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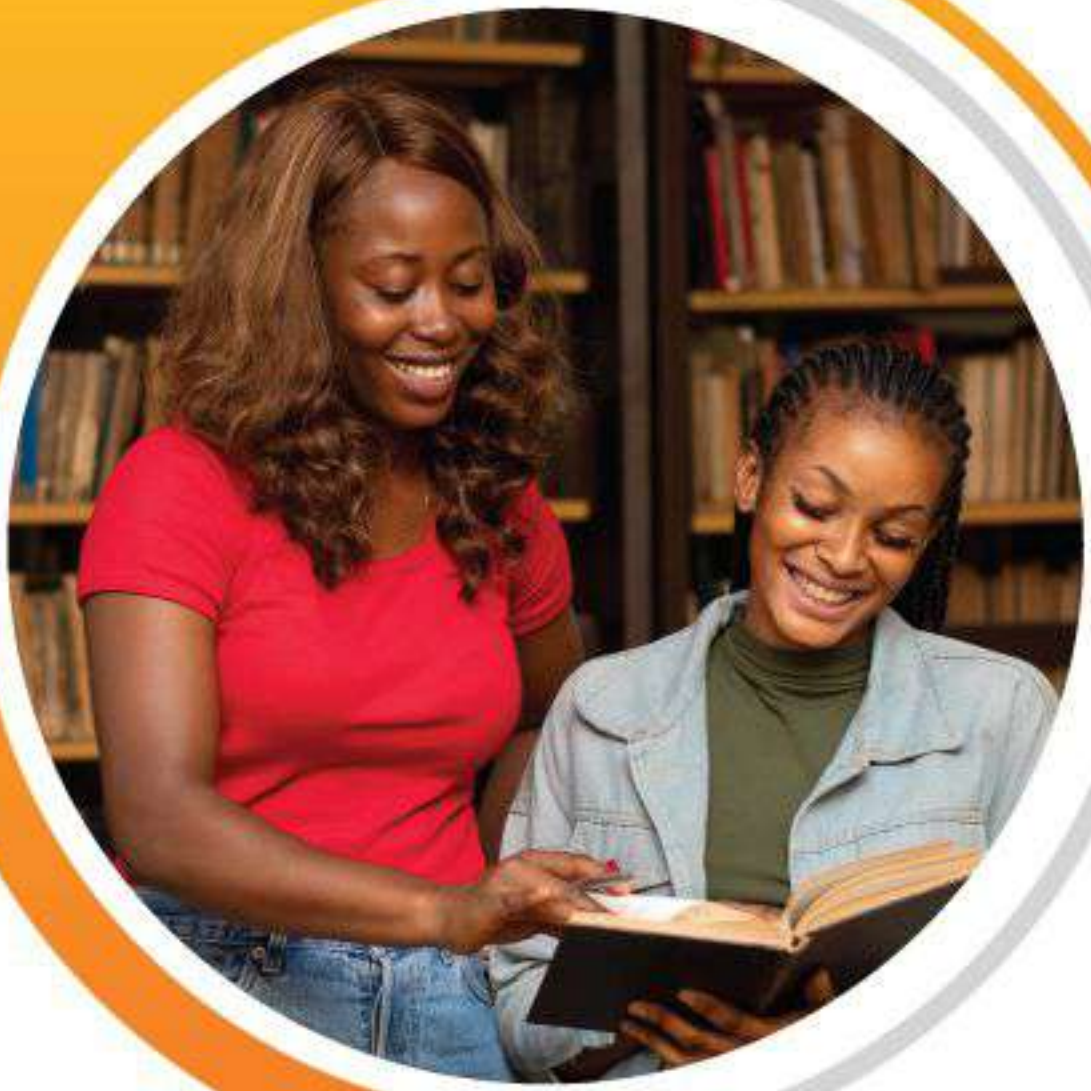

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# The Influence of Low-Income Families on Adolescents' Psychosocial Adjustment: 10 Helpful Tips for Professionals to Work with Low-Income Families

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***Abstract***

*This article examines the effects of socio-economic conditions on children, specifically focusing on how low income can lead to marital tensions. These tensions, in turn, negatively affect parenting styles, which impacts adolescents' adjustment within their families, their relationships with their parents, and their overall health and social development. This article also discusses physical development, cognitive development, and emotional and social development in Adolescents supported by Erikson's theory on adolescence, and previous empirical studies. The article concludes with 10 helpful tips professionals can use when working with low-income families.*

***Keywords****: Adolescents, Adjustment, Children, Families, Low Income.*

## Introduction

Families have incredible dynamics. Yet when a crisis engulfs a low-income family, it can exert a variety of influences. Therefore, socio-economic conditions and their impact on children. Adolescent family members are the focal point of this topic as their experience relates to low-income families and health, both physical and physiological (healthy relationships among the family members). Family lives in low income might be the lead to marital tensions and in turn negatively impact parenting style which affects adolescents' adjustment in their families, their relationship with their parents as well as their health and social development [15]. This article discusses physical development, cognitive development, and emotional and social development in adolescents supported by Erikson's theory on adolescence, and previous empirical studies.

### Adolescent's Physical Development

Adolescence is a period in time (changes occur in physical, cognitive, emotional) whereas adolescents are the individuals (teenagers) are in that period in time. Puberty is a change that occurs to both male and female differently both inside and outside the body. During childhood growth occurs slowly and in puberty, change is rapid and dramatic. Puberty is defined as the transition to adulthood through the process of physical changes, hormonal change and body growth. Male and female have different sexual maturation; it is determined by the sex hormones. In females, it is called estrogen while in male is called androgen testosterone. Estrogen hormone change in a female causes development of breast, uterus, ovaries, and vagina; it contributes to regulation of the menstrual cycle. While in male, androgen testosterone hormone leads to muscle growth, body, and underarm and facial hair. Puberty also leads to psychological changes and feelings of autonomy [4]. Autonomy is important not only for becoming an adult but also for gaining an identity. And adolescents' engaging with peers for emotional support a way to deal with puberty [34]. Moreover, primary sex characteristics are changes directly

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in the reproductive organ. Changes in females are menarche, uterus, ovaries and vagina. In contrast, secondary sex characteristics are physical changes. It is visible and appears outside on the body. Changes in females are in breast, and underarm and pubic hair and male's changes are in the voice and growth of underarm and facial hair. So, the age for puberty changes to be completed is varying among adolescents. Some adolescent completes these puberty changes in 2 years, while other adolescents take 4 to 5 years. Puberty does not only follows a hereditary pattern but also is influenced by an adolescent's experience. Experience is a major influence affecting the growth of a person. For example, experiences a person goes through or responsibilities a person undergoes cause abrupt growth, which make him or her demonstrate characteristics different from those of his or her age group [3].

## Cognitive Development in Adolescents

Adolescents are in a period where they are totally egocentric, thinking mainly of themselves. Adolescents believe that they are the focus of everyone's attention and concern, they feel that they are unique and special, and others constantly watching and judge them. Adolescents become more self-conscious. Imaginary audience is a new form of egocentrism that is raised in adolescents. Adolescent egocentric is overcome with continued intellectual development and social interaction. In this transition, adolescents need more guidance from their parents [4, 34]. However, parents should be a positive reaction to their teens. Parent should provide just advice to their teen without criticism since they are so sensitive person in the period. Moreover, imaginary audience play a part of personal fable, this is a cognitive distortion. Personal fable is that the adolescent thinks he or she is special and unique, and their feeling and experiences are special [4]. Adolescents have an exaggerated sense of invulnerability that may put them in risk of tackling new and dangerous experiences: drugs, and sexual risk. Moreover, formal operational stage beginning around age 11, where adolescents develop the ability for abstract thinking. Adolescents become a young cognizer, and fully understands the concepts of analogy and metaphor. Further, language in this stage starts to demonstrate metaphorically and refer to more abstract objects or ideas [24].

## Emotional and Social Development in Adolescents

Erickson's theory, in the stage of "identity versus role confusion", emphasized identity as the major personality achievement of adolescence [13].

## Erikson's Theory on Adolescence

As a boy who never got to know his father, Erikson has made identity a central issue in his work. [13]. Erikson believed that development is founded on the individual's experience of problems or crises. Growth occurs when the individual successfully resolves these problems, and in this way, the individual develops his or her character, identity, and a strong sense of self. Crises are inevitable when a person lives in a society and is part of a culture, and with every crisis we master, our identity develops further. Erikson explains that in stages a person moves from one stage to the next by overcoming the crisis presented at each stage. Each crisis must result in an acute emotional reaction and will continue to worry the individual until it can be resolved. Crises are normally turning points in an individual's life, e.g., entering school as a child, moving from elementary to middle school, from middle school to high school and so on; all these crises require one to develop social skills and obligations, and one copes with each stage successfully or unsuccessfully. Every stage needs to be dealt with fully before a person can move on to the next. Erikson believed the psychology of the individual to be shaped by

nurture, and that the individual, or rather the child, must pass through various stages of development with a crisis at each stage. How the child deals with those crises determines the child's ability to deal with the next stage. Erikson focused mainly on the issue of identity during adolescence rather than during childhood, as the adolescent years bring mental uncertainty combined with physical revolution, and it is a period during which individuals redefine themselves. During this stage, adolescents start to develop a sense of identity and become different people to what they were in the childhood period; they are no longer children, and this is apparent from the physical and mental changes they are going through. In Erikson's view, this stage can be a period of confusion for individuals who have comfortably and satisfactorily overcome the childhood stages, and now have to start over. More importantly, adolescence involves changing schools after spending seven or eight years in one school, and with that comes the responsibility of dealing with new relationships, new teachers, new systems, and new obligations and expectations. In addition, this is the time when individuals start to think about career paths. All of these factors require individuals to deal with the crisis and establish a new identity in order to define themselves at yet another level. This often results in adolescents being nonconformist with authority figures such as parents, but conformist with peers. Mainly, kids understand themselves through the looking glass, by seeing themselves reflected in others. Although ultimately, many adolescents in this stage end up agreeing with the values of their parents, from whom they initially wanted independence, they will have a chance to question these values and make decisions accordingly. By the end of the process, they should have developed a satisfying sense of self; otherwise, they will suffer role confusion and, as a result, will continue to struggle with the issues of adolescence as they move into adulthood [13].

## Parenting Styles and Adolescents' Psychosocial Adjustment

Having supportive parenting has a substantial influence on the overall health of the child, both physically and psychologically [33]. Thus, emotional support plays a critical role in developing healthy behaviors among children. Researchers examined individual, family, and environmental factors that indicate unhealthy behavior among children. Researchers found that improving parent-child communication could decrease the risk factors in individuals such as poor academic performance and self-esteem. They recommended that assessment strategies should be developed to identify youth who are prone to unhealthy behavior, and that community-based strategies to enhance communication between parents and children should be applied [26]. Other study found that adolescents' perceptions of problems involving communication with parents were associated with the psychosocial risk [20]. Similarly, other study found that adolescents who perceived communication with one of their parents as open were involved with less serious forms of delinquency [5]. Researchers found that open communication prevents the child's involvement in health-risk behaviors. From other perspectives According to [31], parenting styles will influence directly the kind of parent's children will become. Here, a good (positive and emotionally supportive) parenting style produces quality parents in the future, while maltreatment and harsh and abusive parenting produces a similar parent. Therefore, parenting style is an indicator of the child's future behavior. A child's behavior can reflect his or her underlying range of emotions, including fear or frustration. According to [4], parenting style is very important in child rearing. It forms the child's character. Therefore, parents should try to follow a certain authoritative style from the beginning to develop the role of habit in the child. This habit includes the boundaries that the parents set for the child, which include rules the challenge of

which will lead to the child's being punished. This, in my belief, would help nurture not only a successful and respectful individual but an individual who is a good citizen also [22]. "Reciprocal parent-child associations were most evident under conditions of adolescent negativity" ([28], p. 1479). For example, harsh parenting relates negatively to flexible, involved adolescents, thus parenting behavior discourages the development of effective adolescent problem solving. Regardless of parenting strategies, unidirectional (parent-child) influences occur when the adolescent takes an appositive position to resolve an issue; harsh inconsistent parenting offsets that positive approach, encouraging coercive behavior from the adolescent. On the other hand, non-coercive, nurturing, or authoritative parenting is based on an understanding of the child's needs, producing a positive parent-child relationship and encouraging a flexible and rational child-parent relationship. The controlled and individualistic families pose two differences of family relationship and parenting styles [16]. Another study focused on parenting styles, among them authoritative parenting: the kind of parenting observed in the controlled family, and authoritarian parenting as it manifests in individualistic parenting. [36].

## Adolescents' Psychosocial Adjustment in Law-Income Families

The term "low income" clearly describes families whose earnings fall below the threshold needed for basic sustenance. These families often struggle to meet essential needs, leading to significant financial stress. This economic hardship impacts children and adolescents, particularly in terms of their health and family dynamics. Adolescents in such families are especially affected, with their experiences tied closely to issues of physical and psychological health, as well as family relationships. The ability to maintain cohesive family dynamics distinguishes families with effective control from those where members are more isolated and individualistic [19].

Research has shown that a family's economic status influences how adolescents adapt within the family environment. For instance, study explored how adolescents from low-income families handle conflicts, revealing that family conflict is linked to the internalization of symptoms among these youth. [11]. Researchers investigated the effects of economic hardship on male adolescents, while other study found that economic instability impacts parental emotions and behaviors, leading to marital tensions, which subsequently affect parenting styles and adolescent adjustment [8]. Both parents, regardless of gender, are equally affected by financial strain [6]. Additionally, researchers examined how poverty and neighborhood conditions impact parenting styles, finding that living in poverty with a poor neighborhood diminishes warmth in parenting and increases harshness [25].

Another study looked into parental stress and its effects on adolescent adjustment. It found that parental stress, often resulting from financial strain, was linked to stress-related depression in parents, which disrupted their disciplinary practices and influenced adolescent development. Moreover, financial stress had both positive and negative effects on parent-adolescent relationships, with increased psychological stress leading to more negative interactions and fewer positive ones [9].

Growing up in poverty also exposes adolescents to other mental health risks. Poorer adolescents are more likely to face violence, experience alienation from school, and endure high levels of stress [14]. Chronic poverty has been associated with academic struggles, behavioral problems, and higher rates of depression and suicidal thoughts [30, 35]. Furthermore, another research highlighted that low income is often linked to poor nutrition, which contributes to health issues. Poor dietary choices, such as frequent consumption of fast food and inadequate intake of healthy foods, are major factors in disease and early death among

low-income families. [19]. Researchers suggested that poverty affects not only income levels but also the quality of consumption choices. [17]. Similarly, other researchers argued that low-income families are at higher risk for malnutrition, leading to conditions like heart disease, stroke, and cancer, which lower life expectancy compared to middle- or upper-class families [19]. However, making healthy grocery choices and maintaining good eating habits can be equated to effective budgeting. Parents, therefore, need to create a structured environment with clear rules and consequences [19].

In contrast, individualistic families often cite financial constraints as a primary reason for poor dietary choices, believing that convenience foods are more affordable. Economic problems impact adolescents differently based on gender. For girls, economic stress can lead to increased responsibilities and maturity within the family, while boys may experience heightened conflict, especially if their fathers are unemployed, which can lead to diminished respect for their fathers [12]. Economic strain creates a challenging family environment, putting adolescents at risk for various issues [10] found that harsh parenting is linked to psychological and behavioral problems in adolescents. Repeated exposure to unresolved marital conflict increases the likelihood of aggression and depression in these youths. Adolescents who experience aggressive parenting often reflect these behaviors in their relationships with siblings and later in their own families [7].

## What are 10 Helpful Tips Professionals can use when Working with Low-Income Families?

Families have incredible dynamics. Yet when a crisis engulfs a low-income family, it can exert a variety of influences. And while it is interesting to question how a family acquired its low-income status, it is not a point to be pursued at this juncture. Therefore, since we know that low-income families exist, what are 10 helpful tips professionals can use when working with them? Above all else, establish a relationship based on trust. Professionals must make observations about the relationships among the family members, and making these observations does not involve judging. Avoid "I" statements, be objective in making comments, and continue to make observations even while talking. Essentially, focus on the positive and encourage [27, 37].

Professionals must be able to make contributions to families, personal networks, and neighborhoods. Moreover, professionals are not replacements for families; instead, they must remain cognizant of their responsibility to provide the tools necessary for families to achieve their goals. Professionals must be able to present themselves in a manner that will allow them to communicate effectively with the low-income families that need their help. A clear and honest definition of the professional's responsibilities, resources, and expectations must be provided to each low-income family with which he or she works. A key issue is the motivation inherent in everyone involved: the families and the professionals as well.

Professionals who target the strengths of a family will learn about its resilience despite the crisis that may have been exacerbated by its low-income status. These Low-Income Family 3 strengths also exist in personal networks among families and friends. Low-income families tend to live in specific communities; therefore, the professional should include community social support resources to mitigate the crises these families must confront. Low-income families maintain self-recognition, so it is important to target their wellbeing.

Because of their socioeconomic status, poor families may incur multiple problems, such as mental illness, addiction, and generally poor health due to malnutrition. Thus, the professional must lead them to becoming the type of family identified by as the controlled family, which learns to make healthy choices in

shopping for groceries and cooking meals from basic ingredients [19]. The strategies used to achieve this include providing nutritious meals on a budget. This ability distinguishes a controlled family from an individualistic family, whose members are essentially separate units. In comparison, the individualistic family cites its lack of financial resources as being a major reason for not eating proper food. The members of such families believe it is cheaper to consume convenience food. But which doing so satisfy their hunger, it does not keep them healthy. Thus, low-income families are at risk of afflictions, such as heart disease, stroke, and cancer, which lower their life expectancy more than families in the middle or upper classes [1]. Accordingly, the professional must help guide these families to develop an awareness of this condition. Such families must understand the importance of making healthy nutritious choices, which recognizes the fact that child development is affected significantly by these circumstances.

Are professionals judgmental rather than encouraging? Professionals must remain aware that they are not engaged with the family to serve as a replacement for the Low-Income Family for parents. In fact, they should underscore the accountability held by the parents who are ultimately responsible. Further, while professionals must be able to connect with the family, they cannot be viewed as being the permanent solution. The family must function properly and independent of professional facilitation [32]. Therefore, boundaries must be recognized and maintained. Professionals should focus on the strengths offered by personal networks within poor families and look to those for solutions concerning emotional guidance and social regulation. To be effective, these networks should be self-sustaining. Solutions can also be developed by capitalizing on the strengths of both families and neighborhoods. Neighborhoods are committed networks that offer self-sufficiency, educational outcomes, pride, and resources. By focusing on communities, the efforts taken will influence the individual directly. For example, a community that develops leadership training will acquire the skills necessary to practice self-sufficiency. Once professionals teach these skills to those in need, the neighborhood will have developed the tools it needs to implement, adjust, and sustain leadership. The neighborhood thus will be prepared to create short- and long-term goals for the community based on data collection and measured results. Clearly, the professional must recognize that it will be challenging to sustain the motivation of the leaders and members of the community. Therefore, the leaders' goals must include continued growth as well as the involvement of all community members. A strong mission, vision, and organizational structure will provide an enviable image of the community's thoughts and commitment, with professionals serving as the co-manufacturers [2].

The family dynamics utilized to achieve changes among individuals and the community must be based on honesty and strength. Will the professional be able to give his or her best? Will the low-income family be fortunate enough to receive the best assistance? Certainly, the professional must be healthy to be credible as a teacher of health. In the process of the instruction being given, the low-income family will learn a new way of life, and painful changes will take place; however, sending healthy people back to a dysfunctional community may not necessarily enable an individual to influence the community. Professionals thus should be concerned with supporting the individual and community in a robust, socioeconomically correct context, which advocates effective public policy. Indeed, a simple change would be to replace the label of "multi-problem poor family" to "multi-challenged families" or "financially challenged family." This can be considered a positive method to promote resilience over crisis [37]. Understanding why we do what we do and

sharing this knowledge with low-income families will reassure them that they are indeed being heard. To that end, what can professionals do to improve communications in order to meet the needs of low-income families?

