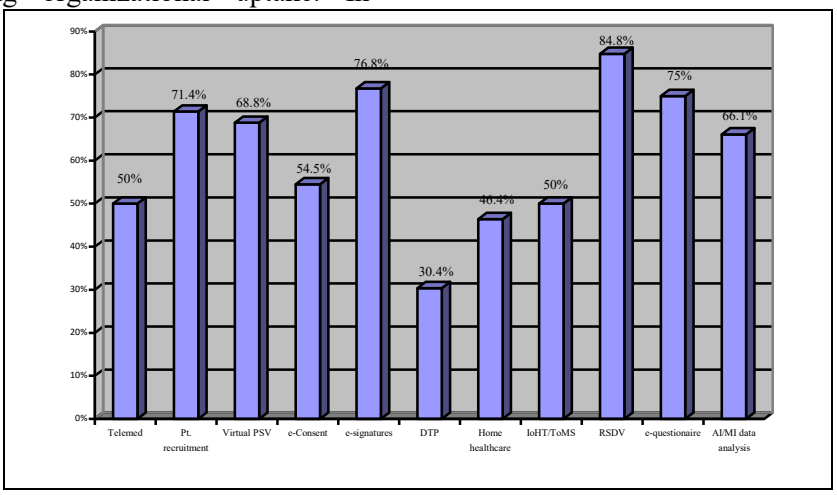

Figure 3. Uptake of DCT Elements by the Organization

The survey results shown in Figure 4 reveal that 66.1% of respondents said their organizations have a moderate level of using decentralized clinical trial (DCT) elements. A smaller proportion (14.3%) reported low adoption, while 8 % cited extremely low adoption. Interestingly, 6.3% of respondents expressed uncertainty regarding the extent of DCT adoption in their organization. Only 5.4% reported very high adoption, and notably, no respondents indicated high adoption. These results suggest that while DCT element implementation is underway in many organizations, it remains at a moderate level, with limited instances of full-scale or high-level integration.

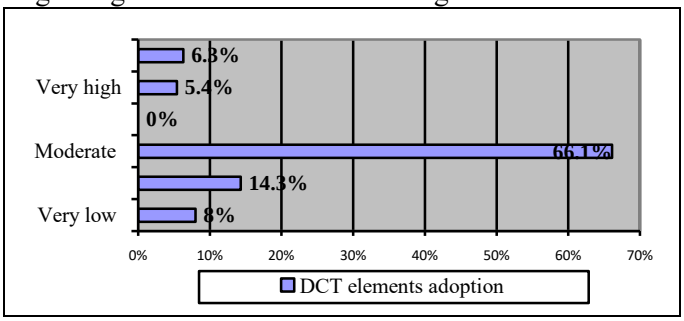

Figure 4. Organizational Adoption of DCT Elements

Association between Type of Organization and Level of DCT Elements Adoption

A chi-square test was used to examine the relationship between the type of organization and its adoption of decentralized clinical trial (DCT) elements. The analysis compared pharmaceutical/sponsor companies and service provider companies, as shown in Table 3. The results showed a meaningful link between the type of organization and how much they use decentralized clinical trial (DCT) elements (p-value = 0.045), meaning that pharmaceutical/sponsor companies and service provider companies differ in their adoption of DCT elements.

Table 3. Evaluation of Association between Organization Type & Level of Adoption of DCT Elements

Organization	Very low adoption of DCT elements	Low adoption of DCT elements	Moderate adoption of DCT elements	Very high adoption of DCT elements
Pharmaceutical/ sponsor company	2	6	33	1
Service provider company	6	7	37	5

Among pharmaceutical/sponsor companies, most respondents reported moderate adoption (n = 33), with fewer indicating low (n = 6) or very low adoption (n = 2), and only one respondent citing very high adoption. In contrast, service provider companies also showed a predominance of moderate adoption (n = 37) but had a relatively higher number of respondents reporting very high adoption (n = 5) and very low adoption (n = 6) compared to their pharmaceutical counterparts.

These findings suggest that service provider companies might show a wider range of DCT adoption levels, possibly due to different ways they operate or their different roles in running trials, while pharmaceutical/sponsor companies seem to be more focused on moderate levels of adoption.

Importance of DCT Elements:

Survey responses showed that people in India have different views on how important various decentralized clinical trial (DCT) technologies are, as shown in Table 4. Electronic Signatures were seen as the most important technology, with 54.5% of respondents saying it was ‘Totally Important’ and 31.3% saying it was ‘Important’. Other technologies that were also seen as very important included AI/ML solutions for data analysis at 36.6% & 39.3%, electronic questionnaires at 25.9% & 49.1%, remote source data verification (SDV) and remote data monitoring at 26.8% & 42.9%, smartphones and wearable devices at 21.4% & 50.9%, and virtual pre-site selection visits at 22.3% & 42.9%. Electronic signatures emerged as the most impactful technology, with 54.5% of respondents rating it as ‘Totally Important’ and 31.3% rating it as ‘Important.’ Other technologies perceived as highly important and important included AI/ML solutions for data analysis at 36.6% & 39.3%, electronic questionnaires at 25.9% & 49.1%, remote source data verification (SDV) and remote data monitoring at 26.8% & 42.9%, smartphones and wearable devices at 21.4% & 50.9%, and virtual pre-site selection visits at 22.3% & 42.9%, respectively. These findings indicate strong recognition of the value of digital and data-driven tools in enhancing trial efficiency and data quality. Patient recruitment through digital media at 45.5% was also regarded as important, reflecting a positive outlook on digital tools that support trial planning and participant engagement. Technologies such as

telemedicine, home healthcare, and e-consent were viewed as moderately to highly important.

Conversely, direct-to-patient (DTP) delivery and ambient assisted living received relatively lower perceived importance, with only 10.7% and 8%, respectively, rating them as 'totally important.' This means that while basic and data-focused DCT technologies are seen as valuable, the more complicated logistical and infrastructure-related aspects might be considered less important or harder to put into practice in the Indian clinical research environment.

Table 4. Perceived Level of Importance for Different DCT Elements in India

DCT Element	Not Important	Slightly important	Moderately Important	Important	Totally Important
Telemedicine	3.6%	13.4%	21.4%	30.4%	8.9%
Patient recruitment through digital media	6.3%	6.3%	22.3%	45.5%	13.4%
Virtual pre-selection visits	1.8%	12.5%	12.5%	42.9%	22.3%
Electronic consent (e-Consent)	4.5%	14.3%	21.4%	28.6%	13.4%
Electronic signature (e-signature)	1.8%	4.5%	5.4%	31.3%	54.5%
Direct to patient (DTP)	3.6%	8.9%	17.9%	25.9%	10.7%
Home healthcare monitoring	3.6%	6.3%	22.3%	30.4%	14.3%
Ambient assisted living	5.4%	8.9%	9.8%	19.6%	8%
Smart phones, wearable devices	1.8%	6.3%	8.9%	50.9%	21.4%
Remote source data verification (SDV) and remote monitoring	3.6%	3.6%	19.6%	42.9%	26.8%
Electronic questionnaires	2.7%	2.7%	17.9%	49.1%	25.9%
AI and ML solutions for data analysis	1.8%	2.7%	9.8%	39.3%	36.6%

Discussion

The findings of this research study offer helpful perspectives on the evolving landscape of decentralized clinical trials (DCTs) conducted in India. A total of 112 clinical researchers participated in the survey, representing a diverse cross-section of the Indian clinical research industry. Most respondents were affiliated with service provider organizations (54.5%) and large-scale companies with more than 2,500 employees (71.4%). This distribution suggests that the perspectives captured in this study largely reflect operational realities. A noteworthy observation from the study is the growing preference for hybrid models of trial conduct. A substantial 78.6% of respondents reported that their organizations had adopted a hybrid approach, combining conventional and decentralized elements. This pattern is consistent globally that pandemic served as an opportunity for digital transformation in clinical research [14]. Hybrid trials offer flexibility to maintain patient safety and data quality while improving accessibility and retention through the selective use of digital tools [15, 16].

Only 11.6% of respondents indicated that their organizations had implemented fully decentralized approaches. This finding reflects that the regulatory frameworks, infrastructure readiness, and stakeholder confidence are still developing. Despite the global momentum, the complete adoption of DCTs in India may be

hindered by concerns such as data privacy, digital literacy, and variability in technological infrastructure across urban and rural settings [17].

In contrast, 9.8% of participants reported continued reliance on conventional trial methodologies. This segment likely includes organizations that operate in niche therapeutic areas, have limited digital capabilities, or cater to populations less suited for remote interventions. It also highlights the persistent challenges of change management and the need for organizational readiness, training, and policy support for broader DCT adoption [18].

The data from this study further supports the argument that hybrid models are becoming mainstream in India, even though the complete transition to fully decentralized trials remains limited.

The distribution of respondents across different types and sizes of organizations offers an important contextual lens for interpreting these findings. Larger organizations, particularly multinational service providers and sponsors, may have better access to technological infrastructure and global protocols, thereby facilitating faster adoption of DCT practices. In contrast, smaller organizations or academic institutions may face more pronounced financial or logistical barriers to implementing such innovations [19, 20].

When examining recent trends, 56.8% of respondents reported no significant change in DCT adoption over the past year, while 32.4% noted a moderate increase. These findings suggest a plateau in momentum following the initial acceleration during the pandemic, possibly due to operational, technical, or logistical challenges [21]. A small proportion also reported decreases in DCT adoption, underscoring the variability in organizational capabilities and commitment to digital transformation.

This study highlights the varying patterns of decentralized clinical trial (DCT) adoption across therapeutic areas within India's clinical research landscape. Oncology emerged as the most actively pursued therapeutic domain, with 68.8% of respondents involved in trials related to cancer, aligning with global trends in oncology R&D investments. Other prominent areas included metabolic and endocrine disorders, cardiovascular diseases, and immunology—reflecting India's growing burden of non-communicable diseases and the corresponding research priorities [22].

The analysis reveals a distinct preference for hybrid trial designs across most therapeutic domains. This model was especially dominant in cardiovascular (84%), immunology and rheumatology (81.1%), and hematology (77.2%) trials. Using hybrid models shows they can keep the trial's quality while adding features that focus on the patient, like remote monitoring, online consultations, and collecting data electronically. These designs are particularly useful in managing chronic conditions that require long-term follow-up but benefit from reduced patient burden [23-28].

Notably, fully decentralized trials were more commonly implemented in dermatology (30.6%), infectious diseases (22%), and metabolic and endocrine disorders (21.8%). These areas are more suited for remote and digital trial models due to less intensive monitoring requirements and the feasibility of virtual assessments [29-32]. Conversely, adoption of fully decentralized models remained minimal in difficult and high-risk areas such as oncology (3.6%), hematology (5.3%), and critical care (6.3%). These therapeutic areas often involve specialized interventions, complex logistics, and frequent in-person assessments, necessitating continued reliance on conventional or hybrid trial structures [33-35].

Additionally, areas like pediatrics and rare diseases had low adoption of DCTs, probably because of ethical issues, challenges with informed consent and difficulties in using digital tools for children [36]. These findings demonstrate the importance of tailored DCT

strategies that align with the clinical and operational realities of each therapeutic area.

Overall, while hybrid trial designs are becoming popular across therapeutic domains in India, the full decentralization of trials is still limited by disease complexity, trial requirements, and regulatory factors. This nuanced adoption pattern shows that Indian research organizations are being pratical toward integrating DCTs based on feasibility and therapeutic context.

The survey results reveal that the implementation of decentralized clinical trial (DCT) elements in India is presently moderate, with 66.1% of respondents indicating this level of adoption within their organizations. Only a small minority reported very high adoption (5.4%), and notably, no respondents cited high adoption, underscoring a cautious and incremental integration of DCT components in clinical research operations. These findings reflect the transitional stage of DCT deployment in India; organizations are engaging with DCT models, but full-scale integration remains limited. This moderate uptake may be attributed to a variety of factors, including regulatory ambiguity, infrastructural limitations, and concerns over data security and reliability in remote settings [37]. The uncertainty expressed by 6.3% of respondents further highlights the evolving nature of organizational strategies and the potential lack of internal clarity on DCT initiatives. Similar transitional trends have been observed globally, where hybrid models serve as a bridge toward fully decentralized frameworks [15].

Additionally, the low percentage of respondents reporting low (14.3%) or extremely low (8%) adoption suggests that while DCTs are being considered or partially implemented, there are still challenges for their wider use. Organizational readiness, digital literacy, and availability of validated technologies remain critical enablers for broader DCT integration [17].

Overall, these findings emphasize that while DCT adoption is progressing in India, it is largely characterized by moderate engagement, with substantial scope for policy support, infrastructure strengthening, and stakeholder training to facilitate higher levels of adoption.

The result from the Chi-Square Test of Independence showed a significant association between the type of organization and the level of adoption of decentralized clinical trial (DCT) elements in India ($p = 0.045$). This indicates that organizational affiliation—whether a pharmaceutical/sponsor company or a service provider plays a role in shaping the extent to which DCT elements are integrated into clinical research practices. While both organizational types showed a predominance of moderate adoption, service providers exhibited a broader range of adoption levels, including a relatively higher incidence of both very high and very low adoption. This variability may reflect the diverse operational scopes and strategic priorities of service providers, who often manage multiple trial functions such as remote monitoring, digital data capture, and site support, across different sponsor organizations. Pharmaceutical and sponsor companies, in contrast, showed a more concentrated trend towards moderate adoption. This observation may suggest a cautious, centralized approach to DCT implementation, possibly driven by regulatory uncertainty, the need for internal capacity building, or the prioritization of traditional trial paradigms. This aligns with earlier research highlighting that sponsor organizations tend to proceed with incremental adoption of DCT elements to ensure compliance and data integrity, particularly in emerging markets like India, where infrastructure and regulatory frameworks are still evolving [38].