1. Know myself and prepare myself adequately by acquiring a professional education that is geared toward low-income families. Choose literature with multicultural themes and diverse characters depending on the target population. Professionals should always remember that they are guests in the community.
2. Professionals should understand their target families and the basic issues they face due to their low income.
3. Low-income families follow a diet regimen that places them at greater risk for sickness, disease, and premature death than families from the higher socioeconomic groups. Thus, to preserve the family, professionals should establish a goal of instilling in them the habit of making healthy food choices in a manner that suits their budget.
4. Organize, create, and choose an approach to be taken with low-income families through individuals, families, or neighborhoods that benefit from both mission and vision statements.
5. Develop structures, training, and programs to work with low-income families. [20, 37]. Since each family's situation is different, professionals should be aware of the living arrangements within the family setting. They should provide an educational structure and programs based on the information available about a particular family as a uniquely individual unit.
6. The professional should establish a relationship based on support and encouragement. The professional should serve low-income families but must also enable entire communities to thrive by advocating community involvement from political, corporate, religious, and civic leaders, and capitalize on their time, talent, and treasures.
7. Professionals should facilitate mentor and protégé programs. Neighborhood meetings should be held to acquire community input [18].
8. Communicate with low-income families using practice examples. Examine the needs and areas of improvement for these families.
9. Seeking funding from foundations to enable improvements in schools, parks, and family training.
10. Professionals should be prepared to share information with other professionals in order to track and evaluate outcomes. This ensures that goals are met and enables adjustments to be made to the changes that are already occurring [18].

## Conclusion

Children primarily depend on their parents for support, with society playing a secondary role. For instance, parents need to provide for their children's economic needs, which requires them to be part of a larger societal framework. A society is a collective of individuals who live together for mutual benefit, united by shared beliefs, values, and common goals. Essentially, society is made up of individuals who form a cohesive unit through a common understanding of their world. Individuals contribute to societal progress and secure their livelihood by working towards these collective goals. Thus, personal skills and efforts benefit the broader society [29].

However, job insecurity is a significant issue exacerbated by the complex economic systems in modern competitive societies [21]. An individual may lose their job through no fault of their own, which impacts more than just their income. Beyond the psychological toll of lost ambitions and diminished self-worth, job loss can lead to homelessness and an inability to provide for one's children. However, poverty often results from the cyclical nature of the

market, where some benefit while others suffer. In such cases, society should take responsibility for supporting those affected by economic downturns [30]. As researchers argue, by aiding those who are disadvantaged, society not only helps its members but also ensures its own continuity and prosperity by investing in the future generation of leaders [23].

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# Navigating Depression: Traditional and Emerging Therapies

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***Abstract***

*Major depressive disorder (MDD) is a severe illness marked by a minimum of one distinct episode of depression lasting for a minimum of 2 weeks. This period is defined by clear shifts in mood, interests, and pleasure, as well as alterations in cognitive function and vegetative symptoms. On a global scale, it is considered one of the primary causes of illness burden, especially in North America. The treatment landscape for major depressive disorder (MDD) heavily relies on serotonergic drugs, despite their limited efficacy, prompting the search for new mechanisms and targets. This has led to the exploration of other processes and targets in search of novel treatment approaches. Recent endeavors in drug discovery have produced some innovative candidates, although a significant number of them have proven unsuccessful in clinical testing. The pressing want for safer and more efficacious antidepressants highlights the significance of continuous research endeavors. A full discussion is provided on the development of clinical research on potential medications and recent advancements in the discovery of small-molecule therapeutics. The primary objective of the study is to offer a comprehensive assessment of the existing status of antidepressant therapy, with the goal of guiding future research endeavors. The review contributes to the collective effort to improve outcomes for individuals with Major Depressive Disorder (MDD) by explaining the intricacies of depression and the ongoing progress in drug research.*

***Keywords:*** *Major Depressive Disorder, Novel Molecules.*

## Introduction

Major depressive disorder (MDD) is characterized by a persistently depressed state of mind. Low self-esteem is associated with anhedonia, the loss of interest or pleasure in typically pleasurable activities. Psychotic, atypical, seasonal, postpartum, melancholia, and catatonic subtypes of major depression are among examples [1, 2]. MDD is a debilitating illness characterized by the presence of at least one distinct depressive episode lasting a minimum of 2 weeks. This period is marked by noticeable alterations in mood, interests, and pleasure, as well as impairments in cognitive function and vegetative symptoms [6].

MDD, a significant health condition, impacts more than 15 million American adults annually, representing 6.7% of individuals aged 18 and above in the country. Depression is the primary cause of disability in the United States for individuals aged 15 to 44. MDD typically starts in individuals aged 20 to 30 and reaches its highest point between the ages of 30 and 40. It is more common in women than in men. According to the World Health Organization (WHO), major depression is currently ranked as the fourth largest contributor to the worldwide burden of illness, and the leading cause in North America [3, 4, 5].

This article majorly focuses on the treatment available for depression and

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summarizes novel research that is ongoing to enhance the treatment of depression.

## Materials and Methods

A literature search was carried out to understand on the current development and research ongoing in the depression therapy area. The details of these molecules were searched on electronic database (Embase, clinicaltrial.gov, molecule originator's company sites, abstracts in various conferences).

## Results

### Traditional Treatment and Management of MDD

Antidepressant medicines are commonly prescribed for those suffering from depression, however in exceptional cases they may also get psychotherapy or counselling. The primary objective of treatment is achieving remission. All antidepressants have equivalent efficacy in this regard (Table 1). Antidepressants have an impact on the general equilibrium of the three neurotransmitters in the brain that regulate emotions, stress responses, and the physiological needs for sleep, food, and sexual desire. Advocates of the monoamine theory argue that the selection of the most efficacious antidepressant should be based on careful consideration. Individuals who exhibit symptoms of anxiety, irritability, reduced energy levels, and diminished enjoyment of life can benefit from the administration of selective serotonin reuptake inhibitors (SSRIs) or serotonin noradrenaline reuptake inhibitors (SNRIs) [6, 7, 8].

These medications are important breakthroughs in MDD pharmacotherapy, but their limits show the need for safer, mechanistically innovative treatments.

**Table 1**. Antidepressants Commonly used in the Treatment of MDD

| **Antidepressants in used today for treatment of depression (the list is not exhaustive)** | | |
|---|---|---|
| **Classes** | **Pharmacological Targets** | **Mechanism of action** |
| **Monoamino oxidase inhibitors** (MAOi): Selegiline, Phenelzine | Monoamino oxidase enzymes (MAO-A and MAO-B) | Prevent 5-hydroxytryptamine (5-HT) degradation; increase 5-HT availability at the synapses |
| **Tricyclic antidepressants (TCA)**: Amitriptyline, Imipramine, Nortriptyline | 5-HT reuptake transporters; norepinephrine (NE) reuptake transporters | Inhibit NE and 5-HT reuptake transporters; increase 5-HT and NE availability at the synapses; bind to postsynaptic receptors for noradrenaline, histamine and acetylcholine |
| **Selective serotonin reuptake inhibitors (SSRI)**: Fluoxetine, Paroxetine, Sertraline, Escitalopram | 5-HT reuptake transporters | Specifically inhibit 5-HT reuptake, increasing 5-HT availability at the synapses |
| **Noradrenaline and specific serotonergic antidepressants (NaSSA)**: Mianserin, Mirtazapine | a2 NE receptors<br>5-HT receptors | a-2 NE receptor antagonists that induce an increase in 5-HT and NE release; act as antagonists/agonists of several specific 5-HT receptors |
| **Serotonin noradrenaline reuptake inhibitor (SNRI):** Duloxetine Venlafaxine | 5-HT receptors and NE reuptake transporters | Inhibit the reuptake of both 5-HT and NE, and increase their availability at the synapses |

| | | |
|---|---|---|
| **Atypical (multimodal) antidepressants**: Bupropion, Vortioxetine, Agomelatine | 5-HT receptors NE receptors Melatonin receptors *others | Bupropion acts as a DA and NE reuptake inhibitor; vortioxetine acts as an agonist/ antagonist of several 5-HT and NE receptors; agomelatine activates melatonergic receptors and antagonizes some 5-HT receptors |

*Table is adapted from - Tsugiyama LE. Drug Discovery Today. 2023 Dec 1;28(12):103804.*

## Emerging Treatment Options in MDD

Current treatments have low responsiveness and efficacy. Thus, stronger and safer antidepressants are urgently needed. We reviewed the literature on small molecules being developed to treat depression. Table 2 shows innovators' most promising depression drug targets.

**Table 2.** Small- Molecules being Investigated for their Potential to Treat Depression

| **Molecule code[13]** | **Mechanism** | **Current stage of development[16]** | **Formulation** | **Chemical name** | **WHO ATC code** | **Company or Institute** |
|---|---|---|---|---|---|---|
| NV-5138 | mTORC1 activator | Phase II Study (NCT05066672) Ongoing | Capsule, Liquid | (2S)-2-Amino-5,5-difluoro-4,4-dimethylpentanoic acid | N06A (Antidepressants) | Navitor Pharmaceuticals, Inc. |
| BTRX-335140 (also known as **NMRA-335140)** | KOR antagonist | Phase III study (NCT06058039, NCT06058013, NCT06029439, NCT06029426) ongoing | unspecified | 1-[6-ethyl-8-fluoro-4-methyl-3-(3-methyl-1,2,4-oxadiazol-5-yl)quinolin-2-yl]-N-(oxan-4-yl)piperidin-4-amine | N07X (Other Nervous System Drugs) | Originator-BlackThorn Therapeutics Developer-Neumora Therapeutics |
| JNJ-54175446 | brain-penetrant antagonist of the adenosine triphosphate (ATP)-gated P2X7 channel | Phase II study (NCT04116606) ongoing | Capsule, Suspension | Methanone, (2-chloro-3-(trifluoromethyl)phenyl)((4R)-1-(5-fluoro-2-pyrimidinyl)-1,4,6,7-tetrahydro-4-methyl-5H-1,2,3-triazolo(4,5-C)pyridin-5-yl)- | N06A (Antidepressants) | Janssen Pharmaceuticals |

| | | | | | | |
|---|---|---|---|---|---|---|
| NSI-189` | Neurogenesis stimulants | Phase II study completed; No active trial was registered on ClinicalTrials.gov. | unspecified | (2-(Piperazin-1-yl)pyridin-3-yl)(4-(pyridin-4-ylmethyl)piperazin-1-yl)methanone | A10X (Other Drugs Used in Diabetes), N05B (Anxiolytics)N06A (Antidepressants), N07X (Other Nervous System Drugs), N07X-X (Other nervous system drugs) | Neuralstem Inc |
| GW679769 | Neurokinin 1 antagonists | Two Phase II trial completed, No active trial was registered on ClinicalTrials.gov. | Injection, Tablet | (2R,4S)-4-(4-acetylpiperazin-1-yl)-N-{(1R)-1-[3,5-bis(trifluoromethyl)phenyl]ethyl}-2-(4-fluoro-2-methylphenyl)-N-methylpiperidine-1-carboxamide | A04A (Antiemetics and Antinauseants), G04B-D (Drugs for urinary frequency and incontinence), N05B (Anxiolytics), N05C (Hypnotics and Sedatives),N06A (Antidepressants) | GlaxoSmithKline |
| CERC-301 (MK-0657) | NR2B N-Methyl-D-Aspartate antagonists | Phase II study completed (NCT01941043, NCT02459236), Phase III study planned, No active trial was registered on ClinicalTrials.gov. | Capsule, unspecified | (3S,4R)-4-Methylbenzyl 3-fluoro-4-[(pyrimidin-2-ylamino)methyl]piperidine-1-carboxylate | C01 (Cardiac Therapy), N04 (Anti-Parkinson Drugs), N06A (Antidepressants) | Avalo Therapeutics; Merck & Co |
| AV-101 | Kynurenine modulators; NMDA receptor antagonists | Phase II study completed (NCT03078322, NCT02484456). | Capsule, Powder, unspecified | (2S)-2-Amino-4-(2-amino-4-chlorophenyl)-4-oxobutanoic acid | C02 (Antihypertensives), N02B (Other Analgesics and Antipyretics), N03A (Antiepileptics), N04 (Anti-Parkinson Drugs), N05A (Antipsychotics), N07X (Other Nervous System Drugs) | Aerovate Therapeutics; Baylor College of Medicine; National Institute of Mental Health; VistaGen Therapeutics |

| | | | | | | |
|---|---|---|---|---|---|---|
| HR-071603 | AMPA receptor agonists; NMDA receptor antagonists | Phase I study completed (NCT04108234) | Intranasal spray | (2R)-2-(2-chlorophenyl)-2-(methylamino) cyclohexan-1-one | N06A-X (Other antidepressants) | Jiangsu Hengrui Medicine Co. |
| SUVN-911 | Alpha4beta2 nicotinic receptor antagonists | Phase II study ongoing (NCT06126497) | Tablet | (1R,3S,5R)-3-[(6-chloropyridin-3-yl)oxymethyl]-2-azabicyclo[3.1.0]hexane | N06A (Antidepressants) | Suven Life Sciences |
| NRX-1074 | NMDA receptor agonists | Phase II study completed (NCT02067793), No active trial was registered on ClinicalTrials.gov. | unspecified | (2R)-1-[(2S)-1-[(2S,3R)-2-amino-3-hydroxybutanoyl]pyrrolidine-2-carbonyl]-N-[(2S,3R)-1-amino-3-hydroxy-1-oxobutan-2-yl]-2-benzylpyrrolidine-2-carboxamide | N06A-X (Other antidepressants) | AbbVie; Gate Neurosciences ; Naurex |
| REL-1017 | NMDA receptor antagonists | Phase III study completed (NCT04855747, NCT06011577) | Tablet, unspecified | 3-Heptanone, 6-(dimethylamino)-4,4-diphenyl-, (S) | N07B-C02 (Methadone) | Relmada Therapeutics |

## Discussion

MDD continues to be a disorder characterized by an enigmatic underlying mechanism. Currently, there are no recognized biomarkers for Major Depressive Disorder (MDD). Although certain causal elements and physiological processes have been established, there is still a lack of a comprehensive theory that fully explains the pathology of MDD. Therefore, identifying specific pharmaceutical targets for the treatment of MDD is challenging [9]. Although there have been significant breakthroughs in the treatment of depression, a considerable number of patients still exhibit poor response to currently available antidepressant medications. As a result, researchers have been motivated to investigate alternate ideas and mechanisms that cause sadness, with the goal of finding more efficient therapies [10].

Some areas of exploration include glutamate (Glu) and $\gamma$-aminobutyric acid (GABA) systems, crucial for mood and

cognition regulation, being investigated for potential imbalances contributing to depression. Additionally, dysregulation of stress response through the HPA axis is closely linked to depression [11, 12, 13, 14]. Researchers are studying how abnormalities in this system may contribute to depressive symptoms and whether interventions targeting it could be beneficial. Epigenetic mechanisms, changes in gene expression without altering DNA sequence, have also been implicated in depression. Research aims to understand how environmental factors influence these changes in the brain, potentially leading to novel treatment approaches. Moreover, increasing evidence suggests inflammation may play a role in depression. Immune dysregulation and chronic low-grade inflammation are observed in some depressed individuals, prompting investigation into anti-inflammatory treatments for depressive symptoms.

Table 2 illustrates the diverse areas of focus beyond neurotransmitter systems currently under investigation by both the pharmaceutical industry and researchers. Specifically, attention is directed towards the Glu and GABA systems, with a primary focus on targeting the NMDA receptor, AMPA receptor, and GABA receptor. Promisingly, other agents, such as AV-101, which antagonize NMDA receptors, exhibit antidepressant-like actions in preclinical studies. Additionally, NV-5138 represents a groundbreaking agent designed for the mTOR pathway, a critical target for depression, acting as a downstream intracellular signal following direct activation of AMPA and neurotrophic factor receptors [14, 15].

SSRIs and SNRIs are frontline treatments for Major Depressive Disorder (MDD), yet a substantial number of patients do not respond adequately to these medications. Real-world studies indicate that despite multiple treatment trials, nearly 30% of MDD patients do not achieve remission. This suggests that current understanding of MDD pathogenesis is incomplete, necessitating further research into the pharmacological mechanisms of existing antidepressants. The persistence of treatment-resistant depression highlights the need for novel therapeutic targets and approaches. Continued investigation into how SSRIs and SNRIs interact with brain chemistry and neurotransmitter systems is crucial for developing more effective treatments. Addressing these gaps in knowledge could lead to improved outcomes and better quality of life for individuals struggling with MDD who do not benefit from current medication options [16, 17, 18].

Recent advancements in depression treatment include the discovery of new pharmacological targets and antidepressants that have gained clinical approval. Additionally, non-traditional therapies such as phototherapy and acupuncture have shown effectiveness in alleviating depressive symptoms. These developments highlight a growing interest in diversifying treatment options beyond conventional antidepressants like SSRIs and SNRIs. The exploration of novel targets and therapies represents a promising avenue for enhancing treatment outcomes and addressing the persistent challenge of treatment-resistant depression [18, 19, 20].

Moreover, a variety of small molecular candidates, including opioid receptor agonists, CRF1 receptor antagonists, NK1/2R antagonists, and partial agonists or antagonists, are in the experimental stage. These offer a spectrum of options for the treatment of depression, expanding the potential repertoire of therapeutic approaches under investigation.

## Conclusion

The continuous development of the economy and society has brought about increasing pressures from various aspects of daily life and work. Consequently, there has been a progressive rise in the incidence of depression, with a concerning trend towards

younger age groups. This surge in depression cases has emerged as a significant social health issue that cannot be overlooked. Recent years have seen the identification of novel antidepressant targets, including opioid receptors, NMDAR, and mGluR (refer to Table 1) [14, 15]. Additionally, emerging research has highlighted the intricate relationships between depression and factors such as gut microbes, potassium ion channels, acid-sensing ion channels, and sigma receptors. These factors hold promise as potential antidepressant targets.

The development and adoption of immune-targeted therapeutics for depression could also revolutionize current treatment paradigms by challenging traditional syndromic categorizations like Major Depressive Disorder (MDD). Instead of solely relying on broad diagnostic labels, these therapies advocate for a shift towards targeting transdiagnostic symptom dimensions, such as anhedonia, which may be linked to identifiable immune mechanisms in specific subsets of patients. By focusing on these specific symptoms and underlying immune dysregulations, clinicians may be able to tailor treatments more effectively to individual patient profiles [17].

Moreover, targeting multiple receptors simultaneously has become a popular strategy in drug design, offering new avenues for the discovery and development of antidepressant medications. Recent advancements in drug design have leveraged machine learning, molecular dynamics, and protein docking techniques to elucidate the pharmacological mechanisms of antidepressants. These approaches not only optimize the pharmacological properties of antidepressants but also aid in the discovery of new antidepressant targets and scaffolds for lead compounds [10, 11, 12].

This paper presents a systematic, comprehensive, and instructive review of antidepressant research. It offers a wealth of research information, feasible ideas, and guidance, providing multidimensional support to drug researchers in related fields.

## Conflict of Interest

There is no conflict of interest.


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# Does the Effective Execution of an Organization's Strategic Priorities Affect its Corporate Value? To what Degree?

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***Abstract***

*Organizations have over the years been bedevilled with challenges ranging from the level of competition, to how they satisfy their customers, and how to acquire a large percentage of the market share, amongst others. To build and maintain competitive advantage therefore, organizations would typically define a set of strategic priorities upon which the pillars which would facilitate the attainment of its corporate vision, would be built. However, for the priorities to deliver the desired value to the organization, they must be executed correctly and timely. Strategy, therefore, no matter how beautifully curated and well-intended, without a sound execution plan, may not deliver on its promise because the correlation between both is dependent. Some things are thus important such as an understanding of the factors which can encumber strategy, good leadership (from top to bottom), alignment of strategy with other organizational parts, sound performance management system, concise and effective communication, amongst others. A study of a globally recognized financial enterprise with a presence in four continents, on how well effective Execution could impact Strategy, was carried out using a convergent parallel design approach because of its capability to seamlessly combine the rudiments of stratified and cluster sampling. The Regression results exposed a significant relationship between Strategy Execution and Corporate Value with an R value of 0.61. An F-value variance test result of 141.62; $p < 0.05$ revealed a statistical significance; while a $\beta = 0.61$; $p < .05$ helped to demonstrate that strategy execution significantly influenced corporate value completed the analysis.*

***Keywords:*** *Corporate Value, Execution, Effective Communication, Regression, Strategy.*

## Introduction

All businesses experience varied difficulties at different times of their life cycles. To tackle these priorities from a vision and value perspective, organizations create strategic priorities with which they aim to be competitive amongst its peers. But the problems of achieving the strategic priorities set by an organization have continuously become a source of concern for stakeholders and the management of the organizations. Between the three pillars of an organization's defined strategic priorities, its chosen structural philosophy, and the manner of execution, it is vital that there is an understanding of how these pillars fuse together to create a nexus of synergies which would lead to better corporate value: typically, the objective. This intrinsic relationship leads to specific questions which require investigation.