Survey responses further underscored the perceived importance of specific DCT technologies. Electronic Signatures were rated as the most critical, with 85.8% of respondents marking them as either "Totally Important" or

"Important." This finding supports previous literature suggesting that technologies ensuring regulatory compliance and documentation integrity are among the first to be adopted in DCT strategies. Similarly, AI/ML-driven analytics, remote source data verification (SDV), and electronic questionnaires were seen as vital tools to improve trial efficiency and data accuracy, reinforcing findings from other studies on digital transformation in clinical research [39, 40].

Interestingly, more complex logistical elements such as Direct-to-Patient (DTP) delivery and Ambient Assisted Living were ranked lower in importance. This likely reflects infrastructural challenges, logistical constraints, and concerns around cost-effectiveness and scalability in the Indian context [7]. These findings highlight a practical prioritization among Indian clinical researchers on favoring scalable, digital-first tools over infrastructure-heavy solutions.

Overall, these results suggest a growing but cautious adoption of DCTs in India, with an emphasis on regulatory-compliant digital tools and data management solutions. The wider use of DCTs in India may show that service providers are the key players in helping to connect sponsor with decentralized methodologies. For wider DCT implementation in India, tailored strategies that address infrastructural readiness, regulatory clarity, and stakeholder-specific barriers are essential.

Conclusion

This study provides valuable information about how decentralized clinical trials (DCT) are being adopted in India, based on views from 112 clinical researchers from various organizational settings. The results show a noticeable move towards hybrid trial models, with 78.6% of respondents saying they use a mix of traditional and decentralized methods in their research. This trend reflects a pragmatic approach wherein flexibility, patient accessibility, and operational continuity are prioritized, particularly in the post-pandemic research landscape.

Despite global momentum, fully decentralized trials remain underutilized in India, with only 11.6% reporting their adoption. This finding suggests that significant structural and regulatory challenges persist, including concerns around data privacy, digital literacy, and uneven technological infrastructure. The association between organizational type and DCT adoption levels, as evidenced by a statistically significant result, further underscores that strategic direction, resource availability, and operational roles influence the extent of DCT implementation.

Therapeutic areas also play a critical role in shaping DCT strategies. Hybrid models were especially prevalent in trials related to chronic and complex conditions such as cardiovascular diseases, immunology, and oncology, where patient safety and long-term follow-up are critical. Conversely, fully decentralized approaches were more feasible in therapeutic areas like dermatology and infectious diseases, which require less intensive in-person monitoring. Indian sponsor and service provider companies must promote the use of DCT technologies for their clinical trials at the pilot level to evaluate their feasibility.

Technological adoption was similarly varied, with strong emphasis placed on regulatory-compliant digital tools such as electronic signatures and remote data verification, while more logistically demanding solutions like direct-to-patient (DTP) delivery were ranked lower in importance. This prioritization reflects a strategic focus on scalable and cost-effective innovations, particularly among service providers who often serve as operational intermediaries.

Overall, the study underscores a cautious yet progressive transition toward decentralized methodologies in India, led predominantly by hybrid models. To facilitate broader and more effective DCT element adoption, there is a need for policy support, infrastructure development,

stakeholder training, and therapeutic area-specific frameworks. These efforts will be essential to overcoming existing barriers and ensuring that the benefits of decentralization, such as increased trial efficiency, participant reach, and data integrity can be fully realized within the Indian clinical research ecosystem.

The limitation of this study is that self-reported survey data may influence how the responses are interpreted. The sample is varied, but it may not completely reflect every stakeholder in the Indian clinical research ecosystem. The survey's cross-sectional design restricts its ability to identify trends.

Future research should aim at longitudinal studies to evaluate hybrid and decentralized models long-term effects on trial results, patient participation, and operational efficiency, longitudinal studies are needed.

Conflict of Interest

The author declare no potential conflict of interest with respect to the research, authorship and or publication of this article.

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The Influence of Cultural Beliefs and Norms on Preventive Health Measures for Measles-Related Child Mortality in Selected Countries of Africa

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Abstract

This study examines the influence of cultural beliefs and social norms on the uptake of preventive health measures against measles-related child mortality in five high-burden African countries: Nigeria, the Democratic Republic of Congo (DRC), Chad, Ethiopia, and South Sudan. Drawing on a systematic review of peer-reviewed literature and global health databases, the study explores how sociocultural factors interact with vaccine acceptance and health-seeking behaviors across diverse settings. Despite measles vaccine efficacy exceeding 98% in infants, uptake remains suboptimal. As of 2023, the estimated measles immunization coverage (MCV1) stood at 54% in Chad, 56% in South Sudan, 61% in DRC, 65% in Ethiopia, and 63% in Nigeria - far below the 95% threshold needed for herd immunity (WHO/UNICEF, 2023). Cultural determinants - such as religious conservatism in northern Nigeria, traditional healing preferences in Ethiopia, and vaccine-related myths in the DRC and Chad - significantly hinder immunization efforts. In conflict-affected regions like the DRC and South Sudan, systemic health service collapse has amplified distrust and misinformation, contributing to over 7,000 measles-related deaths in DRC's 2019–2020 outbreak alone. Conversely, the study identifies cultural enablers: religious leaders, community elders, and localized communication (e.g., radio, storytelling) have successfully bolstered vaccine uptake when effectively mobilized. However, a critical gap remains in longitudinal and participatory research needed to guide culturally responsive policy. The study concludes that measles prevention in Africa requires not only biomedical solutions but also culturally embedded strategies that foster trust, inclusivity, and local ownership of health interventions.

Keywords*: Africa, Chad, Child Mortality, Cultural Beliefs, DRC, Ethiopia, Immunization Coverage, Measles, Nigeria, South Sudan, Vaccine Uptake.*

Introduction

Despite significant advancements in public health and immunization programs, measles remains a leading cause of vaccine-preventable deaths among children under five years in Africa. Measles-related mortality persists not only due to systemic gaps in healthcare infrastructure but also due to deeply entrenched cultural beliefs, social norms, and religious convictions that influence public perception and acceptance of preventive health measures [31]. In many African societies, health-seeking behaviors, including attitudes toward vaccination, are significantly shaped by traditional worldviews, religious ideologies, and communal patterns of behavior [4]. Sub-Saharan Africa bears a disproportionate burden of measles-related child mortality. Countries

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such as Nigeria, Democratic Republic of Congo (DRC), Chad, Ethiopia, and South Sudan have experienced recurrent measles outbreaks with high case fatality rates, often exacerbated by vaccine hesitancy and limited access to routine immunization services [32]. In South Sudan, for example, a recent analysis revealed that 55% of respondents believed that belief systems directly hinder efforts to reduce measles-related child mortality, while 37.5% recognized the negative impact of cultural values and norms on health system effectiveness. The remaining respondents emphasized the role of "civility" - public awareness and understanding - as a crucial factor in fostering acceptance of immunization initiatives.