A lot of theories abound on how organizations can make strategic decisions on the most useful ways to navigate fluid business

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environments and extract value with which it can advance on its contemporaries. But there are not so many concepts on the importance of strategy execution and how to manage the various intricacies, some of which might be intrinsic to an organization.

## The Strategy Diamond

In the aftermath of the determination of an organization's strategic intent, finding the right approach to communicating the strategic intents is crucial, if only to eliminate ambiguity and incomprehension amongst other possible pitfalls, but while promoting execution albeit simultaneously [1].

While hopes and dreams are imaginary, a Strategy Diamond is a concise, visual and analytical summary of the parts of strategy. Hambrick and Fredrickson [1] are generally credited with the creation of the concept of a Strategy Diamond, a notion which illustrates how the different parts of strategy synthesize with each other, and how these can be effectively communicated to stakeholders. It (Strategy Diamond) refers to the critical themes which are central in the strategic management process and are crucial when defining a strategy or when considering a strategic selection. **Figure 1** below is a graphical illustration of the Strategy Diamond and provides insight into the architecture of strategy and its linkages, in the form of a diamond [1].

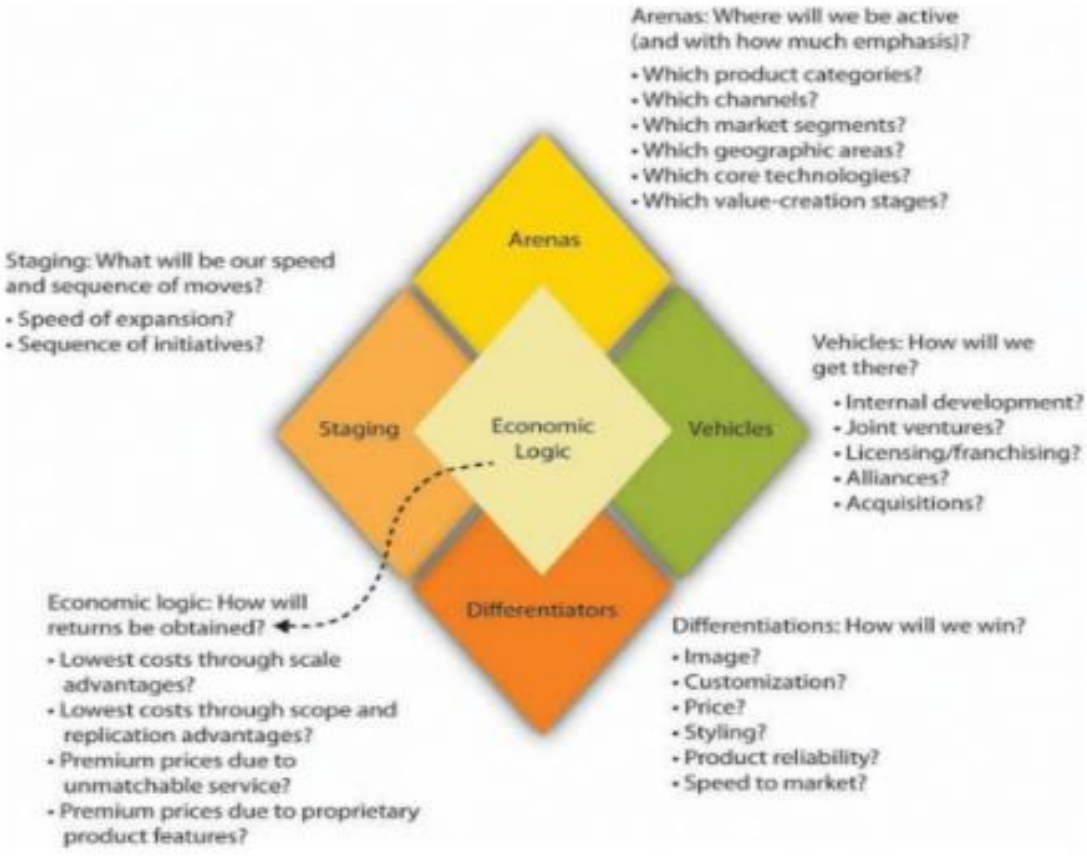


**Figure 1.** The Strategy Diamond [1]

*Source: Adapted from Donald C. Hambrick and James W. Fredrickson, "Are You Sure You Have a Strategy?" Academy of Management Executive 19, no. 4 (2005): 51–62*

While Figure 1 is an excellent graphical pictorial of the Strategy Diamond, a simpler depiction, using the central questions around each theme is shown in tabular form in Table 1.

**Table 1.** The Strategy Diamond [1]

| S/No | Theme | Critical question |
|---|---|---|
| **1** | Arena | In which markets/industry/sector will we play? |
| **2** | Vehicles | How will we reach our destination? What will take us there? |
| **3** | Differentiators | How will we win in the marketplace? What will be the uniqueness of our value proposition? |
| **4** | Staging | What will be our velocity and order of actions and initiatives? |
| **5** | Economic logic | How will be achieve/obtain our returns |

*Source: Adapted from Donald C. Hambrick and James W. Fredrickson, "Are You Sure You Have a Strategy?" Academy of Management Executive 19, no. 4 (2005): 51–62*

## Strategy Execution

According to Cote [2], Strategy execution is the implementation of a strategic plan towards achieving the set corporate goals and objectives. Execution of strategy therefore entails everyday activities involving structures, systems, and operational goals that motivate work teams to always be eager to achieve success. Successful strategy execution is all about commitment to success while wading off those setbacks and likely threats that can hinder organizations from a successful strategy execution. It is therefore vital for strategists and managers of corporate organizations to understand several factors that can impede strategy execution. Cote [2] identified poor communication of strategic objectives, lack of employee buy-in, and ineffective risk management as major setbacks to strategy execution in an organization.

Secondly, it is also expected that a solid structure should precede the implementation of every strategic plan. That will not happen without fusing strategy with structure. Such an action will align perfectly with Chandler's viewpoint when he proposed that "Structure follows strategy." This implies that for an organization to effectively deliver on its objectives, it needs to have a near perfect and seamless fusion between its strategy and its structural form. These two variables are dynamically related simply because a key element of structural design is the pursuit of strategic objectives [3]. Another expert, such as Rhodes [4] encapsulated Chandler's thoughts when he said that "when considering a change in organizational structure, organizations must keep in mind the following criteria for a good structure:"

1. Aligns the organization to best follow strategic direction.
2. Allows for clearly defined roles and responsibilities.
3. Clarifies who makes what decisions.
4. Enables clear accountability.
5. Minimizes handoffs that affect the customer experience and minimizes the customer "runaround."
6. Minimizes handoffs that create confusion over who is responsible for what outcomes.
7. Pulls together the people who most need to work closely with each other.

8. Allows information to flow unrestricted to those who need it.
9. Creates manageable spans of control.
10. Is augmented by informal channels of cross boundary communication.

Furthermore, Olivier and Schwella [5] identified and discussed seven main barriers to successful strategy execution. They include poor leadership (especially from the CEO or top management), poor strategic planning (not SMART, nor cascaded), poor project management, poor alignment of the strategy with the rest of the organizational elements (staff, skills, culture, structure, processes, technology, and budget), lack of sound performance appraisal system, poor internal drive, and poor engagement (of management and staff in strategic management during the planning process and throughout execution).

To maximize every opportunity to execute strategy successfully, Cote [2] offers five ways-out, including:

1. Showing commitment to a strategic plan.
2. Aligning current or future jobs/tasks to existing strategy.
3. Communicate effectively to empower the workforce.
4. Measuring and monitoring performance and progress, and.
5. Maintaining the expected balance between innovation and control.
6. In addition, Higgins [6], in his contributions offered eight S' of successful strategy execution. These include:
7. Strategy and Purposes: Establishing a strategy and sense of purpose worth pursuing are the keys to improving shareholder value.
8. Structure: He added that after a course of action has been rightly determined with a clear sense of purpose, a solid structure is the next to be put in place. This entails the leadership style of empowering managers and leading innovation and the entire product process from product development to delivery.
9. Systems and Processes: He perfectly mentioned and matched two essential systems, including information and rewards that will make strategy work perfectly as intended.
10. Leadership Style: He noted that successful strategy execution needs dynamic and forward-looking leadership that will help build relationships with managers around the new vision it sets to achieve.
11. Staff: After getting the leadership question right, he stated the need to hire a few selected managers and staff with growth and positive mindset and attitudes about quality and efficiency.
12. Resources: Next is to make available in the right quantity and quality resources that will be necessary to accomplish the objectives behind strategy and organizational purposes.
13. Shared Values: There's need for the team that is in charge to have some shared meanings about the firm's strategic vision, and that they are convinced and ready to buy into new values: quality, efficiency, and rewards for performance that the firm is currently seeking to achieve.
14. Strategic Performance: All the seven S' earlier mentioned must work together to deliver the financial results in a more convincing and positive manner than ever.

Overall, he posited that a firm must be able to align the seven contextual S' in order to achieve the eighth S of Strategic Performance at the end.

## Limitations

The study was delimited to respondents from a first-class multinational bank with global presence in Asia, Africa, Middle East, Europe and the Americas. Another delimitation might be that the survey sample was partially delimited to surveying the opinions of selected senior members of staff and other fulltime employees from different functions and

segments of the multinational bank. Non-fulltime employees were not necessarily considered.

### Objective

This study examines the classic blend between the execution of an organization's Strategic Priorities and the attainment of desired Corporate Value with the specific objective being to examine the impact of Execution on Corporate Value.

### Significance

This study will contribute to existing body of knowledge around the effective execution of an organization's strategic priorities and how such execution affects the attainment of an organization's Corporate Value. Experts, Academics and Practitioners would find it very useful because today, organizations are in need of more innovative ways to deliver their services in the face of massively changeable and emulous business environments which range from rapidly fluctuating regulations to policy stiffening, to the COVID-19 pandemic, to trade wars (USA v. China), military wars (Ukraine v. Russia), et al.

### Corporate Value

Corporate value is a quality measure of how a firm is consistent in different efforts leading to the attainment of both financial and non-financial objectives of the company in a sustainable way [7]. Other experts [8]; [9]; [10]; [11] consider corporate value the belief system, philosophy, and a set of principles that drive a company or an organization towards the realization of its set goals and objectives.

Thus, a corporate value statement is expected to identify and enlist the core principles that serve as a set of guidelines and direction to the organizational purpose, its culture, and tends to help create a kind of moral compass underlying the uniqueness of behaviour and actions of the organization and its workforce [12], [13], [14]. Based on the foregoing, corporate value is an achievement desired by shareholders, who are owners of the organization [15] being a critical success factor of the overall business process management [16]. However, corporate value cannot operate in isolation. In fact, it is a by-product of, and consequent upon some actions and inactions of an organization.

## Materials and Methods

### Case Study

A global multinational banking institution with presence in 53 countries across the world was selected as the subject matter for this exercise. This was principally because the organization has a precise and defined set of strategic priorities which it runs with, and which was important for the data collection and results analysis.

### Approach

The study embraced quantitative and qualitative research methods, from an approach perspective. Amongst the advantages of using a descriptive and cross-sectional design and a quantitative approach is that it enables the adoption or adaptation of quantitative research instruments like survey questionnaires to collect and analyse primary data from the target study population and sample, in a field exercise. Furthermore, the use of qualitative methods and techniques such as unstructured or semi-structured interviews would play a complementary role and help re-confirm or state otherwise of some of proxy data and figures obtained via quantitative study [17].

### Experimental Design

A convergent parallel research design was employed as it allowed the elicitation of quantitative data through the use of questionnaire while also eliciting responses through qualitative data – interviews, and analysing both separately to have a proper in-depth insight on the subject matter [18], [17]. Though the study adopted mixed methods, but specifically a convergent parallel design so as

to strengthen the study methodology and conduct a more comprehensive study to gain a very strong insight.

## Population of the Study

The study population was finite and a mixed sampling strategy with a combination of probability and non-probability sampling procedures was adopted alongside a multi-stage sampling technique to select a representative sample size from among the study population. This sampling procedure was adopted because of its multi-faceted features of combining perfectly the characteristics of cluster sampling with stratified sampling elements and advantages in dealing with a complex, larger and geographically dispersed population of a study.

The sample size computation was carried out as follows:

According to Yamane (1967):

$$n = N/[1 + N(e)^2$$

Where n = is the sample size

N = is the population

e = is the error limit (0.05 on the basis of 95% confidence level)

Therefore,

$$n = \frac{500}{[1 + 500\ (0.05)^2]}$$

$$n = \frac{500}{2.25}$$

$$n = 222.22$$

$$n \sim 222$$

The target sample size is therefore 222 based on the computation above

## Data Collection Process

Both primary and secondary data were used for the study being a quantitative and qualitative study, and also due to the need to obtain and make use of both primary and secondary data sources. Hence, the primary data collection was done with the use of self-administered structured survey questionnaires designed for the planned field study. Two sets of questionnaires were designed for the study. One was a structured survey questionnaire which was designed for the target and selected members of staff of the bank while the second was an unstructured/semi-structured interview questionnaire designed for the collection of the qualitative opinions from the target respondents who were selected to participate in the study.

The survey questionnaire techniques were administered once, and a 5-scale Likert questionnaire design method was also adopted for each of the sets of questionnaires [19]; [20]. The questions of each of the survey questionnaire instrument were tailored alongside the major variables of the study. Each survey questionnaire design was divided into two separate sections – A and B with section A of the questionnaire featuring personal data entailing all relevant characteristics and profile of the respondents while section B consisted of relevant questions underlying the topic being studied.

The Likert response scale type that was adopted for the questions under section B were: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) to Strongly Disagree (SD) as applicable in each question.

## Statistical Analysis

The study made robust use of quite a few statistical tools, some of which included:

1. Skewness tests to assess the normality of the data, and
2. Regression analysis to demonstrate influence or impact.
3. Regression analysis to demonstrate the degree of influence or impact of the independent variable in the study – Strategy Execution, on the dependent variable – Corporate Value.

# Results

To assess the normality of the data, a test of skewness was adopted by the study. The skew value of a normal distribution is zero, implying a symmetric distribution. A variable is close to normal as a rule of thumb if the skewness has

values between -3.0 and +3.0. using the rule of thumb, the results of the Table 2 revealed that all the variables had a skewness coefficient range from -0.465 and 1.018. Based on this, it was concluded that the data of the variables were normally distributed' in line with Bryman [18] and Saunders [17].

**Table 2.** Skewness Tests

| Variables | N | Sum | Skewness | |
|---|---|---|---|---|
| | Statistic | Statistic | Statistic | Std. Error |
| **Technology Innovation** | 246 | 839 | -0.205 | 0.155 |
| **Service Delivery** | 246 | 881 | -0.309 | 0.155 |
| **Wealth Management** | 246 | 1050 | -0.104 | 0.155 |
| **Market Efficiency** | 246 | 978 | -0.054 | 0.155 |
| **Improve Productivity** | 246 | 961 | -0.057 | 0.155 |
| **Corporate Value** | 246 | 1036 | -0.465 | 0.155 |
| **Organizational Structure** | 246 | 771 | 1.018 | 0.155 |
| **Strategy Execution** | 246 | 894 | 0.234 | 0.155 |

To assess the impact of Strategy Execution on Corporate Value, a multiple regression analysis was carried out with an R value of 0.61 showing the significant relationship between the independent variable – Strategy Execution and the dependent variable – Corporate Value, as can be seen in Table 3. An $R^2$ value of 0.37 indicates that 37% of the variance in corporate value is explained by the influence of organizational structure, while the remaining 63% could be caused by other factors not captured by this study. Summarily, the results revealed that strategy execution significantly influenced corporate value ($\beta = .61$; $p < .05$).

**Table 3.** Multiple Regression Result of the effect of Strategic Execution on Corporate Value

| ***Variables*** | ***B*** | ***Beta*** | ***SE*** | ***Sig*** | ***R*** | ***$R^2$*** | ***F*** | ***P*** |
|---|---|---|---|---|---|---|---|---|
| Constant | 1.43 | | .22 | <.05 | | | | |
| Strategy Execution | .76 | .61 | .06 | <.05 | .61 | .37 | 141.62 | <.05 |

*Dependent Variable: Corporate Value*

*Source: Field Survey Results (2023)*

## Discussions

The analysis which focused on the degree to which effective Strategy Execution does affect the attainment of Corporate Value in an organization was used to formulate the study objective.

The findings revealed that Strategy Execution significantly influences Corporate Value.

## Conclusion

The results of the quantitative study clearly demonstrate the significant relationship between an organization's ability to effectively execute its defined strategies and the corporate value that will be attained upon a successful execution of these priorities.


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## Conflict of Interest

The authors hereby declare that there was no conflict of interest in the study.

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# Knowledge Levels of Community-Based Health Workers on the Community-Led Total Sanitation Approach in Turkana County, Kenya

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***Abstract***

*Community-Led Total Sanitation (CLTS) is a widely adopted approach to address health issues related to open defecation. While CLTS has shown success in arid and semi-arid regions, there is limited understanding of its implementation, particularly regarding the engagement and expertise of Community-Based Health Workers (CBHWs). This study aimed to assess the knowledge levels of CBHWs on the CLTS approach in Turkana County, Kenya. A community-based cross-sectional design was employed, involving 200 CBHWs and 430 households, selected through multistage sampling. Additionally, 21 key informants were purposively sampled. Quantitative data was managed and analysed using Excel and STATA version 17, employing both descriptive and inferential statistics. Qualitative data was analysed using NVivo, with thematic methods applied to identify key insights. The findings indicate that the majority of CBHWs in Turkana County possess a strong understanding of CLTS principles, with 75.51% of participants rating their knowledge as "Very Good" and 24.49% as "Excellent." Around 80% of CBHWs have undergone formal training in CLTS, primarily through workshops and seminars, reflecting the critical role of structured training in their effectiveness. This study underscores the robust knowledge of CLTS among CBHWs in Turkana County. However, it also reveals certain knowledge gaps and challenges in the implementation process, highlighting the need for ongoing training and empowerment of CBHWs to enhance CLTS outcomes.*

***Keywords:*** *Community-Based Health Workers, Community-Led Total Sanitation, Knowledge, Open Defecation, Open Defecation Free, Households.*

## Introduction

Kamal Kar created the idea of Community-Led Total Sanitation (CLTS) for Bangladesh's rural areas around the year 2000 [1]. Around 2011, the CLTS strategy attained widespread acceptance [2]. When CLTS was first implemented in a nation, non-governmental organizations frequently took the lead [3]. Communities may receive recognition from their local governments by being granted "open defecation free" (ODF) status [4]. The initial CLTS plan purposely excluded toilet subsidies because they could make the procedure more difficult [1]. At least 53 nations use CLTS in some capacity [2]. It is a participative strategy intended to inspire a shift in everyone's behavior in rural areas [5]. The CLTS technique was first created in 2009 in Bangladesh, and it has subsequently been used all around the world [1].

In 2011, the Open Defecation Free Rural Kenya was committed to making the whole country free of open defecation by the year 2020, and to do so, in May 2011, they started the Open Defecation Free (ODF) Rural Kenya

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Campaign [6]. By the end of 2014, 15% of Kenyan villages had adopted CLTS, with 7% of those villages declaring themselves ODF; the highest concentration of ODF villages was in Busia, Kisumu, and Siaya Counties [7]. In these counties, the ODF status was 33%, 30%, and 29%, respectively [8]. Despite several purposeful attempts, Kenya failed to make progress toward the MDG target of halving the population without access to clean water and toilets by 2015 [9]. The lack of progress is attributed to various challenges, including insufficient infrastructure and community engagement [10].

A better approach to sanitation is crucial for maintaining human health [11]. Access implies that everyone will be able to easily access a facility for sanitation and hygiene whenever they need it, wherever they are, whether at home or in a public setting [12]. Numerous water-related illness outbreaks, such as the cholera outbreaks in Turkana in 2013 and 2018, as well as the high rates of typhoid and trachoma, have been linked to open defecation [13, 14]. After lack of water, poor sanitation is the second biggest problem affecting communities in Turkana County, Kenya [15]. The impact of open defecation on community health has been well-documented in various studies [16].