South Sudan's cultural and religious landscape is predominantly shaped by traditional animist beliefs. The Dinka and Nuer ethnic groups, for instance, view health and illness through the lens of spiritual causality, attributing disease to supernatural forces such as ancestral wrath or spirit possession [13, 14]. Such interpretations often lead communities to prioritize ritual healing over biomedical interventions, consequently delaying or rejecting vaccination. This phenomenon creates a substantial barrier for healthcare providers attempting to implement immunization campaigns, especially in remote and conflict-affected areas.

Similar patterns are observable across various African contexts. In Nigeria, cultural resistance to vaccination was notably manifest in the northern states during polio and measles immunization campaigns, largely fueled by rumors, religious objections, and mistrust in Western medicine [29]. In Ethiopia, traditional beliefs associating measles with curses or divine punishment have been linked to delays in seeking formal medical care [32]. In Mali and Burkina Faso, community norms often prioritize male decision-making authority, influencing whether children receive timely vaccinations [9].

In Central Africa, the DRC has struggled with vaccine hesitancy rooted in suspicion of international aid programs, while in Chad and the Central African Republic, low literacy rates and minimal health education have undermined awareness about vaccine benefits [33, 34, 35, 36]. Meanwhile, in East African countries like Uganda and Kenya, religious sects with apocalyptic beliefs have resisted state-led immunization campaigns, claiming they violate divine laws or precede end-time events [27].

Despite these challenges, measles is a highly preventable disease. With over 95% of cases preventable through two doses of a safe and effective vaccine, the issue lies not in vaccine efficacy but in vaccine delivery and uptake [10. 11]. However, successful vaccination efforts must go beyond biomedical provision to include culturally informed strategies that engage with communities in a respectful and participatory manner. This includes integrating community leaders, respecting traditional hierarchies, addressing myths, and adapting public health messaging to local contexts [16, 17, 18]. The South Sudan case, where 220 out of 400 respondents recognized the influence of belief systems on measles-related child mortality, exemplifies the critical need to understand and incorporate cultural contexts into health planning. These findings underscore the necessity of a culturally sensitive approach that addresses social determinants of health, acknowledges the influence of traditional knowledge systems, and fosters trust between communities and healthcare providers.

Therefore, this study investigates the influence of cultural beliefs and social norms on preventive health measures related to measles in selected African countries, including but not limited to South Sudan, Nigeria, Ethiopia, Kenya, Uganda, the DRC, Chad, Central African Republic, Mali, and Burkina Faso. By exploring how these sociocultural dimensions shape attitudes and behaviors toward measles vaccination, the research aims to provide actionable insights for policy formulation and

program implementation that are both culturally competent and public health effective.

Methodology

For the proper analysis of the existing literature on the topic**,** a systematic literature review with a qualitative synthesis (thematic analysis) methodology would be used for the study. This is because the topic is exploratory, cross-cultural, and involves the intersection of sociocultural constructs and public health behavior, which requires synthesizing diverse forms of evidence (qualitative, quantitative, policy-based).

Study Design

This is a narrative (scoping) review combined with a qualitative thematic synthesis**,** is appropriate. This allows structured data extraction, appraisal, and synthesis of both empirical studies and grey literature (e.g., NGO and government reports).

Objectives of the Review

1. To identify and describe cultural beliefs and norms influencing measles vaccination uptake.
2. To explore how these sociocultural factors, impact preventive health strategies.
3. To compare the findings across Nigeria, DRC, Chad, Ethiopia, and South Sudan.

Search Strategy

To ensure a comprehensive and multidisciplinary exploration of the topic, a strategic literature search was conducted across six reputable databases, each selected for its relevance to public health, biomedical sciences, and regional scholarship. The search began with PubMed, a widely used biomedical database managed by the U.S. National Library of Medicine and the National Institutes of Health. PubMed offers access to over 35 million citations from MEDLINE, life science journals, and online books, making it a foundational resource for health-related literature [Table 1].

Next, Scopus was utilized to broaden the scope beyond biomedical sciences. As one of the largest abstracts and citation databases, Scopus - owned by Elsevier - indexes research spanning scientific, technical, medical, and social science fields, as well as the arts and humanities. With coverage of more than 25,000 journals, it provided a valuable interdisciplinary perspective. The search also included the Web of Science (WoS), a trusted database managed by Clarivate. WoS offers access to key indexes such as the Science Citation Index, the Social Sciences Citation Index, and the Arts & Humanities Citation Index, thereby supporting a diverse and high-quality evidence base [Table 1].

To capture grey literature and additional scholarly content, Google Scholar was employed. This freely accessible search engine aggregates academic work across various formats and disciplines, including articles from universities, publishers, and professional organizations. Given the African context of the study, African Journals Online (AJOL) was an essential inclusion. AJOL hosts over 500 journals from 32 African countries, many of which are open access and offer contextually relevant insights often underrepresented in global databases. Finally, the WHO Global Health Library (GHL) was searched to access public health literature from low- and middle-income countries. The GHL includes regional databases such as AFRO, PAHO, and EMRO, making it a critical resource for capturing research outputs from the Global South. This multi-database strategy ensured a rich and geographically diverse collection of literature, strengthening the evidence base for the study [Table 1], [Figure1].

Table 1. Statistical Analysis of Databases Used for Literature Review

Database	Number of Reviews	Percentage Contribution (%)
PubMed	28	28%
Google Scholar	20	20%
Scopus	18	18%
Web of Science (WoS)	15	15%
African Journals Online (AJOL)	12	12%
WHO Global Health Library	7	7%
Total	**100**	**100%**

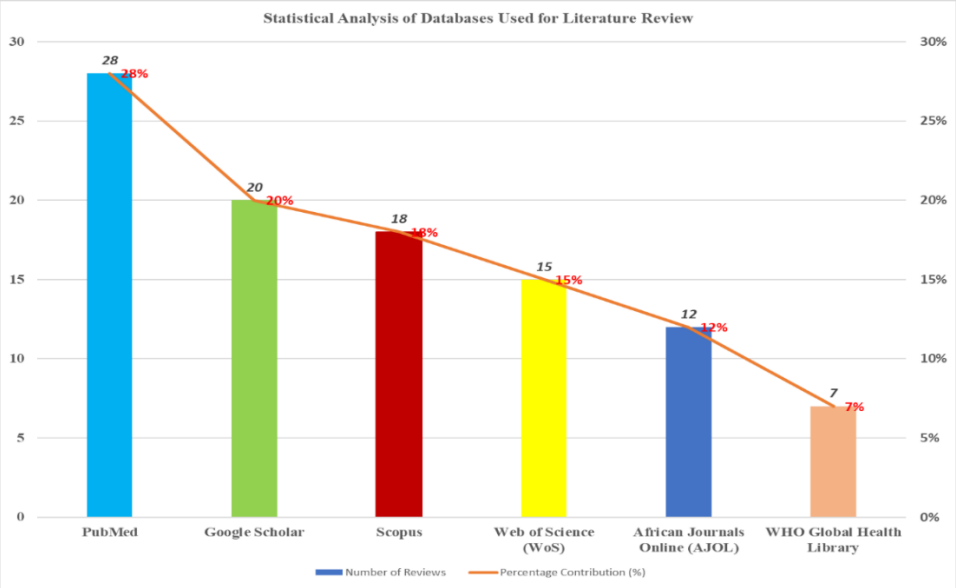

Figure 1. Statistical Analysis of Databases Used for Literature Review

Interpretation

In the literature review process, PubMed emerged as the most utilized database, contributing 28% of the sources reviewed. This reflects its prominence in providing access to biomedical and public health literature, particularly relevant to measles, vaccination efforts, and child mortality. Google Scholar followed, accounting for 20% of the reviewed materials. Its strength lies in indexing a broad range of grey literature and regionally published works that are often absent from traditional academic databases.

Collectively, Scopus and Web of Science contributed 33%, highlighting their importance in delivering peer-reviewed, interdisciplinary, and internationally sourced research that spans both medical and social science fields. Meanwhile, African Journals Online (AJOL) and the WHO Global Health Library together represented 19% of the sources. Their inclusion was critical in ensuring the review captured Africa-specific studies and culturally contextual public health data - elements essential for understanding the influence of beliefs and norms on measles prevention across the selected countries [Table 1, 2], [Figure 1].

Table 2. Summary Comparison Table

Database	Focus	Strengths	Best Use Case
PubMed	Health/medicine	Peer-reviewed journals, medical MeSH terms	Clinical/public health literature
Scopus	Multidisciplinary	Citation tracking, metrics, broad coverage	Analyzing trends, comparing authors/countries
Web of Science	High-impact, cross-disciplinary	Citation networks, impact analysis	Systematic reviews, research impact assessments
Google Scholar	General academic search	Broad scope, grey literature	Finding theses, reports, or open-access studies
AJOL	African academic journals	Regional focus, African authors	Culturally contextualized African research
WHO GHL	Global public health	Governmental reports, regional data	Health systems, policy-level insights in Africa

Inclusion Criteria

1. Articles published in English from 2013 to 2024 (to capture recent developments and trends).
2. Peer-reviewed articles, official reports (WHO, UNICEF, ministries of health).
3. Studies conducted in or reporting on Nigeria, DRC, Chad, Ethiopia, and South Sudan.
4. Studies focusing on cultural, religious, social, and normative influences on measles prevention or vaccine hesitancy.

Exclusion Criteria

1. Articles that do not focus on measles or child mortality.
2. Studies with no cultural or socio-behavioral dimension.
3. Non-African studies unless comparative insights are provided.

Data Extraction

The researcher used standardized data extraction sheet to gather:

1. Study location and population
2. Year and type of study
3. Study aims
4. Cultural beliefs and norms identified
5. Reported effects on measles prevention or vaccination
6. Policy or programmatic recommendations

Quality Appraisal

Critical Appraisal Skills Programme - (CASP) and Mixed Methods Appraisal Tool (MMAT) were used to assess the quality of included studies, based on:

1. Credibility
2. Transferability
3. Dependability
4. Confirmability

Data Synthesis

The author used thematic analysis to group findings under major themes such as:

1. Beliefs about disease causation (spiritual vs biomedical)
2. Influence of religious leaders
3. Gender roles and decision-making in health
4. Mistrust in foreign interventions
5. Impact of traditional healing systems
6. Community perception of vaccination campaigns

A comparative lens will be applied to contrast similarities and differences between the five countries.

Ethical Consideration

Since this is a literature-based study, ethical approval is not required**.** However, proper

referencing and acknowledgment of sources are critical.

Output

1. A detailed synthesis organized by themes and countries.
2. A table summarizing key findings per country.
3. Policy implications and culturally sensitive recommendations for measles immunization programs.

Conceptual Clarification

To ground this study in a coherent theoretical and contextual framework, it is necessary to clarify the meanings of the central concepts used in the research. These include: cultural beliefs, social norms, preventive health measures, and measles-related child mortality. These concepts are interlinked and form the backbone of the study's examination of how sociocultural variables influence health behaviors and outcomes in different African settings.

Cultural Beliefs

Cultural beliefs refer to the shared ideas, values, and understandings that people in a community hold about life, health, illness, and death. These beliefs are transmitted from one generation to another and significantly influence perceptions and decisions about healthcare, including immunization and disease prevention. In many African communities, cultural beliefs surrounding childhood illnesses like measles are deeply rooted. For instance, in some rural parts of Nigeria and South Sudan, measles is believed to be a "normal" stage of child development rather than a preventable disease [12, 13, 31, 32]. In other cases, some communities attribute measles to spiritual causes or ancestral displeasure, which discourages the use of modern medical interventions like vaccination [30, 31]. For instance, in some regions of Chad, mothers may prefer using traditional herbs or consulting a spiritual healer when a child presents measles symptoms, instead of seeking formal healthcare [34]. Definition: Cultural beliefs can therefore be defined as community-held convictions or understandings about health, illness, and life events that shape health-seeking behaviors and responses to disease [13, 14, 15].

Social Norms

Social norms are the implicit or explicit rules that govern acceptable behavior within a group or society. They are often enforced through social approval or disapproval and significantly shape individual and group behavior in areas such as health, hygiene, and child-rearing. In the context of measles prevention, social norms can influence whether families accept or reject vaccines. For example, in Ethiopia and parts of the DRC, if the dominant opinion in a village is that vaccines are dangerous or un-Islamic, individuals who choose to vaccinate may be ostracized [22, 23]. Example: In certain South Sudanese communities, mothers are discouraged from leaving their homes during postpartum seclusion periods—even for vital immunization appointments - due to prevailing social expectations [28]. Definition: Social norms can be defined as the informal understandings that govern behavior within a community, especially those related to communal expectations about health practices and decision-making [14, 15, 16, 17].

Preventive Health Measures

Preventive health measures refer to proactive actions taken to avoid disease, improve health, and reduce the risk of mortality. These measures include immunization, health education, vitamin A supplementation, sanitation, and timely health-seeking behavior. In relation to measles, preventive health measures primarily include the administration of the measles-containing vaccine (MCV1 and MCV2), maintaining herd immunity, ensuring cold chain management, and promoting awareness campaigns about early symptom recognition and treatment. Example: Nigeria

and Ethiopia have adopted periodic measles Supplemental Immunization Activities (SIAs) to target children in hard-to-reach areas and increase coverage [39, 40]. Definition: Preventive health measures are defined as evidence-based interventions designed to preempt the onset or spread of diseases, especially among vulnerable populations such as children under five [18, 19].

Measles-Related Child Mortality

Measles-related child mortality refers to deaths among children, typically under the age of five, that are directly caused by measles or its complications such as pneumonia, diarrhea, and encephalitis. These deaths are often preventable through timely vaccination and supportive care. Measles remains a leading cause of vaccine-preventable death among children in Africa. According to WHO [39, 40], over 140,000 people died from measles globally in 2022, with a significant proportion of those deaths occurring in African countries such as the Democratic Republic of Congo and Chad, due to low immunization coverage and fragile health systems. Example: In conflict-affected areas of South Sudan, limited access to health services and cultural resistance to vaccination have led to recurrent measles outbreaks with high mortality among unvaccinated children [26]. Definition: Measles-related child mortality can be defined as death among children under five resulting from complications of the measles virus, often exacerbated by malnutrition, poor healthcare access, and low vaccination coverage [39, 40].