The Kenya Campaign was launched, and other sanitation campaigns have been running in Turkana since 2007, when Community-Led Total Sanitation (CLTS) programs were first executed [6]. Despite all these efforts, there hasn't been much progress since open defecation is still practiced by a large percentage of the population (72%) [17]. In addition, there aren't many latrines available, and as such, residents don't practice good personal hygiene [18]. Collectively, these issues have led Turkana County to have a high burden of water-related diseases, despite a rise in the number of community health units to 167 and the number of community-based health workers to 2,238 [19]. The inadequacy of sanitation facilities and health education continues to be a significant challenge [20].

Due to different contextual concerns and challenges, CLTS adoption has been slow in many parts of Kenya [3]. ODF achievement in diverse communities is hampered by many contextual difficulties, and Turkana County is no exception [7]. To date, no specific research has been carried out to examine the obstacles that community-based health professionals face in Turkana County [18]. Even though numerous studies on CLTS have been conducted in both Kenya and other nations, most studies conducted in Kenya have not made a conclusive statement regarding the adoption and implementation of the CLTS approach as a strategy used to address the issue of open defecation [3]. There is a shortage of data on the examination of community-based health workers' (CBHWs) knowledge, function, motivation, and obstacles related to the implementation and adoption of the CLTS strategy to achieve ODF status [20].

It is upon this background that the current study was set to determine the impact of CBHWs on CLTS implementation on latrine ownership and the practice of open defecation among household members in Community-Led Total Sanitation in Turkana County in Kenya. The current survey aimed at evaluating the effectiveness of CBHWs in the implementation of CLTS in Turkana County, Kenya.

## Methods

### Study Area

The study was conducted in Turkana County, the most populous county in North-Western Kenya, which is bordered by Uganda, Ethiopia, South Sudan, Lake Turkana, Marsabit County, and the Ilemi Triangle. The county, with a population of 926,976 according to the 2019 census [21], is located south and east of West Pokot, Baringo, and Samburu Counties.

The County comprises seven sub-counties: Loima, Kibish, Turkana Central, Turkana West, Turkana East, Turkana South, and North

Turkana. Turkana, Kenya's poorest county, faces challenges such as dry and semi-arid environments, distance from the capital, limited access to services, and poverty [22]. Turkana County ranks 47th out of 47 in infant vaccination, literacy, sanitation, and health care indicators [17]. The arid region experiences high temperatures and heavy rainfall, impacting its economy based on nomadic pastoralism [23]. Disease outbreaks and unusual migratory patterns persist [24]. Livestock numbers are slowing down, making it difficult for locals to make a living off herding alone [25].

### Study Design and Participants

A community-based cross-sectional survey was conducted with Community-Based Health Workers, households, key informants, and focus group discussion (FGD) participants to collect information on the effectiveness of Community-Based Health Workers in the implementation of the CLTS approach.

### Data Collection

A total of 12 research assistants participated in data collection. They were trained for two days on data collection procedures and other aspects related to the study. A structured questionnaire was used to collect data from households and CBHWs, while an interview guide and schedule were used to collect data from key informants and FGD participants.

### Data Management and Analysis

Excel and STATA version 17 were both used for data management, analysis, and presentation of quantitative results, while NVivo was used for qualitative data. Descriptive and inferential statistics such as mean, standard deviation, frequencies and their percentages, chi-square test, and multivariate logistics were used for the analysis of quantitative data and thematic analysis for qualitative data. Regression analysis was used to test for association. In all tests, $p<0.05$ was considered statistically significant.

### Ethical Consideration

The study obtained ethical approval from Mount Kenya University Ethics and Research Committee (ERC) (MKU/ISERC/2659) and National Council for Science, Technology and Innovation (NACOSTI) (679798) Kenya. Written consent was also sought from all study participants.

## Results and Findings

### Characteristics of the Respondents

The recruitment rates for both households (97.4%; 419 of 430) and community-based health workers (98.0%; 196 of 200) for the study were high, and good enough for quantitative analysis and inferences. For households' characteristics (Table 1), most of the study participants were aged over 40 years (52.51%), with a relatively balanced gender distribution. Similarly, majority of the participants were married (68.74%), unemployed (61.58%) and identified as Christian (90.21%). Educationally, the sample was diverse, with significant proportions having completed secondary school (22.43%) or post-secondary education (27.45%).

**Table 1**. Demographic Characteristic for Household

| Characteristics | n | % |
|---|---|---|
| Age Category | | |
| 21-30 | 47 | 11.22 |
| 31-40 | 152 | 36.28 |
| > 40 Years | 220 | 52.51 |
| Gender | | |
| Female | 208 | 49.64 |
| Male | 211 | 50.36 |

| | | |
|---|---|---|
| Marital Status | | |
| Married | 288 | 68.74 |
| Separated | 61 | 14.56 |
| Unmarried | 11 | 2.63 |
| Widowed | 59 | 14.08 |
| Religion | | |
| Christian | 378 | 90.21 |
| Muslim | 41 | 9.79 |
| Education | | |
| No Formal Education | 113 | 26.97 |
| Primary | 97 | 23.15 |
| Secondary School | 94 | 22.43 |
| Post-Secondary School | 115 | 27.45 |
| Occupation | | |
| Employed | 95 | 22.67 |
| Own a Business | 66 | 15.75 |
| Unemployed | 258 | 61.58 |

## Demographic Characteristics for Community based Health Worker

The demographic analysis of community-based health workers reveals several notable patterns (Table 2). Most health workers fall within the age range of 31-40 (71.94%), with a relatively balanced gender distribution. The majority were married (83.67%) and identified as Christians (98.47%). Educationally, there was a diverse range of attainment levels, with a significant portion having completed post-high school education (45.92%). In terms of occupation, a substantial portion were employed (41.84%) or self-employed (33.67%), with roles primarily in agriculture (10.2%) or pastoralism (14.29%). Moreover, majority were Community Health Volunteers (57.65%), with varying durations of service, with a notable proportion having worked for 2-4 years (46.43%).

**Table 2**. Demographic Characteristics for Community based Health Workers

| Characteristics | n | % |
|---|---|---|
| Age Category | | |
| 21-30 | 17 | 8.67 |
| 31-40 | 141 | 71.94 |
| >40 | 38 | 19.39 |
| Gender | | |
| Female | 97 | 49.49 |
| Male | 99 | 50.51 |
| Marital Status | | |
| Married | 164 | 83.67 |
| Separated | 19 | 9.69 |
| Unmarried | 3 | 1.53 |
| Widowed | 10 | 5.1 |
| Religion | | |

| | | |
|---|---|---|
| Christian | 193 | 98.47 |
| Muslim | 3 | 1.53 |
| Education Level | | |
| No Formal Education | 49 | 25 |
| Primary | 42 | 21.43 |
| High School | 15 | 7.65 |
| Post High School | 90 | 45.92 |
| Occupation | | |
| Agriculture | 20 | 10.2 |
| Employed | 82 | 41.84 |
| Pastoralism | 28 | 14.29 |
| Self Employed | 66 | 33.67 |
| Position in Health Unit | | |
| Community Health Extension | 83 | 42.35 |
| Community Health Volunteer | 113 | 57.65 |
| Duration Worked | | |
| 2-4 Years | 91 | 46.43 |
| 5-7 Years | 32 | 16.33 |
| 8-10 Years | 13 | 6.63 |
| Below 2 Years | 60 | 30.61 |

## CBHWs Knowledge on CLTS Approach

Most of CBHWs in Turkana County have a good understanding of CLTS, with 75.51% rating their knowledge level as "Very Good" and 24.49% as "Excellent" (Table 3). Furthermore, the majority had received training on CLTS (86.22%). The primary methods through which CBHWs in the county ensured they have knowledge on CLTS include attending training workshops (55.10%), consulting their supervisors (31.63%), and reading about CLTS (13.27%). To stay updated on CLTS, CBHWs primarily attend training workshops (49.49%), consult their supervisors (38.27%), and read about CLTS (12.24%). Additionally, when addressing knowledge gaps, CBHWs commonly attend training workshops (54.08%), consult their supervisors (30.61%), and read about CLTS (15.31%). The results highlight high knowledge on CLTS among the Community health workers in Turkana County and a strong commitment to further acquire it primarily through training, consultation with supervisors, and self-study, which are essential for effective implementation of sanitation initiatives.

**Table 3.** CBHWs Knowledge on CLTS approaches

| Characteristics | n | % |
|---|---|---|
| CBHWS Knowledge level on CLTS | | |
| Very good | 148 | 75.51 |
| Excellent | 48 | 24.49 |
| Received Training | | |
| No | 27 | 13.78 |
| Yes | 169 | 86.22 |
| How CBHWs Ensure They Have Knowledge on CLTS | | |

| | | |
|---|---|---|
| Attending Training Workshops | 108 | 55.10 |
| Consult My Supervisor | 62 | 31.63 |
| Reading About CLTS | 26 | 13.27 |
| How they stay updated on CLTS | | |
| Attending Training Wo | 97 | 49.49 |
| Consult My Supervisor | 75 | 38.27 |
| Reading About CLTS | 24 | 12.24 |
| How CBHWs Address Knowledge Gap | | |
| Attending Training Workshops | 106 | 54.08 |
| Consult My Supervisor | 60 | 30.61 |
| Reading About CLTS | 30 | 15.31 |

## Sources of CBHWs Information on CLTS

Figure 1 below shows sources of information about Community-Led Total Sanitation (CLTS) for Community-Based Health Workers (CBHWs) in Turkana County. The results show that training workshops and seminars (39.29%) is the main source of information for the CBHWs while observation what others (7.14%). These percentages indicate that CBHWs predominantly rely on formal channels such as training workshops/seminars for acquiring knowledge on CLTS, suggesting that structured training sessions play a significant role in enhancing their understanding of CLTS principles and practices.

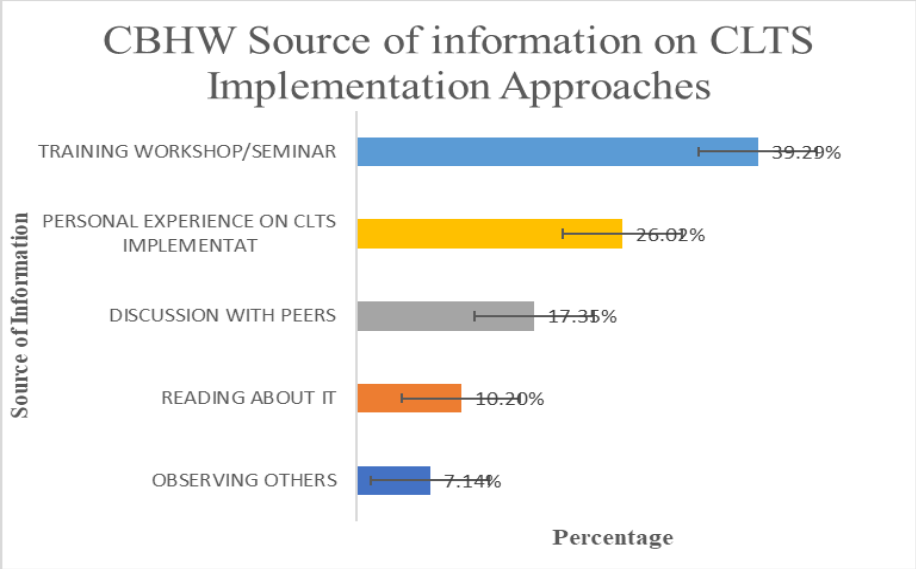


**Figure 1.** CBHWs Sources of Information on CLTS

## Multivariate Logistic Regression of CBHWs Knowledge Associated Factors

Table 4 shows the analysis of CBHWs knowledge-associated factors using multivariate logistic regression, highlighting the influence of Community-Based Health Workers' (CBHWs) knowledge and training on latrine ownership and the practice of open defecation. The data demonstrates that CBHWs' knowledge level on Community-Led Total Sanitation (CLTS) significantly impacts latrine ownership. Specifically, those with higher CBHWs' knowledge on CLTS are 3.495 times more likely to own a latrine (AOR: 3.495, 95% CI: 7.7-19.98, p = 0.039). Conversely, the likelihood of using open defecation decreases,

with an adjusted odds ratio of 0.37 (AOR = 0.37, 95% CI: 6.49-18.97, p = 0.022). This suggests that greater CBHWs' knowledge correlates with a higher probability of latrine ownership and a reduced tendency towards open defecation.

Training received by CBHWs also plays a crucial role. Those who have received training are significantly more likely to own a latrine, with an (AOR = 8.872, 95% CI: 11.6-20.0, p = 0.021). This training also reduces the likelihood of using open defecation (AOR = 2.01, 95% CI: 7.27-17.31, p = 0.028), indicating that proper training enhances both latrine ownership and the reduction of open defecation practices.

Further, the ability of CBHWs to ensure they have knowledge on CLTS is associated with increased latrine ownership (AOR = 2.072, 95% CI: 9.59-11.77, p = 0.014) and decreased use of open defecation (AOR = 0.13, 95% CI: 4.67-18.15, p = 0.017). This suggests that when CBHWs are well-informed about CLTS, they are more effective in promoting latrine usage and reducing open defecation.

Staying updated on CLTS also has a significant impact, with an (AOR = 1.541, 95% CI: 14.28-11.51, p = 0.033) for latrine ownership and an (AOR = 0.52, 95% CI: 4.33-18.62, p = 0.034) for open defecation. This indicates that continual updates on CLTS knowledge are associated with better outcomes in both latrine ownership and reduced open defecation.

Lastly, CBHWs addressing knowledge gaps also contributes positively, as evidenced by an (AOR = 4.725, 95% CI: 14.84-15.52, p = 0.027) for latrine ownership and an (AOR = 1.188, 95% CI: 13.08-24.91, p = 0.031) for decreasing open defecation. This shows that filling knowledge gaps is instrumental in improving latrine ownership and reducing the practice of open defecation.

Overall, these findings highlight the critical role of CBHWs' knowledge, training, and ongoing education in enhancing latrine ownership and reducing open defecation practices. The results underscore the importance of investing in CBHWs' capacity-building to improve sanitation outcomes at the household level.

**Table 4.** Multivariate Logistic Regression of CBHWs Knowledge Related Factors

| Characteristics | Own A Latrine | | | Used Open Defecation | | |
|---|---|---|---|---|---|---|
| | AOR | 95% CI | p | AOR | 95% CI | p |
| CBHWS Knowledge level on CLTS | | | | | | |
| No | REF | | | REF | | |
| Yes | 3.495 | 7.7-19.98 | 0.039 | 0.37 | 6.49-18.97 | 0.022 |
| Received Training | | | | | | |
| No | REF | | | REF | | |
| Yes | 8.872 | 11.6-20.0 | 0.021 | 2.01 | 7.27-17.31 | 0.028 |
| CBHWs Ensure They Have Knowledge on CLTS | | | | | | |
| No | REF | | | REF | | |
| Yes | 2.072 | 9.59-11.77 | 0.014 | 0.13 | 4.67-18.15 | 0.017 |
| Stay updated on CLTS | | | | | | |
| No | REF | | | REF | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Yes | 1.541 | 14.28-11.51 | 0.033 | 0.52 | 4.33-18.62 | 0.034 |
| CBHWs Address Knowledge Gap | | | | | | |
| No | REF | | | REF | | |
| Yes | 4.725 | 14.84-15.52 | 0.027 | 1.188 | 13.08-24.91 | 0.031 |

COR, crudes odd ratio; *AOR, adjusted odds ratio –were calculated using multiple regression model by adjusting independent variables; *P-values were calculated using multivariate logistic regression model.

## Discussion

The demographic profile of the households reveals a predominantly mature population, with over half (52.51%) of the respondents being over 40 years old. This age distribution suggests that a significant portion of the population possesses considerable life experience, potentially influencing their views on health and sanitation practices. The nearly equal representation of genders provides a balanced perspective from both male and female participants.

A majority of respondents are married (68.74%) and identify as Christian (90.21%). These factors may play a role in shaping communal health practices and the acceptance of interventions such as Community-Led Total Sanitation (CLTS). The high unemployment rate (61.58%) highlights economic challenges that could hinder the ability to invest in sanitation facilities like latrines. Education levels among respondents are varied, with notable percentages having secondary (22.43%) and post-secondary education (27.45%), which could positively influence health awareness and practices.

The demographic data of Community-Based Health Workers (CBHWs) indicate a predominantly middle-aged group, with 71.94% aged between 31 and 40 years. This age range is typically associated with both the maturity and physical capacity necessary for the demanding tasks of CLTS activities. The nearly equal gender distribution suggests active participation of both men and women in community health work, which is essential for addressing the diverse needs of the community. A high proportion of CBHWs are married (83.67%) and Christian (98.47%), reflecting the household characteristics and potentially aiding cultural alignment between the workers and the communities they serve.

Educationally, a significant portion of CBHWs (45.92%) have education beyond high school, likely enhancing their ability to comprehend and effectively convey health information. Their diverse employment status, with many being employed (41.84%) or self-employed (33.67%), indicates that they are well-integrated into the local economy, potentially bolstering their credibility and influence within the community.

The findings reveal that most CBHWs possess a strong understanding of the CLTS approach, with 75.51% rating their knowledge as "Very Good" and 24.49% as "Excellent." This solid knowledge base is crucial for the successful implementation of CLTS initiatives, as it directly affects their ability to educate and influence the community. The fact that 86.22% of CBHWs have received CLTS training underscores the importance of formal education in enhancing their skills and knowledge. Training workshops (55.10%) and consultations with supervisors (31.63%) are the main sources of this knowledge, highlighting the significance of structured learning and mentorship in capacity building. Ongoing knowledge updates, primarily through additional training (49.49%) and consultations (38.27%), indicate the dynamic nature of the CBHWs' roles and the necessity of continuous education to effectively address new challenges and promote sanitation practices.

Training workshops and seminars are identified as the primary sources of information on CLTS for CBHWs (39.29%), underscoring the critical role of formal, structured training environments in equipping CBHWs with the necessary skills and knowledge for effective CLTS implementation. The relatively low reliance on observation (7.14%) suggests that while hands-on experience is valuable, it is less commonly used as a primary learning method compared to formal training sessions.

The logistic regression analysis demonstrates a significant link between CBHWs' knowledge of CLTS and improved sanitation outcomes, such as increased latrine ownership and decreased open defecation. Higher levels of knowledge are significantly associated with latrine ownership (AOR: 3.495, $p = 0.039$) and a reduction in open defecation (AOR: 0.37, $p = 0.022$), highlighting the crucial role of knowledgeable CBHWs in promoting community sanitation. Training further strengthens these outcomes, with trained CBHWs being more likely to own latrines (AOR: 8.872, $p = 0.021$) and less likely to engage in open defecation (AOR: 2.01, $p = 0.028$). This finding emphasizes the importance of formal training programs in empowering CBHWs for effective CLTS implementation.

Continuously updating knowledge and addressing knowledge gaps also positively impact sanitation outcomes. CBHWs who actively seek to update their knowledge or address gaps are more likely to promote latrine ownership and reduce open defecation, reinforcing the need for ongoing education and training to sustain the effectiveness of CLTS interventions.

Overall, these findings highlight the critical role of CBHWs' knowledge, education, and ongoing training in promoting sanitation practices in Turkana County. The strong correlation between CBHWs' knowledge and improved sanitation outcomes underscores the importance of investing in their training and continuous education for the success of CLTS initiatives. Additionally, the demographic characteristics of both households and CBHWs suggest that socio-economic factors and community dynamics must be considered when designing and implementing health interventions.

## Conclusion

The study highlights the critical role of Community-Based Health Workers (CBHWs) in the successful implementation of Community-Led Total Sanitation (CLTS) initiatives in Turkana County. The demographic profile of CBHWs, characterized by a middle-aged, educated, and economically active group, positions them as influential agents in promoting community health behaviors. The high recruitment rates and strong knowledge of CLTS among CBHWs, bolstered by structured training programs, validate the study's findings that well-informed and well-supported CBHWs are essential for achieving improved sanitation outcomes.

However, the study also identifies challenges, including knowledge gaps and coordination issues, that could hinder the effectiveness of CLTS initiatives. These challenges underscore the need for ongoing support and capacity-building for CBHWs. Addressing these issues through continuous education, training, and better coordination mechanisms is crucial for enhancing the overall effectiveness of CLTS programs. By doing so, the community can achieve sustained improvements in sanitation practices, ultimately leading to better health outcomes in Turkana County.

In conclusion, while the study reaffirms the importance of CBHWs in driving CLTS success, it also calls for a sustained investment in their development to ensure the long-term impact and sustainability of sanitation initiatives in the region.

## Conflict of Interest

We hereby declare that there are no conflicts of interest regarding the thesis.