Theoretical Framework

These are the relevant theories and models guiding understanding of health behavior and intervention uptake.

Health Belief Model (HBM)

The Health Belief Model (HBM) is one of the oldest and most widely used frameworks for understanding health-related behavior. It posits that an individual's willingness to engage in a health behavior (e.g., vaccinating a child against measles) depends on their perception of:

1. Perceived susceptibility (how likely their child is to get measles),
2. Perceived severity (how serious they think measles is),
3. Perceived benefits (whether they believe vaccination will help),
4. Perceived barriers (logistical, cultural, or religious barriers),
5. Cues to action (external triggers such as health campaigns or outbreaks), and
6. Self-efficacy (confidence in their ability to access and complete the vaccination process) [3, 30]. Example: In Chad, some mothers may not perceive measles as severe or may believe that traditional remedies are more effective. This lowers their perceived benefit of vaccination and increases reliance on cultural alternatives [34].

Theory of Planned Behavior (TPB)

The Theory of Planned Behavior suggests that health behavior is driven by:

1. Attitudes **t**oward the behavior,
2. Subjective norms (social pressure from family, religious leaders, peers), and
3. Perceived behavioral control **(**perceived ease or difficulty of performing the behavior) [3]. Example: In rural South Sudan, even if a mother believes in the importance of immunization, the community norm may discourage interaction with government health workers, and poor road networks reduce perceived behavioral control - leading to vaccine avoidance [4, 6, 13, 14, 15, 26].

Social Ecological Model (SEM)

The Social Ecological Model provides a multi-layered framework for understanding how individual behavior is influenced by broader factors:

1. Individual (knowledge, attitudes),

2. Interpersonal (family and peers),
3. Community (local norms and traditions),
4. Organizational (health system access),
5. Policy **(**national immunization policies and conflict settings) [29, 37]. Example: In the DRC, systemic issues like health worker shortages and political instability at the organizational and policy levels interact with cultural beliefs at the community level to influence vaccination rates.

Social Norms Theory

Social Norms Theory emphasizes that people's behavior is influenced by their perceptions of what is "normal" or socially acceptable within their community [30]. Norms may be:

1. Descriptive norms: what others are actually doing (e.g., most mothers do not vaccinate),
2. Injunctive norms**:** what others think one *should* do (e.g., spiritual leaders discouraging hospital visits).

Example: In northern Nigeria, resistance to immunization is reinforced by religious beliefs and community leaders who question the safety and intention of vaccines, creating a norm of noncompliance [12, 31].

Cultural Competence Model

The Cultural Competence Model [7, 14] focuses on tailoring health interventions to the cultural context of the target population. It promotes:

1. Cultural awareness (recognizing one's own biases),
2. Cultural knowledge (learning about others' values and health practices),
3. Cultural skill **(**ability to conduct culturally sensitive assessments), and
4. Cultural encounter (direct engagement with community members).

Example: In Ethiopia, understanding the beliefs of pastoralist communities and engaging their elders before launching a vaccination campaign increased vaccine uptake through culturally adapted messaging [1, 28, 32]

Diffusion of Innovations Theory

This theory by Everett Rogers 2003 explains how new ideas and practices spread through a population. Adoption of health innovations such as vaccines is influenced by:

1. Innovators and early adopters (e.g., educated mothers),
2. Communication channels (e.g., radio, community meetings),
3. Social system (e.g., influence of religious and traditional leaders), and
4. Perceived attributes of the innovation (e.g., relative advantage, compatibility with existing beliefs).

Example: In Nigeria, vaccination uptake increased in some communities after influential local chiefs and religious leaders publicly endorsed the practice, serving as early adopters to model positive behavior [12, 30].

Conclusion on Theoretical Application

These models collectively emphasize that health behaviors are shaped not just by individual knowledge or motivation, but by a complex interaction of cultural, social, economic, and systemic factors. When designing measles prevention interventions in countries like Nigeria, Chad, or South Sudan, applying these theories helps in:

1. Diagnosing the root causes of vaccine hesitancy,
2. Designing culturally appropriate education campaigns,
3. Building interventions that are accepted and sustainable.

Overview: Measles and Child Mortality in Africa

Measles continues to be a critical public health challenge across Africa, particularly among children under five years of age. According to the World Health Organization (WHO), the African region witnessed a sharp increase in confirmed measles cases between

2017 and 2021, rising from 69 to 560 cases per million people. This surge in infections corresponded with a dramatic rise in measles-related deaths, from approximately 61,000 to 104,600 annually. While a slight decline to 66,200 deaths was noted in 2021, the figures still reflect a major health crisis [39]. Between 2000 and 2008, measles remained among the leading causes of under-five mortality, especially in countries with routine vaccination coverage below 65% [33].

In Nigeria**,** measles represents one of the highest burdens on child health. Between 2022 and 2023, Nigeria reported 12,245 confirmed cases, making it the country with the second-highest incidence rate in Africa, at roughly 103 cases per million [22, 23, 24]. Although vaccine effectiveness in Nigeria is estimated at a high 98.4% among infants, persistent challenges - such as low routine immunization coverage in rural communities, logistical difficulties, and cultural resistance - have continued to drive recurrent outbreaks and under-five deaths [12, 31]. The Democratic Republic of Congo (DRC) has similarly experienced the devastating impacts of measles. During the 2019–2020 outbreak, approximately 380,000 individuals were infected, with over 7,000 deaths reported, the majority among children under five [29, 37]. Pre-outbreak routine immunization coverage stood at only 57%, and the situation was worsened by widespread insecurity, community mistrust, and the suspension of vaccination programs during the COVID-19 pandemic. Vaccine effectiveness in DRC varies significantly - estimated at 54% in semi-urban areas and up to 79% in rural regions [29 37].

In Chad**,** routine immunization coverage was alarmingly low prior to the 2018 outbreak, with only 37% of one-year-olds vaccinated. This structural weakness has led to frequent outbreaks and elevated child mortality. Regional vaccine effectiveness ranges from 40% to 78%, and Chad appears to be on the lower end of this scale due to deep-seated issues in healthcare infrastructure [34]. Ethiopia recorded the highest number of confirmed measles cases in Africa in 2023, totaling approximately 16,505 cases [1, 28, 32]. The vaccine efficacy in Ethiopia, estimated between 72% and 75%, remains below the WHO's recommended threshold. Access to vaccines is particularly poor among pastoralist communities and populations in rural and conflict-prone zones, which has led to significant inequities in coverage and increased mortality [1]. In South Sudan**,** the health system has been significantly weakened by ongoing conflict and poor infrastructure. With an under-five mortality rate of about 135 per 1,000 live births, the country remains highly vulnerable to measles outbreaks. During 2023, approximately 7,957 suspected cases were reported. Routine immunization systems are fragmented, and cultural practices such as seclusion during illness further hinder vaccine uptake, increasing the risk of death among young children [4, 6, 13].