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# Mastering Suicide Assessment: Tools for Insight and Intervention

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***Abstract***

*Suicide is a profound public health issue globally, prompting healthcare systems and accreditation bodies like The Joint Commission (TJC) to emphasize the necessity of suicide risk screening in clinical settings. Healthcare providers and administrators tasked with implementing screening programs must choose from several validated tools, considering factors such as ease of administration, the age groups they are intended for, and the reliability of supporting data. This review aims to summarize the characteristics of concise suicide risk screening tools found in the literature. While these tools can effectively identify potential risks, they may not comprehensively identify all individuals at risk of suicide, highlighting the importance of complementing screening with thorough clinical assessments by trained professionals. Therefore, while brief screening tools provide valuable initial insights, their integration into hospital protocols should be accompanied by awareness of their limitations and the implementation of comprehensive suicide risk management strategies. The 9-item Patient Health Questionnaire (PHQ-9), Ask Suicide-Screening Questions (ASQ), Suicide Behaviors Questionnaire–Revised (SBQ-R) and Columbia-Suicide Severity Rating Scale (C-SSRS triage version) scales are the great tools in examining the suicide risk. The Columbia-Suicide Severity Rating Scale (C-SSRS) has become a widely utilized tool for evaluating suicidal ideation and behavior across diverse populations, including adolescents and adults.*

***Keywords:*** *Suicide, Suicide assessment Tools.*

## Introduction

Mental well-being forms the cornerstone of overall wellness and effective functioning, encompassing prevention, treatment, and rehabilitation of mental health issues. Depression, a prevalent mental disorder, manifests as prolonged periods of low mood or disinterest in activities, affecting approximately 280 million individuals worldwide [1].

Linked closely to depression, suicide presents a complex and significant public health challenge, particularly impacting young adults aged 15–29, ranking as the fourth leading cause of death. Globally, nearly 800,000 lives are lost to suicide annually, translating to one death every 40 seconds, with more than 20 attempts for each completed suicide [2].

In emergency department settings, suicidal ideation often surfaces, necessitating nuanced approaches to screening, assessment, and mitigation. While no method guarantees absolute reliability, effective strategies can significantly reduce risk [3]. Suicide represents a pressing and increasingly serious public health issue in India. However, it can be prevented through timely, evidence-based, and often cost-effective interventions. In 2016, the suicide mortality rate per 100,000 population was 16.5, surpassing the global average of 10.5 per 100,000. Particularly vulnerable groups include individuals aged 15-29, the

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elderly, and those with special needs. Implementing suicide screening protocols, as outlined in the National Mental Health Policy of India 2014, in conjunction with multidisciplinary collaboration, is crucial [4].

The majority of practitioners are familiar with assessment methods. Training in psychiatry consistently emphasizes the recognition of signs and symptoms that may indicate suicidal tendencies in patients. However, it remains important to regularly review and evaluate changes in standards of care and documentation protocols. Clinicians must continuously refine their understanding of suicide risk factors and evolving standards of care. Addressing access to firearms, for instance, emerges as a critical aspect of assessment due to its association with heightened fatality rates in suicide attempts. Recognizing the complexity of suicidal behaviour, interventions must be tailored to individual circumstances, acknowledging both modifiable and unchangeable risk factors. Although no universal screening tool comprehensively addresses this complexity, the focus remains on sound clinical assessment. This article underscores the understanding of suicide assessment tools accessible to practitioners, which can serve as effective screening measures to precisely identify individuals at risk of suicide attempts.

A literature search was carried out to understand the tools for suicide risk assessment. Search words like “suicidal scales, suicidal tools, Suicide risk assessment scale” were used and search was conducted. The review articles and research articles were considered and thoroughly explored. The literature search was conducted on electronic database such as Embase and PubMed.

## Materials and Methods

A literature search was carried out to identify suicide measures and to include them in this review. The details of these scales were searched on electronic database Embase. Search terms used were “suicide scales”, “suicide scale in depression” and “valid suicide scales”.

## Results

### Tools for Suicide Risk Assessment

In 2007, The Joint Commission (TJC), issued an alert to medical centers of increased scrutiny on suicide and promulgated the National Patient Safety Goal 15.01.01 for suicide prevention [5, 6]. Effective July 1, 2019, TJC required screening for suicidal ideation with a validated screening tool for all patients being evaluated or treated for behavioral health conditions as their primary problem. TJC did not require screening all patients. TJC added that it was important to assess medical-surgical patients whose prognosis or psychosocial issues put them at risk of suicidal ideation [7]. Meanwhile, the United States Preventive Services Task Force has recommended screening for depression in the adult population, including pregnant and postpartum persons, as well as older adults [8]. The accumulation of all these screening rules has led hospitals to introduce universal screening protocol in regular practice. Table 1 summarizes suicidal assessment tools that are been used by various researchers and clinicians widely.

**Table 1**. Summary of TJC Approved Suicidal Scales

| Scales | Setting | Items | Sensitivity and Specificity |
|---|---|---|---|
| 9-item Patient Health Questionnaire (PHQ-9) | Primary care; adolescents and adults | 9 questions for presence and duration of suicide ideation | sensitivity, 87.6%; specificity, 66.1%; |

| Scales | Setting | Items | Sensitivity and Specificity |
|---|---|---|---|
| Ask Suicide-Screening Questions (ASQ) | Most clinical areas; all ages | 4 questions developed by the National Institute of Mental Health | Sensitivity, 96.9%; specificity 87.6% |
| Suicide Behaviors Questionnaire–Revised (SBQ-R) | Adolescents and adults | 4 questions including past, present, and anticipated future suicidal thoughts and behaviors | No data on sensitivity or specificity; clinical and nonclinical validation studies |
| Columbia-Suicide Severity Rating Scale (C-SSRS triage version) | Most clinical areas; adults and adolescents | Brief version of C-SSRS; positive responses to first two questions lead to more questions | Sensitivity, 94%–100%; specificity, 99%–99.4% |

## Discussion

Many tools have been used to screen suicide risk groups or to predict suicide. Among the variety of depression screening tools, the 9-item Patient Health Questionnaire (PHQ-9), Ask Suicide-Screening Questions (ASQ), Suicide Behaviors Questionnaire–Revised (SBQ-R), and Columbia-Suicide Severity Rating Scale (C-SSRS triage version) scales are on the approval list of TJC.

The Patient Health Questionnaire-9 (PHQ-9) is a validated tool widely used to assess depression severity across various languages and settings. However, its ninth item, which queries about thoughts of death or self-harm in the past two weeks, is not specifically designed for suicide risk assessment. This item's dual focus on passive thoughts of death and active thoughts of self-harm has raised concerns about potentially yielding false-positive results. A recent study by Na et al [9]. examined the utility of PHQ-9 item 9 for suicide screening in 841 adult patients primarily diagnosed with mood disorders. Their findings indicated inconsistent performance across different demographic and clinical groups, leading the authors to conclude that item 9 alone is inadequate for robust suicide risk assessment. This aligns with broader research indicating uncertainty regarding the PHQ-9's ability to reliably predict suicide risk. Therefore, while the PHQ-9 remains valuable for assessing depression severity, clinicians should exercise caution and consider supplemental assessment tools and clinical judgment when evaluating suicide risk in patients [10, 12].

The Ask Suicide-Screening Questions (ASQ) was developed as a validated tool to assess suicide risk in children and young adults presenting to emergency departments (EDs) for medical or surgical reasons. In a study involving 524 patients aged 10 to 21 years across three urban pediatric EDs, researchers evaluated the ASQ's effectiveness. Patients with various chief complaints, including psychiatric and medical/surgical issues, answered an initial set of 17 questions and completed the Suicidal Ideation Questionnaire. The study revealed that a streamlined four-question version of the ASQ accurately identified almost all instances of suicidal ideation. Specifically, this model correctly identified all but one patient who tested positive on the Suicidal Ideation Questionnaire. The ASQ demonstrated a high sensitivity of 96.9% and specificity of 87.6%, highlighting its robust performance in both detecting and ruling out suicide risk in diverse pediatric emergency settings. These results underscore the ASQ's reliability and practicality as a screening tool for identifying individuals at risk of suicide across different medical and psychiatric presentations in emergency care settings [10, 13, 14].

The Suicidal Behaviors Questionnaire-Revised (SBQ-R), developed by Linehan and Nielsen (1981), consists of four questions designed to assess different aspects of suicidal behaviors. Osman et al. (2001) [11] conducted a psychometric evaluation of the SBQ-R across various populations, including college undergraduates, high school students, adolescents, and adults in psychiatric care. They identified specific cutoff scores indicative of high suicidal risk: a score of 7 for high school and undergraduate students, and 8 for psychiatric inpatients. This scale's structured approach allows for comprehensive evaluation of suicidal tendencies, making it valuable in clinical and research settings alike. By probing multiple dimensions of suicidal behavior, the SBQ-R provides a nuanced assessment that helps identify individuals requiring immediate intervention and support. Its reliability across different demographic groups underscores its utility in assessing and mitigating suicide risk effectively [15, 16].

The Columbia-Suicide Severity Rating Scale (C-SSRS) has become a widely utilized tool for evaluating suicidal ideation and behavior across diverse populations, including adolescents and adults. Validated for clinical trials and endorsed by entities like the Department of Defense and The Joint Commission, its structured approach assesses various dimensions of suicidality, from passive thoughts to active ideation, planning, intent, and behaviors. Despite its systematic framework, the C-SSRS does not classify the intent or immediacy of suicidal actions, which are critical factors in determining the level of risk. Concerns have arisen regarding its consistent accuracy in predicting suicidal behavior across different contexts and populations, highlighting the need for careful interpretation and clinical judgment. Nonetheless, its standardized format enables systematic screening and monitoring of suicidal tendencies, making it valuable in both clinical practice and research settings. When individuals report high-risk responses on the scale, immediate safety precautions are recommended until a comprehensive evaluation by a mental health professional can be conducted. While the C-SSRS provides a structured method for identifying individuals at risk for suicide, its limitations emphasize the importance of supplementing its findings with thorough clinical assessment and personalized interventions to effectively manage and mitigate suicide risk.

## Conclusion

Universal suicide screening programs are increasingly adopted by hospitals and healthcare systems due to the profound impact of suicide as a leading cause of death globally and in the United States. The Joint Commission's patient safety goals, effective from July 2019, mandate the use of validated tools for screening all patients primarily treated for behavioral health issues. Factors influencing the choice of screening tool include ease of use, empirical validation in the relevant population, and age-appropriateness. It's essential that screening procedures are systematic and based on tools validated specifically for the population and setting they are used in.

However, all screening scales have inherent limitations in accurately identifying individuals at risk, often validated against other assessments rather than real data on suicidal behavior [17, 18]. Recent studies have shown that both clinical impressions and suicide risk-screening tools may have limited predictive value for outcomes such as psychiatric admissions. Therefore, while screening tools can flag potential risks, they should never replace thorough suicide risk assessments performed by trained clinicians. Ultimately, accurately predicting which patients will attempt or complete suicide remains challenging, emphasizing the ongoing need for careful clinical judgment and

comprehensive assessment protocols in healthcare settings [19, 20, 21].

## Conflict of Interest

There is no conflict of interest.


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# Factors Influencing the Utilization of Long-Term Contraceptive Methods among Women of Reproductive Age in Ting'ang'a Location; Kiambu East District, Kenya

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***Abstract***

*Contraceptive use has increased throughout the world over the years. They are classified into two categories; Short-term term methods which are used within three months and long term used longer than three months. The study aimed to establish the various factors influencing the utilization of family planning methods by women in the Ting'ang'a Location of Kiambu East District. A descriptive cross-sectional study was conducted, and 300 women aged 15 to 49 participated. Structured questionnaires, in-depth interview guides, and FGD were used to collect quantitative and qualitative data. A chi-square test at 95% C.l. was used to test the association of variables regarding knowledge, attitude, and cultural practice of Family planning. Out of 300 respondents, 70.3% were married and 17.0% were single. Their mean age was 30.69 years ± 7.905, the youngest being 15 years, the oldest 49 years. There were 97.0% Christians and 3.0% others and 65.7% had attained primary school. 50.0% currently use modern contraceptives. The Utilization rate was classified as Depo-Provera (50.0%), Implant (21.7%), Pills (19.2%), IUCD (5.6%), Tuba-ligation (1.0%), and others (2.5%). Level of education had no significant (P= 0.490) influence on the current use of FP methods. However, two variables were significant: the age of respondents (P= 0.000) and knowledge of the benefits of FP ( P= 0.000) respectively had an influence on the current use of family planning methods. There was high awareness of FP methods; half of the respondents were currently using a contraceptive. Culture was a key hindrance, constituting 91.1%.*

***Keywords:*** *Contraceptives, Kenya, Longterm, Utilization, Women.*

## Introduction

Reproductive Health as defined by the World Health Organization, is generally a state of complete physical, mental, and social well-being in all matters related to the Reproductive Health system, and not merely the absence of disease or infirmity [1]. RH care system therefore is inclusive of all promotive, preventive and curative services that will be conducive to the well-being of the individual in human reproduction and sexuality [2]. Reproductive Health is made up of many components, amongst which is the aspect of family planning. Family planning is the use of birth control methods to choose the number and timing of children born into a family. It is recognized not only as a key intervention for improving the health of women and children but also as a human right [3]. The basis for action in family planning as stated in the Programme of Action of the UN International Conference on Population and Development, must be, to enable couples and individuals to decide freely and responsibly the number and spacing of their children, to have the information and means to do so, to ensure choices and make available a full range of safe and effective methods [2].

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Contraceptives are classified into two main categories namely; Short term contraceptives which are used within three months and below and Long term contraceptives used from three months and above [4]. Worldwide, 61% of women aged 15–49 years who were married or in a consensual union (635 million women) used some form of contraception in 2019. In developed countries, women relied mostly on oral contraceptives (16%), female or male sterilization (15%) and condoms (13%); only 9% of women used long-acting reversible contraceptive (LARC) methods. The respective percentages in developing countries were 3%, 6%, 18% and 25 % respectively [5].

Although oral contraceptives can be very effective in preventing unintended pregnancies, they have been associated with poor compliance which often results in contraceptive failure [6]. In contrast, female sterilization does not depend on users' adherence, it is highly effective, but it has a permanent contraceptive effect. Notably, Long long-acting reversible Contraceptive methods combine reversibility with particularly high effectiveness, which does not rely (or relies to a small degree only) on users' compliance or correct use. Despite these advantages, the uptake of LARC methods in Britain and most other developed countries is rather low [7].

Approximately 25 % of women and couples in sub-Saharan Africa who want to space or limit their births are not using any form of contraception. In a survey carried out by the CDC on the use of contraceptives in Sub-Saharan Africa in the year 2020, sterilization was 2.4%, contraceptive pills was 10.1%, Intra-uterine contraceptive device was 2.1% and Condom was 1.9%. In most countries, the source of supply will vary substantially, by type of method. As in many regions in Africa, east Africa is facing the threat of HIV and increasing poverty. The governments of these countries are consistently sensitizing and educating on the practice of family planning [8]. One of these countries is the Government of Kenya. The total fertility rate for Kenya in 2021 was 4.6, the use of family planning services was 46%, and the use of IUCD in particular as a long-term method was 2.4%) In 2021 [9].

Women's decisions about non-use, use, and discontinuation can be affected by their perceptions of contraceptive risks and benefits, concerns about how side effects may influence their daily lives, and assessments of how particular methods may affect relationships with partners or other family members. Incorporating women's perspectives into contraceptive introduction strategies can help local family planning programs increase user satisfaction, improve continuation rates, and expand method use, experts suggest. It has been found through several studies that the dependent factors are effectiveness and side effects [2]. Kenya is divided into many Districts which are in turn divided into locations and sub-locations respectively. In Kiambu District, the female population in the reproductive age group made up 26.4% of the total district's population. In this District, different aspects of the provision of reproductive health services were found to be wanting in some locations. This data includes the study area (Ting'ang'a) which has a total population of 8,475 [10]. Thus the objective of this study was to assess the utilization of long-term contraceptive methods by women in Ting'ang'a location in order to facilitate the planning of health care provision. The analysis in this report is based on the findings and responses from women of reproductive age 15-49 years, using SPSS version 18.0. Other popular contraceptive methods, such as the male condom and male sterilization are not examined in this paper, as their use does not depend exclusively on women's choice and compliance.

## Problem Statement

Rapid population growth has contributed to large family sizes that in turn contribute to exacerbating the effects of poverty on people. It

was therefore important to promote the use of long-term contraceptive methods of family planning to control and maintain a manageable family size. It had been observed that the use of short-term contraceptives was higher in the Ting'ang'a location but the use of long-term methods was very low. All GOK health facilities in all the locations of Kiambu provide the two types of contraceptive methods. Long-term methods were more advantageous as they can be used between 3 -12 years once administered without frequent visits to the FP provider [11]. This information and many more on family planning were offered to all women attending ANC services in this District. It was not clear why the Ting'ang'a location in this district had a characteristic of not using long-term contraceptive methods over the past years [10]. Studies have found that the reasons for such a situation could be poor accessibility to the service, high cost, cultural and religious influence and lack of knowledge about these services. The availability of a health facility providing FP services, continuous education on the essence of FP and reduction of the cost of these services could increase the utilization [12].

## Justification of the Study

According to Robert Malthus (1798), if the human population is allowed to increase in an uncontrolled way, then the number of people would increase at a faster rate than the food supply. A point would come when the human population would reach the limit to which food sources could not support. Any further increase would lead to a population crash caused by natural phenomena like famine or disease. In his own words, "passion between the sexes is an inevitable phenomenon hence, when unchecked, population would grow at such a high rate that it would outstrip food supply" [13]. According to Malthus, disease, food shortage and death due to starvation, was nature's way to control the population. He proposed that human beings adopt measures like moral restraints, delaying marriage, avoiding extramarital sexual gratification, and the practice of abstinence before marriage as a way to check population growth [13].

In order to avoid getting into the situation of natural checks as a result of the rapid population growth rate as predicted by Rev. Robert Malthus (1798), which may lead to inadequate access to food, water supply, education and health services, it is important to enhance policies that promote contraceptive prevalence. These policies are only enacted and implemented after a thorough investigation or research has been conducted. The two types of contraceptives are short and long-term methods that: prevent pregnancy; and allow spacing and choice of family size [14]. Modern long-term contraceptive methods such as intra-uterine device (IUD), Implant and tuba-ligation are used to postpone or avoid pregnancy for a long period of time. They are all effective if used in the correct manner are reversible and can be removed anytime one wishes to have a baby except for tuba-ligation which is a permanent method [15].

Research indicates that the most effective birth control method is the method the client is most comfortable with. Client understanding of various methods and comfort with the one they choose is best accomplished with non-directive counselling and education from a family planning provider that they trust. Family planning providers aim to increase the percentage of clients who use their chosen method consistently and correctly [16].

All women are entitled to a contraceptive method of their own choice. Long-term methods are more dependable and reliable as they give a woman a long break from childbearing and better opportunities for involvement in the socio-economic life of the community. A woman's ability to avoid unintended pregnancy is related to her level of risk for pregnancy, her choice of methods, the strength of her motivation to avoid pregnancy and her pattern of contraceptive use [17]. These

factors, in turn, are often associated with a woman's demographic and socioeconomic background, characteristics of her sexual partnerships, and her experiences with and attitudes toward pregnancy and contraception [18]. It was vital for this research to consider the background, demographic, socio-economic, socio-cultural and accessibility factors associated with the use of long-term contraceptives by women aged 15-49 in this location.

Since the information on the utilization of long-term methods of contraceptives in Kiambu East-Ting'ang'a location, is scanty with no scientific study done to access factors influencing the prevalence of use, the information generated by this study gave an insight into prevalence use, accessibility and sociocultural factors hindering long term contraceptive use. The data will help the district management team and other stakeholders in future planning and integration of other health services with family planning.

## Research Question

What are the underlying factors influencing the utilization of long-term contraceptive methods of family planning in the Ting'ang'a Location of Kiambu East District?

## Broad Objectives

To establish the various factors influencing the utilization of long-term contraceptive methods in the Ting'ang'a Location of Kiambu East District.

## Specific Objective

1. To establish the prevalence use of long-term contraceptive methods.
2. To assess the accessibility and availability of Long-term contraceptive services
3. To determine, socio-cultural and religious beliefs and myths hindering the utilization of long-term Contraceptive methods.

## Hypothesis

There are no socio-cultural factors influencing the utilization of long-term contraceptive

methods in Ting'ang'a Location, Kiambu East District.