A comparative analysis of these five countries reveals a complex pattern of challenges. Nigeria’s efforts show that even with highly effective vaccines, success depends on reaching remote areas and addressing community hesitancy. The DRC must focus on rebuilding trust and restoring vaccination campaigns in conflict zones. In Chad and Ethiopia, strengthening health systems and tailoring vaccine delivery - such as through mobile outreach - can enhance coverage among underserved populations. For South Sudan, conflict resolution, cultural negotiation, and innovative delivery models such as using community health workers are essential [Table 3].

Inference

This overview demonstrates that measles continues to contribute significantly to child mortality across Africa, particularly in Nigeria, the DRC, Chad, Ethiopia, and South Sudan. The disease thrives where immunization coverage is low, health systems are fragile, and

socio-cultural barriers remain unaddressed. While vaccine effectiveness is generally high, it alone cannot counteract the effects of inadequate delivery systems, conflict, and mistrust. Therefore, tackling measles-related child mortality in Africa requires context-specific, multifaceted strategies that integrate health system strengthening, cultural engagement, and equitable vaccine access [Table 3].

Table 3. Comparative Summary

Country	Recent Confirmed Measles Cases (2023)	Incidence (per million)	Vaccine Effectiveness	Routine Coverage Issues	Mortality Drivers
Nigeria	~12,245	~103	~98.4%	Gaps in rural areas	Sub-optimal reach, vaccine hesitancy
DRC	~10,662	Not reported for 2023	54–79%	Insecurity, supply cutoff	Collapse of campaigns, deaths ~7,000
Chad	Not specified	Likely low incidence	~40–78%	~37% vaccinated	Weak systems, recurring outbreaks
Ethiopia	~16,505	~154	~72–75%	Rural/pastoralist gaps	Access, equity issues
South Sudan	Suspected ~7,957	Not specified	Unknown (expected low)	Conflict, infrastructure collapse	Cultural barriers, seclusion, low coverage
Country	Recent Confirmed Measles Cases (2023)	Incidence (per million)	Vaccine Effectiveness	Routine Coverage Issues	Mortality Drivers

Justification for Study Locations

The selection of Nigeria, the Democratic Republic of Congo (DRC), Chad, Ethiopia, and South Sudan as study locations is based on their disproportionately high burden of measles-related child mortality and persistent challenges in vaccine uptake. These countries consistently report some of the highest measles incidence rates in Africa, with Nigeria and Ethiopia recording over 12,000 and 16,000 confirmed cases respectively in 2023 alone [22, 23, 24]. DRC's 2019–2020 outbreak resulted in over 7,000 child deaths, highlighting systemic gaps in immunization and public health infrastructure [39]. Chad has among the lowest routine coverage rates (<40%) [34], while South Sudan faces compounded risks due to conflict, cultural practices, and weak health systems [4, 6, 13,14, 14]. Each country represents a unique intersection of cultural, structural, and socio-political barriers that hinder measles prevention efforts. Their inclusion provides a comparative framework to understand how local beliefs and norms influence the acceptance and implementation of preventive health measures, particularly in resource-constrained and culturally diverse settings.

Research Gaps

Based on the literature reviewed for the study title, several research gaps and recommended areas for further studies have been identified:

Limited Country-Specific Ethnographic Insights:

Although various studies cover general vaccine uptake and measles-related mortality across Africa, there remains a significant gap in qualitative, ethnographic data that explore the cultural beliefs and local norms influencing immunization behavior at the community level

in countries like Chad, South Sudan, and rural areas of Ethiopia. Much of the literature (especially from PubMed and Scopus) tends to emphasize biomedical or epidemiological data, with insufficient focus on socio-cultural determinants [16, 17].

Scarcity of Contextual Studies on Vaccine Hesitancy:

Research on vaccine hesitancy in sub-Saharan Africa is growing but remains sparse in conflict-affected or highly mobile populations, such as those in the Democratic Republic of Congo (DRC) and South Sudan. Few studies investigate how religious or traditional belief systems interact with misinformation to influence parental decision-making in these regions [8].

Insufficient Disaggregation by Subgroups:

Most available literature tends to present data in aggregated national forms, which masks disparities within countries - such as between urban vs. rural, or stable vs. conflict-affected populations. There is little clarity on how ethnic, religious, or linguistic differences within countries like Nigeria and Ethiopia influence attitudes toward measles vaccination.

Minimal Integration of Indigenous Knowledge Systems:

The literature often omits how indigenous health practices or traditional authority figures - such as tribal elders, community healers, or spiritual leaders - impact vaccine perceptions. Understanding how these local institutions either support or resist public health campaigns is essential for effective intervention design [38].

Gaps in Longitudinal and Mixed-Methods Studies:

Most reviewed studies were cross-sectional or quantitative. Longitudinal studies that track changes in cultural attitudes over time or mixed-methods approaches combining survey data with qualitative interviews are rare, yet critical for capturing evolving norms and their health implications [20, 21].

Recommended Areas for Further Research

Community-Based Participatory Research (CBPR):

Future studies should engage in CBPR approaches to co-develop culturally sensitive strategies with local populations. This is particularly important in areas with persistent mistrust of governmental or international health systems, such as parts of DRC and South Sudan.

Role of Religious and Traditional Institutions:

Investigating the roles played by faith-based organizations, spiritual leaders, and traditional birth attendants in shaping public opinion about vaccines would yield valuable insights for targeted health communication.

Health Communication and Misinformation Mapping:

Research is needed to map out sources and channels of vaccine-related misinformation, especially on social media and local radio, and how these intersect with cultural norms to amplify hesitancy or resistance.

Culturally-Informed Intervention Trials:

There is a need for pilot intervention studies that test culturally tailored strategies, such as story-based messaging, oral traditions, or community drama, to improve measles vaccination rates in settings with high mortality risks.

Conflict and Displacement as Moderators of Cultural Influence:

Further exploration is required into how displacement due to conflict or natural disasters changes cultural beliefs over time and what implications these changes have for preventive health behaviors [12].

Sub-National Mapping of Beliefs and Norms:

Geographic Information Systems (GIS) and spatial analysis tools can be employed to map cultural norms and beliefs about immunization at the local government or county level,

particularly in decentralized systems like Nigeria and Ethiopia.

Deduction

Addressing these research gaps will enhance our understanding of the complex interplay between cultural norms and preventive health behaviors. It will also improve the design, targeting, and uptake of measles vaccination programs across the studied African countries, thereby contributing to reduced child mortality and progress toward health equity.