## Conceptual Framework

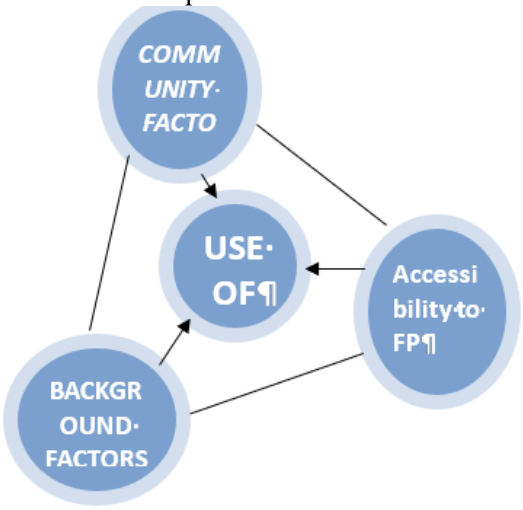


**Figure 1**. Conceptual Framework

## Study Area

Kiambu East is one of the eleven districts in the central province. It borders Nairobi to the south, Thika and Gatundu districts to the east and Kiambu west to the west. The district has a total area of 365.7 km2. It is divided into three administrative divisions namely: Kiambaa, Githunguri and Kiambu Municipality, 16 locations and 48 sub-locations respectively. Population was 2,417,735, with a population

growth of 2.6 % which makes it the most densely populated district in the province with 952.4 persons per square ($Km^2$) [19]. The study area was conducted in Ting'ang'a Location with a catchment population of 8,475, in two sub-locations namely; Kagongo and Ting'ang'a comprising 14 villages respectively.

### Health Facilities

The district had two (2) hospitals; Kiambu District Hospital, Kihara sub-district hospital and Beta Care (nursing home); six (6) health centres and thirteen (13) dispensaries. As per the Community Strategy Mapping, the expected number of Community units in the district is 52. Only seven (7) of these units are functional [19]. In Ting'ang'a, the Catholic Mission dispensary was the only one serving the location.

### Socio-Economic Status

Primary resources in the district include land, soil and water. About 90% of the district was arable land. All divisions had high agricultural potential. Coffee, tea, horticulture and flower farming were major cash crops in the district. Livestock and enterprises were also major economic activities. Other natural resources included, mining (quarries) in the Githunguri division. Long rains in the district occur between April and May while short rains occur from October to November. The majority of the people in the Ting'ang'a location were farmers and in fact (60%) of the women who responded to the interview were farmers, 25.6% were doing marketing, 10% were employed and salaried and 4.4% had no permanent occupation. Farming in this location largely included cattle rearing and milking [19].

## Methodology

### Study Design

A descriptive, cross-sectional study was undertaken to establish the various factors influencing the utilization of long-term contraceptive methods by women of reproductive age (15-49 years) in Ting'ang'a Location of Kiambu East District from June 29 to July 15, 2024.

### Study Population

The study population constituted women of reproductive age group aged between 15-49 in the Ting'ang'a location.

### Sampling

Ting'ang'a location was purposively sampled by the District Health Management Team of Kiambu owing to the low utilization of long-term contraceptives in the area. The sampling frame was households with women aged 15-49 years.

### Sampling Technique

Women aged 15-49 years in the Ting'ang'a location who were present at the time of the study were randomly sampled and interviewed.

### Sample Size Determination

The required sample size was calculated using the approximate percentage of women in the reproductive age bracket (26.4%) of 8475 which totals to 2,238 women (Kiambu East District Profile, 2021). the target population of Caregivers of children with malaria is assumed to be large. Hence, the sample size will be calculated using Cochran's formula for a large population [20].

### Cochran Formula (1963)

The sample size was calculated as follows:

$$n = \frac{z^2\, pq}{d^2}$$

Where n = maximum desired sample size,

z = standard normal deviation set at 1.96, which corresponds with 95% CI

P= proportion of the target population estimated to have a particular characteristic of

Interest (50%)

d= Minimum error (degree of accuracy desired) set at 0.05.

q= the proportion of the remaining population (1-P)

i.e. q =1-0.5=0.5

$n = \frac{1.96^2 * 0.5 * 0.5}{0.05^2} = 384.2 = 385$

Women of reproductive age bracket in Ting'ang'a location are 2,238

$Nf = {}^{n}/_{1\frac{n}{N}} = {}^{385}/_{1\frac{385}{2238}} = 328$

The desired sample size (n) was 328 women

The actual sample size was 300 women (91.5%)

## Study Variables

### Data Collection Methods and Tools

Structured Questionnaires were administered to eligible women in their households. In-depth interview guides moderated by the Principal Investigator were conducted with two key informants (the Chief and woman leader), and two focus group discussions (FGD), where proceedings were recorded using a tape recorder and notebooks. Following this method, both quantitative and qualitative data were collected. Table 1: Key Study Variables of the study group and scale of measure.

### Inclusion and Exclusion Criteria

All women of reproductive age 15-49 years residing within the six villages of the two locations were included in the study. Women of age 15-49 years who were not residing within the six villages together with those who were residing but were not present at the time of the study were excluded.

### Data Analysis

Data cleaning was done by running frequencies to trace the missing data and cross-checking the interview schedule after data entry using SPSS Version 28.0. Categorical data was analyzed and presented in frequencies, proportions and percentages while numerical data was analyzed and presented in measures of central tendency and dispersion.

### Quality Control

The researcher ensured that the data collection tools (30 interview schedules (9.1%) of the desired sample size were filled for pre-testing by women of the Ting'ang'a sub-location and the necessary correction and adjustments done on the final interview schedule. Research assistants were carefully identified on condition that they were fluent in both Swahili and English languages and had no bias against any contraceptive methods of family planning.

## Ethical Consideration

Confidentiality and privacy of respondents was maintained as names of respondent identification were not required and information gathered was limited only to persons authorized to use such type of information. Consents were sought from each administrative leader, facility head, family and respondent before interviews were conducted. Potential benefits to the community were articulated clearly and unambiguously so as to make information useful when needed. Research participants were considered partners, not research subjects and their daily work schedule was respected. Responsible members of the community such as the Chief, Women leader and Community Health Volunteers were given responsibility for ensuring continuous education on family planning. After consultation with the leaders about the proper methods for publishing and disseminating information to benefit the community, community members were the first to receive information about the results of this study.

## Limitations and Delimitations

Time was the major limitation experienced during the study. Heavy rainfall (slippery roads and mud), traffic jams (caused delays) and the farming period (women went to the farms) were also key limitations to achieving the desired sample size. All these contributed to chopping and reducing the research time. However, a

representative sample was achieved through hard work and commitment by the entire team.

## Results and Findings

### Location of the Study

64.1% of the respondents were from the Ting'ang'a sub-location while (35.9%) were from Kagongo. In all the two sub-locations, 3 villages from each were sampled. In the Ting'ang'a sub-location, the villages were, Upper Gituamba (14.4%), Lower Gituamba (15.9%) and Gitundu (15.0%) while the villages in Kagongo sub-location were, Thaara (20.3%), Kagongo (14.4%) and Makenga (20.0%) respectively.

### Socio-Demographic Characteristics

Out of the 320 respondents, 66.9% were married, 26.92 were single and the rest were either separated, divorced or widowed. Their mean age was 29.9 years ± 7.61, the median 28.3; the youngest respondent was 16 years while the oldest was 49 years. 71.3% of the respondents were Catholics while 28.1% were Christian Protestants and over half of the respondents (52.5%) had attained secondary education. The majority (48.4%) of the respondents had their last child between 0-4 years. (31.6%) of the respondents were housewives, (10.0%) were salaried.

### Utilization of Contraceptive Methods

#### Source of Information on Contraceptives

The majority (94.7%) of the respondents were aware of family planning methods. Sources of information were classified as Health provider (85.7%), Chama (women group) (26.7%), Electronic media (23.7%), Partner (13%) and others (friends, seminars, books) (35.6%). A higher percentage of the respondents got information from Health providers during visits to Child Well Fare Clinics (CWC) while a small percentage got it from the Chama (women group) during group meetings. The in-depth interviews with the opinion leaders and the focus group discussions also confirmed that women who practised FP mostly got it during routine visits to the ANC. A full graphical picture is displayed in Figure 2 below.

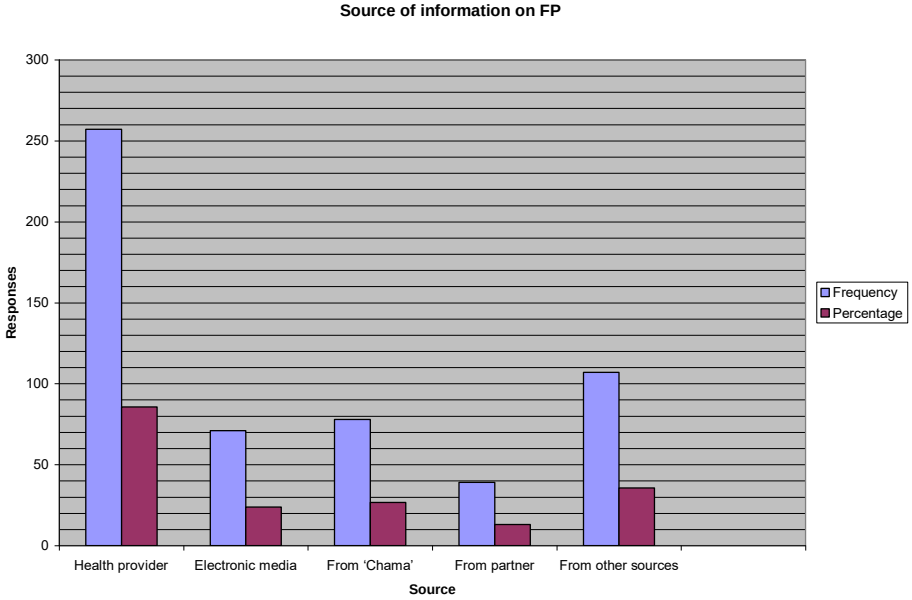


**Figure 2**. Source of Information on FP (*Multiple Respond)*

## Current Use of Modern Contraceptives

Current usage of modern short-term contraceptives was found to be; Depo-Provera (30.3%), Contraceptive Pills (25.9%) and other (natural, herbs) (30.3%) and for long-term contraceptive methods; IUCD (6.6%), Implant (4.7%) and Tuba-ligation (1.3%). The prevalence use of long-term was noted to be low (12.5%) as compared to short-term methods (56.2%). From the focus group discussions, most of the women pointed out that they prefer short-term methods (Depo-Provera and pills) because they are easily available and cheaper in the shops and Chemists. They complained that long-term methods were expensive and only available in hospitals and health centres which were not operating in the location during the time of the study. Most of them mentioned that they were usually frustrated anytime they went to the facility requesting tuba-ligation as they were denied the service for reasons of being young in age owing to its irreversible nature. This was pointed out as one of the reasons for the low prevalence use of tuba-ligation in this location. The table 1 below shows the frequencies and percentages of currently used contraceptives in the location.

**Table 1**. Methods Currently Used by Most Respondents

| Method currently using | Frequency | Percentage |
|---|---|---|
| **Short-Term** | | |
| Depo-Provera | 97 | 30.3 |
| Contraceptive Pills | 83 | 25.9 |
| Not Using | 98 | 30.3 |
| **Long-Term** | | |
| IUCD | 21 | 6.6 |
| Implant | 15 | 4.7 |
| Tuba-ligation | 4 | 1.3 |

## Reasons for Low Use of IUCD

Most of the women were not using IUCD for the following reasons; no idea (59.7%), side effects (18.4%), expensive (5.6%) and others (not available, family decision) (16.3%). According to the women leader, women in the community complain that they experience backache, headache, bleeding and failure and that there are also some misconceptions and myths such as its disappearance in the Uterus, and attachment to the head of the fetus. The women also said that they fear the route of insertion and the method is not available in all the clinics they visit within the location. This is confirmed by WHO [21] in a study aimed at Creating a Common Ground for the use of FP methods. This displayed women's Perspectives on the Selection and Introduction of Fertility Regulation Technologies.

## Future Use of IUCD

A greater percentage of women (56.9%) said they will never use IUCD in future, (34.4%) said they may possibly use it in the future and (8.8%) were not sure as seen in Table 2.

**Table 2**. Future Use of IUCD

| Options | Frequencies | Percentages |
|---|---|---|
| No | 182 | 56.9 |
| Yes | 110 | 34.4 |
| I don't know | 28 | 8.8 |
| **Total** | **320** | **100.0** |

## Socio-cultural and Religious Factors

The majority of the respondents mentioned religion (46.7%) as the most influential socio-cultural factor in the use of long-term modern contraceptive methods. A few of them based their arguments on myths and misconceptions (31.1%) and others (on culture) 22.2%. Figure 3 gives a vivid picture of these results.

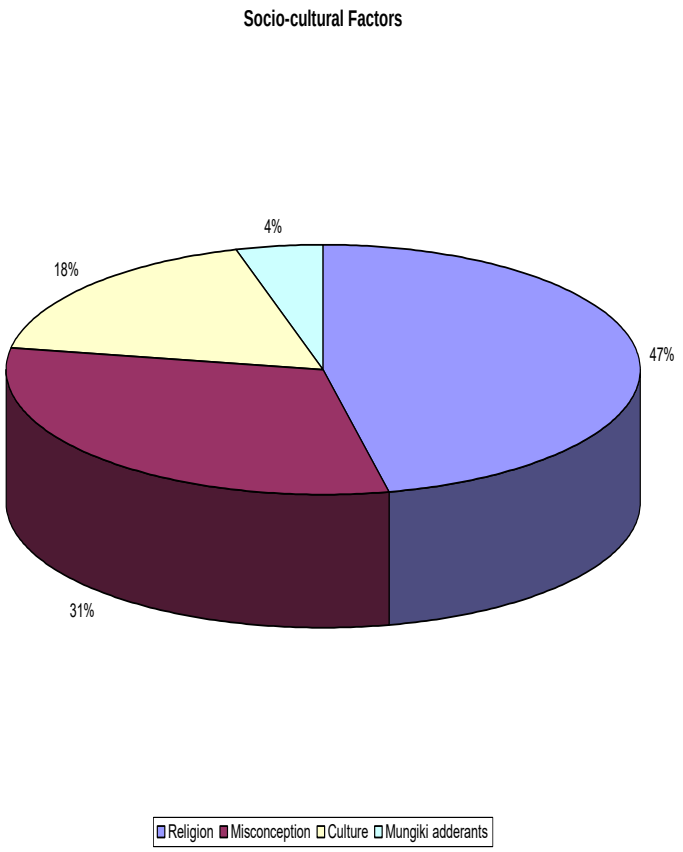


**Figure 3**. Socio-cultural Factors

## Association of Age Group of Respondents to Usage of Contraceptives

Although the Chi-square test could not be used to associate the age groups and utilization of contraceptives because the statistical value exceeded the upper limit of 20, the highest utilization rate was found among women of age group 25-29 as it was 27.2% for short-term and 25.00% for long term. This signifies almost equal acceptance of the two categories of contraceptive methods of family planning**.** On the other hand, women above 30 years use them at a lower rate but the usage of long-term was more than the short term.

## Level of Education of Respondents/Utilization

Although the Chi-square test could still not be used to associate the level of education and utilization of long-term contraceptives because the statistical value exceeded the upper limit of 20, it is evident that utilization is higher for short-term at primary but higher for long-term at secondary. The figure below displays the information.

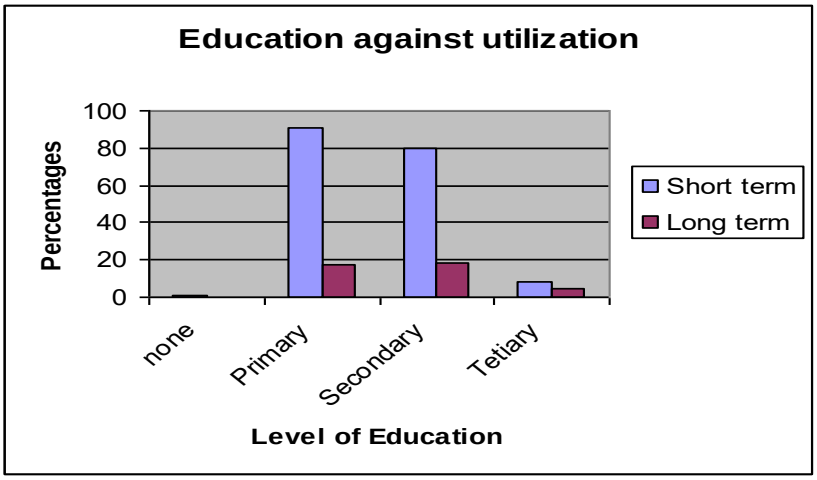


**Figure 4**. Level of Education of Respondents/utilization

## Results of Testing Association of Variables

**Table 3.** Results of Testing Association of Variables

| **Independent Variable** | **Long Term** | **Short Term** | **Statistical Test** |
|---|---|---|---|
| **Sub-location** | | | |
| Ting'ang'a | 18.6% | 81.4% | $\chi 2$ =0.039; 1df; P>0.05 |
| Kagongo | 17.5% | 82.5% | [0.843] |
| **Religion** | **Long Term** | **Short Term** | **Statistical Test** |
| Catholic | 19.8% | 80.2% | $\chi 2$ =0.923; 1df; P>0.05 |
| Protestants | 14.0% | 86.0% | [0.337] |

## Interpretation

The first association testing at a 95% confidence interval at 1 degree of freedom between the sub-location and use of long-term contraceptives showed that there is no significant difference in the prevalence of use patterning to each location. It clearly demonstrated that the place of residence of women had no influence on the utilization rate. The second association test at a 95% confidence interval at 1 degree of freedom was between the religion of the respondent (women) and the use of long-term contraceptives which also showed that the religion of the respondents (women) had no influence and did not determine whether she would use long-term contraceptive or not.

## Conclusion

Awareness and utilization of short-term were found to be higher than long-term contraceptives among women aged 15-49 in the Ting'ang'a location. Accessibility to long-term contraceptive methods within the location was poor and there were no socio-cultural beliefs/myths discovered that hindered women from utilizing long-term contraceptives effectively. However, during the FGD and In-depth interviews, some of the reasons given as to why women do not prefer IUCD could not be scientifically proven and should therefore be considered as misconceptions. Modern contraceptive methods were supplied through clinics in addition to commercial and community-based development (CBD) outlets. Pills, Condoms and other short-term methods were dispensed from any type of facility. Any

method of family planning be it natural or artificial, did not affect the sex life of the couple. However, no method was foolproof and there have been rare cases where women have become pregnant even after using contraception. Therefore, the best way would be to consult one's gynaecologist to understand the appropriate family planning method to practice.

### Recommendations

1. The Ministry of Health should integrate other health services within the location with Family Planning services.
2. The Ministry of Health should reduce prizes of long-term contraceptives to encourage use.
3. The District Management Team in Kiambu should decentralize FP services in order to reduce the unmet needs of families in Ting'ang'a location and curb the dependence on roadside vendors.
4. There is a great need to intensify health education on long-term contraceptives to the whole community of Ting'ang'a location to strengthen the capacity of both men and women on this issue.
5. The Chief, his assistants, the women leaders, the Community Health Workers and other influential leaders should integrate messages on long-term contraceptives during their routine meetings and interaction with the community.


## Acknowledgement

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# Impact of Electronic Banking Fraud on e-platforms. Study of Markets in Abeokuta South Local Government Area Ogun State Nigeria

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***Abstract***

*Electronic banking products are choice alternative to cash payments, globally. However, local people to prefer cash payment in developing environments. The local markets in Abeokuta South Local government area are just like any other local market in developing economies where cash is the major means of payment. The study was carried out to see how fear of e-fraud affect buyers and sellers, in the choice of what payment method to use, in the area of study. With a sample of 50 respondents taken at random from each of the four main local markets, and analyzed with inferential statistics. The result revealed that the market people did not have the same level of fear for all the products. Result showed people felt safer with POS transactions as compared to other electronic platforms.*

***Keywords:*** *Cash Payments, Electronic Banking Fraud, Electronic Banking Product, Local Markets.*

## Introduction

Electronic banking refers to the use of electronic bank-products such as mobile telephone - banking applications (and mobile communication devices), ATM cards, POS terminals and self-serve internet resources in performance of banking transactions. It includes virtual banking, internet banking, POS services and every other process that makes use of information technology to enable self-service among users. Doug, 2024 defines electronic banking as "the use of computers, phones, and other technologies to facilitate banking transactions rather than through human interaction. Electronic banking avails users ease of transactions, great speed in transactions, comfort of transactions and providing efficiency. Electronic banking products make life easier for users as people don't need to go the banking hall to physically carry out many types of transactions as they can effect such transactions, from the comfort of their homes and in any other place of their choice. The availability of electronic banking also serves as source of income, to banks and the other service providers. The suits of product may differ for each bank but, they are essentially aimed at the same goals.