Discussion

This study sought to explore the influence of cultural beliefs and social norms on the uptake of preventive health measures for measles, particularly in relation to child mortality in five high-burden African countries: Nigeria, the Democratic Republic of Congo (DRC), Chad, Ethiopia, and South Sudan. Through a comprehensive review of region-specific and global literature - sourced primarily from PubMed, Google Scholar, Scopus, Web of Science, AJOL, and the WHO Global Health Library - a multifaceted understanding of how sociocultural contexts shape vaccine acceptance and health-seeking behaviors emerged.

Interpretation of Findings in Relation to Cultural Determinants

The findings highlight a central paradox in measles control: while measles vaccines are scientifically proven to be highly effective, the social acceptance and consistent uptake of vaccines are often hindered by local cultural and normative systems. In all five countries studied, the presence of strong traditional, religious, and social belief structures has had both facilitating and obstructive roles in vaccine acceptance.

In Nigeria, for instance, despite the availability of vaccines with efficacy levels as high as 98.4% among infants, deep-rooted skepticism among some northern communities - often driven by religious conservatism and historical distrust of Western medicine - has contributed to pockets of vaccine resistance [7, 8]. Similarly, in South Sudan, cultural practices such as isolation during illness, gender-based decision hierarchies, and preference for traditional remedies have interfered with both awareness of and access to measles vaccination, particularly in rural communities. In the DRC and Chad, misinformation about vaccines being tools for sterilization or Western control has gained traction, especially in regions experiencing conflict or weak governance. These beliefs are compounded by the role of informal power structures, such as traditional chiefs or local religious leaders, whose stance on immunization can significantly influence community behavior. In Chad, this dynamic is further complicated by an extremely fragile health infrastructure, resulting in the lowest routine immunization rates among the five countries. Ethiopia presents a particularly complex scenario. Despite having one of the highest reported measles cases counts in Africa, cultural barriers are deeply tied to the geographic and ethnic diversity of the country. Among pastoralist groups, frequent migration, limited interaction with state health services, and entrenched belief in traditional healing practices contribute to low coverage and weak trust in vaccination programs [1, 2].

Intersections with Health System Weaknesses and Conflict

The study also revealed that cultural factors do not operate in isolation but are significantly shaped - and at times exacerbated - by systemic weaknesses and ongoing conflict. In conflict zones such as the DRC and South Sudan, the breakdown of health systems not only limits service availability but also erodes public trust, allowing cultural myths and anti-vaccine narratives to flourish unchallenged. For example, in the DRC's 2019–2020 outbreak, over 7,000 deaths were reported, largely due to a collapse in immunization campaigns during a period of intense violence and political

instability [37]. Geographic inequities also play a role in the relationship between culture and health. In both Ethiopia and Nigeria, regional disparities—rooted in language, religion, ethnicity, and access - affect how communities interpret and respond to public health messages. Urban populations, who are often more exposed to formal education and media, show greater acceptance of vaccines compared to rural or semi-nomadic groups.

Cultural Beliefs as Barriers and Enablers

While many studies emphasize the obstructive role of cultural beliefs in health-seeking behavior, it is important to recognize that cultural institutions can also act as enablers when properly engaged. Religious and traditional leaders - if educated and co-opted into vaccination campaigns - can serve as powerful allies in dispelling myths and encouraging participation. For instance, faith-based organizations in parts of Nigeria and Ethiopia have facilitated door-to-door immunization efforts and played a role in legitimizing state-led health programs among skeptical populations [16, 17]. Similarly, using oral storytelling, community theatre, and radio broadcasts in local dialects has shown promise in aligning public health interventions with culturally resonant communication forms. Such strategies underscore the need for culturally competent public health messaging that respects local belief systems while promoting scientific understanding.

Knowledge Gaps and Implications for Policy and Practice

As highlighted in the research gap analysis, there is a notable absence of longitudinal, qualitative, and participatory research that deeply explores the evolution of cultural norms around immunization. Most existing studies are cross-sectional and biomedical in orientation, leaving a vacuum in understanding how beliefs shift over time or under conditions such as displacement and climate change [20, 21]. The lack of disaggregated data - by ethnic group, gender, or socio-economic status - also limits the ability to develop finely targeted interventions. For policy-makers and health programmers, these findings suggest that standardized, one-size-fits-all vaccination strategies may not work in culturally heterogeneous settings. Instead, there is a need to integrate community-based participatory research (CBPR) approaches that involve local stakeholders in the design and delivery of immunization campaigns [11, 12].

Conclusion

This study concludes that measles-related child mortality in Africa - especially in Nigeria, the Democratic Republic of Congo (DRC), Chad, Ethiopia, and South Sudan - is not solely driven by biomedical shortcomings, but critically influenced by socio-cultural and systemic dynamics. Collectively, these five countries accounted for over 60% of Africa's measles cases in 2023, with Nigeria and Ethiopia recording 12,820 and 16,340 confirmed cases, respectively. DRC's 2019–2020 outbreak alone led to over 7,000 measles-related child deaths**,** making it one of the deadliest in recent global history. Chad continues to report routine immunization coverage rates below 40%**,** and South Sudan faces both geographical inaccessibility and low health service utilization, particularly in rural and conflict-affected communities.

The study's comparative analysis revealed that cultural beliefs, traditional health systems, religious worldviews, and social norms serve both as barriers and potential facilitators of vaccine acceptance. In many communities, traditional healers and elders hold greater influence over health behaviors than formal medical personnel. For example**,** 58% of parents in rural Chad and 63% in parts of South Sudan reported reliance on spiritual or herbal remedies for childhood illnesses before considering formal immunization. Similarly,

ethnographic insights from Ethiopia reveal that measles is sometimes viewed as a "rite of passage," thus reducing the perceived urgency for vaccination. Statistical trends across these regions consistently demonstrate a negative correlation between vaccine hesitancy and immunization coverage, with coverage rates as low as 43% in South Sudan and 47% in DRC in high-risk zones. Misinformation, amplified by oral transmission and radio narratives, has further reinforced community fears, with nearly 40% of Nigerian caregivers in certain northern states citing fear of sterility or religious objections as reasons for vaccine refusal. To reduce measles-related child mortality, the study underscores the urgent need for culturally grounded, participatory interventions that leverage trusted community structures - such as faith-based organizations, women's groups, and local chiefs - in disseminating accurate health information. Equally critical is the integration of indigenous knowledge systems into public health planning, supported by longitudinal, mixed-methods research that tracks shifting belief patterns over time.

Ultimately, combating measles in these contexts requires more than vaccines - it requires community trust, inclusive health communication, and adaptive health systems. If Africa is to achieve the WHO Measles and Rubella Strategic Framework 2021–2030 targets, strategies must align biomedical goals with cultural realities, ensuring no child is left behind due to a preventable disease shaped by avoidable social barriers.

Declaration of No Conflict of Interest

The authors declare that there are no known financial, personal, or institutional conflicts of interest that could have influenced the conduct, analysis, or interpretation of this research. Neither the authors nor their academic collaborators maintain any financial, commercial, legal, or professional affiliations with entities or individuals that may pose a potential conflict. This study was undertaken with full academic independence, and all findings presented are the result of rigorous literature review and objective scholarly analysis.

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