However, despite the great benefits derivable from electronic banking system to users and the financial institutions providing the services, they are also vulnerable to security challenges resulting to loss of funds to fraudsters. [3] states that " electronic banking frauds have been issue of concern all over the world. It has left so many banks bankrupt, and caused many customers so much pain. Fraudsters are inventing newer techniques continually to elude detection and rub banks and customers of their possessions".

These attacks in the area of study, occur in various ways such as theft of identity, through hacking of peoples' accounts, stealing of personal information through phishing, implantation of Trojans, take-over of users' accounts, cloning of ATM cards and constant innovations by fraudsters. Even though threat

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of e-fraud is a global challenge, it is a major one in Nigeria generally and in the area of study in particular because the threat is compounded by the high level of illiteracy among users, seeming lack of security infrastructures and poor services by the banks in protecting the users. As a result, the electronic banking has not been fully accepted by majority of people in the area of study, not because they don't need it but due to their reservation about the vulnerability and frauds that are common with the products

Basic security feature of electronic banking products is that they are user-friendly and can be used directly and personally outside the direct intervention of the bankers, outside the banking halls. The users have personal responsibility to use the items without the immediate intervention from banks staff and users have a primary responsibility to protect themselves against attacks by securing their banking details, private. holders.

A common form of electronic banking fraud occurs through attack on accounts through acquisition of the telephone sim cards of their victims. Fraudsters often gain access to accounts of people by hacking the telephone lines of their victims and accessing the accounts that are linked to such numbers. This type of fraud known locally as 'fire fire' is done by using special codes to access the linked BVN and account details of the owners. With these details of the victims acquired, fraudsters steal funds and some fraudsters go further to use the personal details to obtain online loans and purchase items online. Electronic banking Frauds often also involve identity theft.

## Relevance of the Research

The aim of this study is unravel the impact of fraud, on the usage of electronic banking products, in **Abeokuta**. The study is considered relevant because, it seeks to unravel electronic banking fraud and improve on the adoption of alternative payment systems in the area of study. It is also relevant because, it seeks to know how the choice of the traders in area of study, is affected by incidence of electronic fraud.

The study is unique because, there is no similar study that has been done on this topic (on the area of study) as much as the writer is aware of, that deals with this specific problem even though there are general studies and literature on electronic banking and frauds in electronic banking.

## Problem Statement

Nigeria is in the process achieving a cashless economy but, people at the grassroots especially market people and petty traders are slow to adopt this method of payment. This does not appear to be necessarily because people hate changes but, it appears to be because of the challenges they are facing with the changes. Amongst these challenges is the threat of fraudulent attacks on electronic payment methods. "There are cases of bank customers that decline the use of electronic banking without any reason, but for the fear of not being hoodwinked" [9]. This creates the need to study the role that electronic banking frauds play in determining the behaviour of the people at the grassroot, in adopting electronic banking and offer solutions increasing the impact of the Cashless policy. It also creates the need to study and provide solutions to the fear.

## Research Objectives

The general objective of this study is to discover how electronic banking fraud affects choice of market people and provide academic input to resolving the menace of electronic banking frauds in the area of study. It is also to serve as a point of reference, on the drive to achieve cashless economy in Abeokuta Ogun state of Nigeria.

The specific objectives are:

1. To determine how the incidence of electronic frauds affects decision

behaviour of individuals in the area of study, in respect of whether or not to use electronic banking facilities.
2. To proffer solution on how to improve on the usage of electronic banking products in the area of study.

## Research Questions

1. What are the factors responsible for the choice of people / traders using electronic banking systems in the market?
2. Does the incidence of electronic banking fraud affect the usage of electronic banking products in the area of study?
3. What is the relationship between incidence of electronic banking frauds and people's usage of electric banking products in the local markets Abeokuta South Local government area of Ogun State Nigeria?

This paper relies on both primary and secondary data. The primary data is based on information gotten by the researcher from the samples from the area of study while the secondary data refers to the existing information already existing in the literature of other researchers, that are relevant to the issues here.

## Literature Review

### Types and Definition of Fraud

Fraud does not have a single universal definition. However, it may be defined as "a deliberate act (or failure to act) with the intention of obtaining an unauthorized benefit, either for oneself or for the institution, by using deception or false suggestions or suppression of truth or other unethical means, which are believed and relied upon by others" [5]. In describing the attributes of fraud, MacEwan University states that, "Fraud is crime, a knowing misrepresentation of the truth or concealment. The deliberate theft, misuse, or misapplication of an organization's assets or resources for personal gain" [6]. This kind of fraud includes any fraudulent act that the doer employs and electronic channel to perpetuate whether directly or indirectly. Fraud "is not an error that someone made or something that accidentally occurred" (MacEwan University) even though it might have been aided by a mistake from victim or another person.

Ref. [3] defined electronic banking frauds "as frauds associated with electronic banking perpetrated using ATM, POS, internet and mobile banking platforms. They further stated that, "electronic banking frauds are achieved through the following: "i) Impersonation: exposing secrete identities to a third party who impersonate and defraud the owner. ii) Phishing and spooling: giving response to futile text messages by revealing identities which are later used to defraud victims. iii) Hacking: using random code generating software developed specifically for frauds purpose to hack into any matching account and defraud victims. iv) Bankers: liaise with fraudsters by providing identities that are used to defraud banks and customers. v) Trojan horse: the interface with user login to divulge user's secret personal codes/identities which is in turn used to defraud victims" [3].

The scope of definition of electronic banking fraud is getting wider as ingenious fraudsters introduce new tricks different products by the day. The term generalizes includes any usage of mobile electronic device or process, to fulfil fraudulent intentions.

## Common Frauds Involving Electronic Banking Products in Abeokuta

Debit and credit card are often the subject of attack by fraudster. The actual cards could be stolen from the account holders violently or tacitly and used to commit fraud. Also, when the actual cards are not available, the personal details of card holders is sufficient and could also be fraudulently obtained through usage of fraudulent/phony websites and used to defraud owners, These frauds could also occur as a result of exposure of card numbers and passwords to fraudsters, done by the bankers.

Fraudulent attacks on the funds of ATM card users have been a major dissatisfaction for the banking public in the area of study. Moreover, between 2007 and 2013, the major attack on bank customers in Nigeria was vide cloned ATM cards. Fraudsters were able to duplicate customers cards and withdraw money from their accounts.

There have been numerous newspaper reports on alarming electronic banking frauds, in Nigeria. For instance, Leadership newspaper, (2024) read that "data released by the Nigeria Inter Bank Settlement System (NIBSS) show that, while losses to fraud in the financial industry in the first quarter (of 2023) stands at N5.1billion, the figure has so far risen to N9.5 billion as at July 2023. This brings the total amount lost to fraud since 2019 to N50. 5 billion". N50bn was the equivalent of USD 78, 284, 014.40 at the mom prevailing exchange rate. Furthermore, the Premium times newspaper of 2nd March 2022 reported that "an investigator with the Economic and Financial Crimes Commission (EFCC) told a Lagos court how four bank officials cloned ATM cards and linked some accounts to them to steal N874 million belonging to Fidelity Bank and its customers in 2019 [10]. That was the equivalent of USD1,950,892.86 at the then exchange rate of N448 to one USD. A weakness that enables enabled this fraud (cloning of ATM cards) globally is that the cards operated with magnetic strips. However, following the directive of the Central Bank of Nigeria, this weakness has been corrected by usage of chips and pin.

Internet banking frauds: Following the availability of portable telephones (GSM) to the general masses in Nigeria and consequent availability of internet services, several people are now able to process transactions online and carry out transactions, instead of going physically to the bank. However, these electronic products are faced with fraudulent attacks on customers accounts on the internet.

The growth of cybercrime – particularly hacking, identity theft, phishing, Trojans, service denial attacks and account takeover– has created several challenges for financial institutions, especially regarding how they protect their assets and prevent their customers from becoming victims of cyber fraud. These criminal activities have remained prevalent due to certain features of cyber, such as the borderless nature of the internet and the continuous growth of the computer networks" [4].

The increase in temptation to carry out fraudulent attacks of electronic banking products is a result of the vulnerability, economic situation, lack of adequate control from stakeholders and gullibility of users.

## Pattern of Electronic Banking Fraud

Fraudsters have been noted to often target new accounts and take advantage of the naiveness of the owners. Often when accounts are opened in commercial in Nigeria, banks and customers receive account notification of the account numbers and ATM cards, they receive phone calls from fraudsters callers who pose as staff of the bank requesting for details of the banking instruments. Such fraudulent callers are often fully armed with the names of the account holders, Bank Verification Numbers (BVN) and account numbers and what they ask for often are the ATM card details. When such details are released to them by the account owners, the fraudsters use them details to defraud the accounts by gaining access electronically to such accounts. Therefore, banks are consequently constantly educating customers not divulge banking information over the phone to persons. But the big question has been how such fraudsters obtain the information of the account holders in the custody of the banks if people close to the account opening process in the banks did not provide them. This shows that there is an unknown point leakage where information from Nigeran banks are getting to fraudsters.

Even the owners of old accounts also receive strange calls from purported staffs of banks requesting for personal details of the account.

Money transfer frauds: This occurs in cases where fraudsters plead with unsuspecting innocent people to accept transfers into their accounts with the excuse that their (fraudster's) ATM cards are faulty or lost. When such incoming transfers are allowed by the unsuspecting victims, they turn-out to be funds from kidnaping, fraud and other crimes. By transferring illicit funds to accounts of innocent people and receiving the equivalent in value or cash from them, fraudsters successfully avoid being part of the recorded audit trail of such funds and avoid being caught in police investigations. Fraudsters often attempt to employ the use of the account belonging to innocent persons to receive proceed of fraud, in order escapee being identified as the actors in crime scenes. Fraudsters have been seen to buy items and then ordering the transfer of fraudulent funds to the accounts of innocent sellers persons, in a form of receiving illicit funds. They (fraudsters) would receive goods while innocent sellers would receive illicit funds. There are also people who have used fake transaction alerts to defraud unsuspecting sellers as evidence of payments. They would generate fake text alerts generated from telephone applications representing payments to unsuspecting sellers in exchange for goods, from unsuspecting sellers.

Electronic fraud increased due to the drive to cashless economy. With transactions moving to electronic channels and greater number of people adopting electronic channels, the volume of transactions increased and multiple channels are now available. But the level of knowledge that will protect the users is not sufficient.

Fraudsters who access the banking details of victims could obtain loans in the accounts of the victims, could buy items online using their credit card and could steal in any form imaginable.

## Theories of Fraud

The earliest theory of fraud is the White collar theory of fraud in 1944 by Edwin H. Sutherland. This theory refer to frauds committed by professionals without violence and for financial advantage. This theory speaks of fraud cases where the preparators are the staff of the financial institutions use their advantaged knowledge and position to steal. The theory known as Fraud Triangle theory was formulated by Donald R. Cressey. This was a study of White Collar crime theory. This theory assets that there are three foundations based on which fraud can or will occur. These basis are Opportunity, Rationalization and Financial pressure. There has been further development in the theories such as the Fraud Scale, Fraud Diamond, M. I. C. E. model, and A-B-C Analysis which all attempt to tell why, how and when fraud occurs and how to prevent it.




**Figure 1**. Fraud Triangle (Maniya, 2019)

## Empirical Literature Review

Ref. [8] investigated the evolution of fraud theory and it's relevance to fraud prevention. on the village government in Indonesia. The research revealed and it was observed that strong internal controls in an organisation could prevent fraud from occurring. The study also established that review of fraud theories could prevent fraud from reoccurring.

Ref. [2] studied E-Fraud committed by staff of Nigerian banks to know why and how they occurred. Using as sample of 120 respondents from fraud investigators in commercial banks in Nigeria, the study undertook to know why e-frauds are committed by staffs of Nigerian banks. It was observed that pressures such financial, occupational presures, integrity issues, systems vulnerability were responsible for the high level of incidence of bankers' involvement in electronic of bankers to temptation to commit e-fraud.

Ref. [4] studied prevention of e-banking fraud and detection in Nigerian banks using mixed research methods. The study revealed that " the factors contributing to the increase in e-banking fraud in Nigeria include ineffective banking operations, internal control issues, lack of customer awareness, lack of staff training and education, inadequate infrastructure, presence of sophisticated technological tools in the hands of fraudsters, negligence of banks' customers concerning their e-banking account devices, lack of compliance with the banking rules and regulations, and ineffective legal procedure and law enforcement. In addition, the enforcement of rules and regulations in relation to the prosecution of financial fraudsters has been passive in Nigeria. Moreover, the findings also show that the activities of each stage of fraud management lifecycle theory are interdependent and have a collective and considerable influence on combating e-banking fraud." Fadayo , 2018.

Ref. [7] studied the impact of card fraud on Customers' Confidence in alternative banking channels using data from Central bank of Nigeria, Nigeria Deposit Insurance Corporation and Nigerian Electronic Fraud Forum. The studies revealed that while Nigeria has aligned with developed countries adopting the comfort of electronic banking, fraudsters have taken advantage and this has affected the confidence of users of electronic banking products in Nigeria, negatively. The results showed negative relationship between card frauds and customer confidence in alternative banking channels. The research concluded that card frauds affect customer confidence in alternative banking channels negatively leading to customers preferring in-branch transactions. The paper recommended improved collaborations between banks and CBN to tackle frauds and leverage on the Bank Verification Number platform to improve security of transactions on ABCs through biometric authentication.

Ref. [3] studied electronic banking fraud, fraud detection and control observed that the use of artificial neural network and geographic information system (GIS) to track criminal activities in hotspot areas is a solution to the threat of cybercrimes. This (a concept called he referred to as geocoding), utilizes a map created to show patterns and trends of crime. This method is a policing measure to curtail the threat of cybercrimes. [3] further noted that computer security can be used also to protect against electronic fraud by means of installing blocking software, V-chip, Browsers with ratings, Audit controls, Encryption, People controls, Fire walls, Access point cloaking. The study further analyses access control in terms of usage of access authorization, anti-virus software to debug viruses and malware, cryptography, Biometric authentication and Legislations and policies

## Materials and Methods

### Research Instrument

The research instrument used for this research, is a structured questionnaire designed by experts, specifically for the study.

### Sampling Technique

A sample of 50 persons made up of sellers and buyers chosen at random, were selected from each market in the area of study. The questionnaires were hand delivered to the respondents by assistants of the researcher and the completed forms retrieved in the same way. This result shows the impact of electronic banking fraud on demand for electronic banking products, case study of markets in Abeokuta using the descriptive and inferential statistics. 50 respondents responded to the questionnaires

### Research Method

The study was carried out as a correlational research. The correlational research method is used for situation when variables have association be positive or not which, is the purpose of this research that is, to study the association between the independent variable (fraud in electronic banking) and the dependent variable (choice of payment method).

The population of the study consists of the local markets in Abeokuta South Local government area in Ogun state of Nigeria. Four markets were selected out of the 8 recognizable markets in the area which includes the large gathering of closely associated shops and stores. A sample of 50 persons from market was targeted purposively, and issued structured questionnaire that was constructed by professional, for this research. The questionnaires were distributed and retrieved by the aids of the researcher and analyzed using simple percentages.

## Results

### Descriptive Analysis

**Table 1**. Gender Data of the Respondents

| Location | Female | | Male | | Unknown | | Mean |
|---|---|---|---|---|---|---|---|
| (Market) | Frequency | Percentage | Frequency | Percentage | Frequency | Percentage | |
| Omida | 31 | 62 | 18 | 36 | 1 | 2 | 16.67 |
| Paseke | 22 | 44 | 8 | 16 | 20 | 40 | 16.67 |
| Kuto | 16 | 32 | 33 | 66 | 1 | 2 | 16.67 |
| Adatan | 3 | 6 | 47 | 94 | | 0 | 25.00 |

Source: Author's computation

Table 1 reveals that 62% of the respondents are female and 36% are male in Omida market. 44% of the respondents are female and 16% are male in Paseke market. 32% of the respondents are female and 66% are male in Kuto market and 6% of the respondents are female and 94% are male in Adatan market. The Statistics shows we have more of men in Adatan and high population of female in Omida in respond to this research.

**Table 2**. Age of the Respondents

| Location | Less Than 20 | | 21-30 | | 31-40 | | 41-50 | | 51 & Above | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (Market) | Freq | % | Freq | % | Freq | % | Freq | % | Freq | % | |
| Omida | 5 | 10 | 6 | 12 | 13 | 26 | 15 | 30 | 11 | 22 | 10 |
| Paseke | 7 | 14 | 15 | 30 | 18 | 36 | 7 | 14 | | 0 | 11.75 |
| Kuto | 5 | 10 | 8 | 16 | 9 | 18 | 11 | 22 | 14 | 28 | 9.4 |
| Adatan | 3 | 6 | 9 | 18 | 12 | 24 | 8 | 16 | 10 | 20 | 8.4 |

Source: Author's computation

Table 2 reveals that respondents with highest populations are above 21 years above.

**Table 3**. Respondents Education Background

| Location | No Formal Edu. | | Primary Edu. | | Secondary Edu. | | Tertiary Edu. | | Post-Graduate | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (Market) | Freq | % | Freq | % | Freq | % | Freq | % | Freq | % | |
| Omida | 5 | 10 | 3 | 6 | 19 | 38 | 7 | 14 | 11 | 22 | 9 |
| Paseke | 1 | 2 | | 0 | 18 | 36 | 18 | 36 | 11 | 22 | 12 |
| Kuto | 1 | 2 | 6 | 12 | 8 | 16 | 8 | 16 | 9 | 18 | 6.4 |
| Adatan | 3 | 6 | 5 | 10 | 9 | 18 | 9 | 18 | 3 | 6 | 5.8 |

Source: Author's computation

Table 3 reveals that most of the respondents have secondary, tertiary and post-graduate education in all the market sampled

**Table 4**. Respondents Connection to Market

| Location | Trade/Shop Owner | | Consumer | | Others | | Mean |
|---|---|---|---|---|---|---|---|
| (Market) | Freq | % | Freq | % | Freq | % | |
| Omida | 37 | 74 | 8 | 16 | 4 | 8 | 16.33 |
| Paseke | 41 | 82 | | 0 | 7 | 14 | 24 |
| Kuto | 36 | 72 | 4 | 8 | | | 20 |
| Adatan | 43 | 86 | | 0 | | | 43 |

Source: Author's computation

Table 4 reveals that most of the respondents are trader and shop owners in all the market sampled

**Table 5**. Respondents Payment Methods in the Market

| Means of Mobile Payment | | Omida | Percentage | Paseke | Percentage | Kuto | Percentage | Adatan | Percentage | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Pos | Yes | 9 | 18 | 26 | 52 | 9 | 18 | 16 | 32 | 15 |
| | No | 36 | 72 | 14 | 28 | 30 | 60 | 32 | 64 | 28 |
| Mobile Money | Yes | 44 | 88 | 37 | 74 | 38 | 76 | 37 | 74 | 39 |
| | No | 6 | 12 | 6 | 12 | 5 | 10 | 7 | 14 | 6 |
| Online Banking | Yes | 35 | 70 | 31 | 62 | 32 | 64 | 19 | 38 | 29.25 |
| | No | 6 | 12 | 6 | 12 | 8 | 16 | 13 | 26 | 8.25 |

Source: Author's computation

Table 5 Reveals that most of the respondents use mobile banking and online banking in all the market sampled than POS

**Table 6.** Respondents on Frequency of Payment Methods in the Market

| Type of Mobile Platform | | Omida | Percentage | Paseke | Percentage | Kuto | Percentage | Adatan | Percentage | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| Pos | Daily | 9 | 18 | 21 | 42 | 11 | 22 | 14 | 28 | 13.75 |
| | Weekly | | 0 | 2 | 4 | 2 | 4 | | 0 | 2 |
| | Monthly | | 0 | | 0 | | 0 | | 0 | 0 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rarely | | 0 | 3 | 6 | 2 | 4 | 2 | 4 | 2.3 |
| Mobile Money | Daily | 37 | 74 | 36 | 72 | 28 | 56 | 30 | 60 | 32.75 |
| | Weekly | 1 | 2 | 3 | 6 | 1 | 2 | 5 | 10 | 2.5 |
| | Monthly | 1 | 2 | | 0 | | 0 | | 0 | 1 |
| | Rarely | 5 | 10 | 3 | 6 | 9 | 18 | | 0 | 5.67 |
| Online Banking | Daily | 30 | 60 | 24 | 48 | 17 | 34 | 6 | 12 | 19.25 |
| | Weekly | 1 | 2 | 2 | 4 | 2 | 4 | | 0 | 1.67 |
| | Monthly | | 0 | | 0 | | 0 | | 0 | 0 |
| | Rarely | 3 | 6 | 4 | 8 | 8 | 16 | 6 | 12 | 5.25 |

Source: Author's computation

Table 6 reveals that most of the respondents perform frequency of payments of electronic banking daily.

**Research Question 1: What are the Factors Responsible for the Choice of People/Traders using Electronic Banking Systems in the Market?**

**What factors encourage you to use POS terminals?**

**Table 7**. Factors that Encourage the Use of POS Terminals

| | | **Convenience of card payments** | **%** | **Availability of POS terminals in the market** | **%** | **Acceptance by a majority of traders** | **%** | **Lower transaction fees compared to other digital methods** | **%** | **Mean** |
|---|---|---|---|---|---|---|---|---|---|---|
| Omida Market | VH | 9 | 18 | 8 | 16 | 8 | 16 | | 0 | 8.33 |
| | H | | 0 | 1 | 2 | 1 | 2 | 1 | 2 | 1 |
| | M | | 0 | | 0 | | 0 | 1 | 2 | 1 |
| | L | | 0 | | 0 | | 0 | 2 | 4 | 2 |
| | VL | | 0 | | 0 | | 0 | | 0 | 0 |
| Paseke Market | VH | 14 | 28 | 14 | 28 | 10 | 20 | 4 | 8 | 10.5 |
| | H | 5 | 10 | 7 | 14 | 11 | 22 | 5 | 10 | 7 |
| | M | 4 | 8 | 4 | 8 | 4 | 8 | 4 | 8 | 4 |
| | L | | 0 | | 0 | 2 | 4 | 3 | 6 | 2.5 |
| | VL | 1 | 2 | | 0 | 1 | 2 | 3 | 6 | 0 |
| Kuto Market | VH | 11 | 22 | 5 | 10 | 7 | 14 | 2 | 4 | 6.25 |
| | H | | 0 | 2 | 4 | 4 | 8 | | 0 | 3 |
| | M | 3 | 6 | 1 | 2 | 2 | 4 | 2 | 4 | 2 |
| | L | | 0 | | 0 | | 0 | | 0 | 0 |
| | VL | 3 | 6 | 1 | 2 | 1 | 2 | 3 | 6 | 2 |
| Adatan Market | VH | 8 | 16 | 5 | 10 | 6 | 12 | 1 | 2 | 5 |
| | H | 2 | 4 | 3 | 6 | 1 | 2 | 4 | 8 | 2.5 |
| | M | 3 | 6 | 3 | 6 | 2 | 4 | 1 | 2 | 2.25 |
| | L | 1 | 2 | | 0 | | 0 | 1 | 2 | 1 |
| | VL | | 0 | | 0 | 1 | 2 | | 0 | 1 |

Source: Author's computation

Table 7 reveals that most of the respondents were motivate to use POS terminals in all the markets.

**What are the reasons for using mobile money services?**

**Table 8**. Reasons for Using Mobile Money Services

| | | **Ease of use via mobile phones** | **%** | **Lower transaction costs** | **%** | **Availability of mobile money agents** | **%** | **Ability to perform transactions remotely** | **%** | **Financial inclusion for those without bank accounts** | **%** | **Mean** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Omida Market | Vh | 37 | 74 | 21 | 42 | 4 | 8 | 35 | 70 | | 0 | 24.25 |
| | H | 6 | 12 | 9 | 18 | 9 | 18 | 6 | 12 | 3 | 6 | 6.6 |
| | M | 1 | 2 | 4 | 8 | 7 | 14 | 1 | 2 | 1 | 2 | 2.8 |
| | L | | 0 | | 0 | 3 | 6 | 1 | 2 | 4 | 8 | 2.67 |
| | VL | | 0 | | 0 | | 0 | | 0 | | 0 | 0 |
| Paseke Market | Vh | 37 | 74 | 21 | 42 | 8 | 16 | 25 | 50 | 4 | 8 | 19 |
| | H | 4 | 8 | 6 | 12 | 2 | 4 | 4 | 8 | 4 | 8 | 4 |
| | M | 1 | 2 | 4 | 8 | 4 | 8 | 3 | 6 | 4 | 8 | 3.2 |
| | L | | 0 | 1 | 2 | 5 | 10 | 2 | 4 | 3 | 6 | 2.75 |
| | VL | 1 | 2 | 1 | 2 | 2 | 4 | | 0 | 4 | 8 | 2 |
| Kuto Market | Vh | 33 | 66 | 10 | 20 | 6 | 12 | 24 | 48 | | 0 | 18.25 |
| | H | 1 | 2 | 4 | 8 | 4 | 8 | 8 | 16 | 2 | 4 | 3.8 |
| | M | 3 | 6 | 4 | 8 | 8 | 16 | 4 | 8 | 3 | 6 | 4.4 |
| | L | | 0 | 1 | 2 | 3 | 6 | | 0 | 1 | 2 | 1.67 |
| | VL | | 0 | | 0 | | 0 | | 0 | 1 | 2 | 1 |
| Adatan Market | Vh | 33 | 66 | 5 | 10 | 9 | 18 | 24 | 48 | 3 | 6 | 14.8 |
| | H | 5 | 10 | 12 | 24 | 3 | 6 | 7 | 14 | 3 | 6 | 6 |
| | M | 2 | 4 | 8 | 16 | 4 | 8 | 4 | 8 | 2 | 4 | 4 |
| | L | | 0 | 1 | 2 | 1 | 2 | | 0 | 1 | 2 | 1 |
| | VL | | 0 | | 0 | | 0 | | 0 | | 0 | 0 |

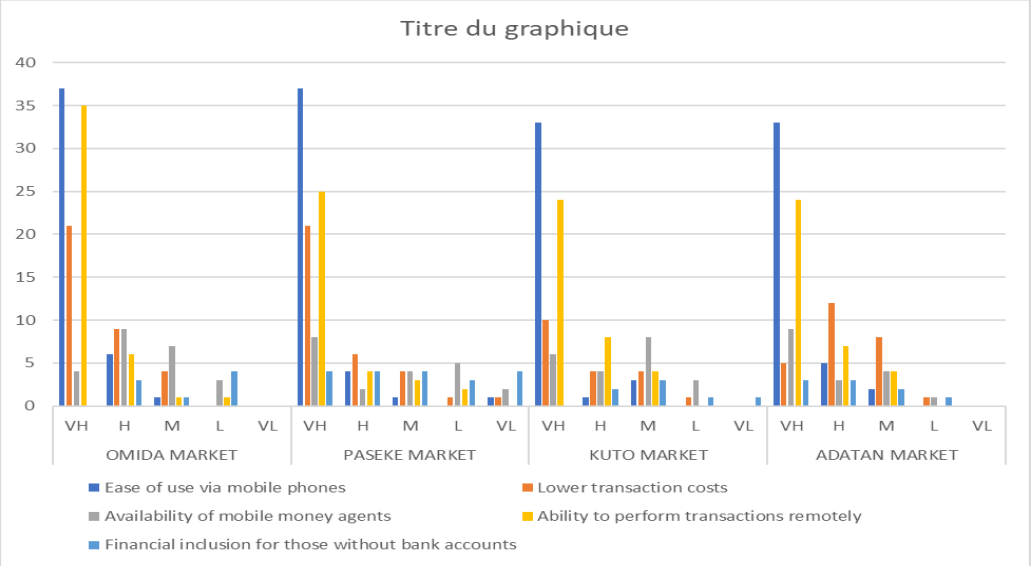


**Figure 2**. Chart Showing the Respondents Reasons for Using Mobile Money Services

Table 8 shows that most of the respondents were motivated to use mobile money services.

**What factors drive the use of online banking?**

**Table 9**. Factors that Drive the Use of Online Banking

| | | **Accessibility From Anywhere With Internet** | **%** | **Convenience of Online Transactions** | **%** | **Integration With Other Financial Services** | **%** | **Ease of Managing Multiple Accounts** | **%** | **Mean** |
|---|---|---|---|---|---|---|---|---|---|---|
| Omida Market | Vh | 25 | 50 | 24 | 48 | 5 | 10 | 6 | 12 | 15 |
| | H | 7 | 14 | 5 | 10 | 5 | 10 | 3 | 6 | 5 |
| | M | 2 | 4 | | 0 | 11 | 22 | 4 | 8 | 5.67 |
| | L | | 0 | | 0 | 5 | 10 | 5 | 10 | 5 |
| | Vl | | 0 | | 0 | | 0 | | 0 | 0 |
| Paseke Market | Vh | 22 | 44 | 12 | 24 | 7 | 14 | 12 | 24 | 13.25 |
| | H | 2 | 4 | 11 | 22 | 4 | 8 | 2 | 4 | 4.75 |
| | M | 3 | 6 | 1 | 2 | 5 | 10 | 2 | 4 | 2.75 |
| | L | | 0 | | 0 | 2 | 4 | 2 | 4 | 2 |
| | Vl | 3 | 6 | 2 | 4 | 3 | 6 | 2 | 4 | 2.5 |
| Kuto Market | Vh | 10 | 20 | 10 | 20 | 7 | 14 | 4 | 8 | 7.75 |
| | H | 8 | 16 | 6 | 12 | 4 | 8 | | 0 | 6 |
| | M | 5 | 10 | 1 | 2 | 1 | 2 | 2 | 4 | 2.25 |
| | L | 1 | 2 | | 0 | 3 | 6 | 4 | 8 | 2.67 |
| | Vl | | 0 | | 0 | | 0 | | 0 | 0 |
| Adatan Market | Vh | 6 | 12 | 3 | 6 | 1 | 2 | 2 | 4 | 3 |
| | H | 3 | 6 | 4 | 8 | 3 | 6 | 2 | 4 | 3 |
| | M | 2 | 4 | 1 | 2 | 1 | 2 | 2 | 4 | 1.5 |
| | L | | 0 | | 0 | 1 | 2 | 2 | 4 | 1.5 |
| | Vl | | 0 | | 0 | | 0 | 2 | 4 | 2 |

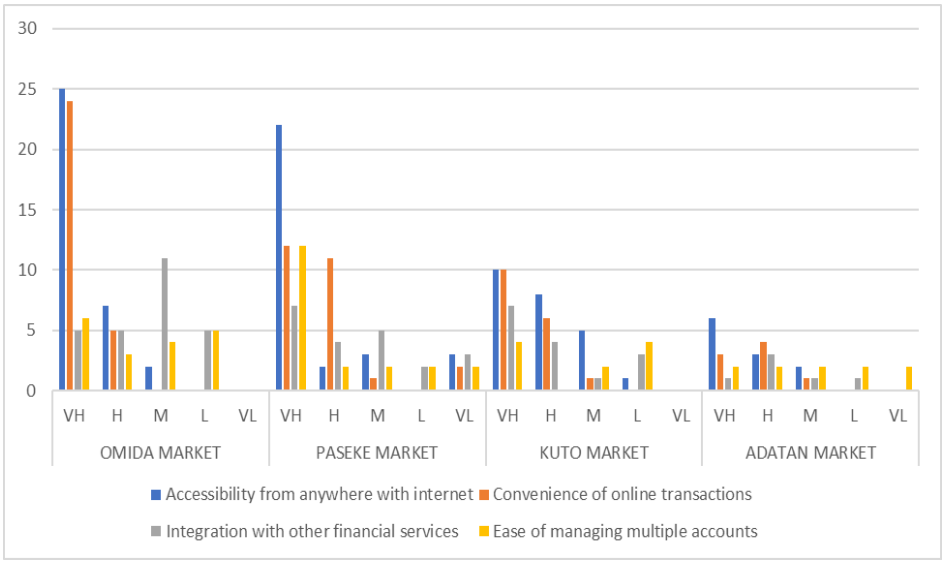


**Figure 3**. Chart Showing the Respondents Reasons for Using Mobile Money Services

Table 9 reveals that most of the respondents in Omida and Paseke markets were using mobile money service but few respondents were using mobile money services.

**Research question 2**. Effect of electronic banking fraud on the usage of electronic banking products

**Table 10**. Effect of Electronic Banking Fraud on Electronic Banking Products

| | | **Availability of payment infrastructure (e.g., POS terminals, mobile networks)** | **%** | **Financial literacy** | **%** | **Security concern** | **%** | **Perceived security on POS** | **%** | **Lack of access to digital payment systems** | **%** | **Mean** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Omida Market | Vh | 26 | 52 | 21 | 42 | 6 | 12 | 1 | 2 | 12 | 24 | 13.2 |
| | H | 15 | 30 | 19 | 38 | 25 | 50 | | 0 | 5 | 10 | 16 |
| | M | 3 | 6 | 5 | 10 | 13 | 26 | 4 | 8 | 13 | 26 | 7.6 |
| | L | | 0 | | 0 | | 0 | | 0 | 7 | 14 | 7 |
| | VL | | 0 | | 0 | | 0 | | 0 | | 0 | 0 |
| Paseke Market | Vh | 24 | 48 | 19 | 38 | 17 | 34 | 7 | 14 | 3 | 6 | 14 |
| | H | 12 | 24 | 7 | 14 | 15 | 30 | 3 | 6 | 3 | 6 | 8 |
| | M | 4 | 8 | 5 | 10 | 1 | 2 | 2 | 4 | 3 | 6 | 3 |
| | L | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 3 | 6 | 2.2 |
| | VL | | 0 | | 0 | | 0 | 3 | 6 | 7 | 14 | 5 |
| Kuto Market | Vh | 21 | 42 | 16 | 32 | 14 | 28 | 3 | 6 | 16 | 32 | 14 |
| | H | 17 | 34 | 18 | 36 | 18 | 36 | 1 | 2 | 4 | 8 | 11.6 |
| | M | 4 | 8 | 2 | 4 | 6 | 12 | 1 | 2 | 3 | 6 | 3.2 |
| | L | | 0 | 1 | 2 | | 0 | 2 | 4 | | 0 | 1.5 |
| | VL | | 0 | | 0 | | 0 | 2 | 4 | 3 | 6 | 2.5 |
| Adatan | Vh | 17 | 34 | 16 | 32 | 15 | 30 | 1 | 2 | 9 | 18 | 11.6 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Market | H | 16 | 32 | 11 | 22 | 14 | 28 | | 0 | 6 | 12 | 11.75 |
| | M | 2 | 4 | 7 | 14 | 5 | 10 | 3 | 6 | 1 | 2 | 3.6 |
| | L | 2 | 4 | | 0 | | 0 | 1 | 2 | | 0 | 1.5 |
| | VL | 1 | 2 | 1 | 2 | 2 | 4 | 1 | 2 | | 0 | 1.25 |

Table 10 shows that most of the respondents reacted on high effect of electronic banking fraud on electronic banking products.

**Research question 3**. Relationship between incidence of electronic banking frauds and people's usage of electronic banking products

**Table 11**. Relationship between Incidence of Electronic Banking Frauds and People's Usage of Electronic Banking Products

| | | **Security Features on Online Mobile Banking** | **%** | **Managing Multiple Accounts on Mobile App** | **%** | **Security Alertness** | **%** | **Alertness on the use of Pos** | **%** | **Mean** |
|---|---|---|---|---|---|---|---|---|---|---|
| Omida Market | VH | 2 | 4 | 6 | 12 | 6 | 12 | 1 | 2 | 3.75 |
| | H | 15 | 30 | 3 | 6 | 25 | 50 | | 0 | 14.33 |
| | M | 9 | 18 | 4 | 8 | 13 | 26 | 4 | 8 | 7.5 |
| | L | | 0 | 5 | 10 | | 0 | | 0 | 5 |
| | VL | | 0 | | 0 | | 0 | | 0 | 0 |
| Paseke Market | VH | 10 | 20 | 12 | 24 | 17 | 34 | 7 | 14 | 11.5 |
| | H | 4 | 8 | 2 | 4 | 15 | 30 | 3 | 6 | 6 |
| | M | 4 | 8 | 2 | 4 | 1 | 2 | 2 | 4 | 2.25 |
| | L | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 |
| | VL | 3 | 6 | 2 | 4 | | 0 | 3 | 6 | 2.66 |
| Kuto Market | VH | 5 | 10 | 4 | 8 | 14 | 28 | 3 | 6 | 6.5 |
| | H | 4 | 8 | | 0 | 18 | 36 | 1 | 2 | 7.67 |
| | M | 4 | 8 | 2 | 4 | 6 | 12 | 1 | 2 | 3.25 |
| | L | 1 | 2 | 4 | 8 | | 0 | 2 | 4 | 2.33 |
| | VL | | 0 | | 0 | | 0 | 2 | 4 | 2 |
| Adatan Market | VH | | 0 | 2 | 4 | 15 | 30 | 1 | 2 | 6 |
| | H | 3 | 6 | 2 | 4 | 14 | 28 | | 0 | 6.333333 |
| | M | 4 | 8 | 2 | 4 | 5 | 10 | 3 | 6 | 3.5 |
| | L | 1 | 2 | 2 | 4 | | 0 | 1 | 2 | 1.333333 |
| | VL | | 0 | 2 | 4 | 2 | 4 | 1 | 2 | 1.666667 |

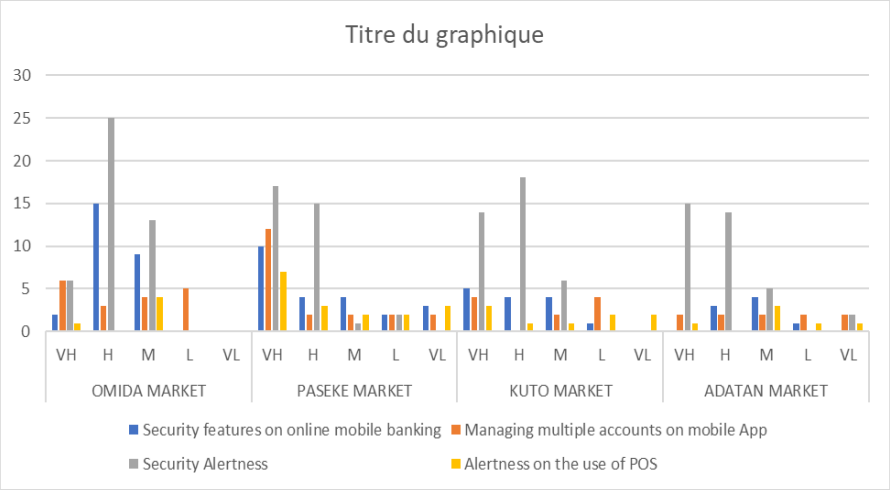


**Figure 4**. Chart Showing the Respondents on the Relationship between Incidence of Electronic Banking Frauds and People's Usage of Electronic Banking Products

Table 11 reveals that most of the respondents showed a high relationship between incidence of electronic banking frauds and usage of electronic banking products

## Interpretation for the Inferential Statistics

### Regression Model

**Table 12**. Table Showing a Regression Model

| **Model Summary[b]** | | | | |
|---|---|---|---|---|
| **Models** | **R** | **R Square** | **Adjusted R Square** | **Std. Error of the Estimate** |
| POS | 0.186 | 0.035 | -0.448 | 6.913 |
| ONLINE BANKING | 0.956 | 0.915 | 0.872 | 2.98 |
| MOBILE BANKING | 0.941 | 0.885 | 0.827 | 0.885 |
| a. Independent variable: effect of electronic banking fraud | | | | |
| b. Dependent variable: pos, online banking, mobile banking | | | | |

**R**: This is the pearson correlation coefficient (r) which describes the strength and direction of linear relationship between two or more variables.

The R-value of 0.186, 0.956 and 0.941 for POS, online banking and mobile banking show that there is a strong correlation with effect of electronic banking fraud variable (Table 12).

**R-Squared ($R^2$):** The coefficient determination (R-Squared) is used to measure the goodness of fit or the explanatory power of a model. Technically, the $R^2$ gives the proportion or percentage of the total variation in the dependent variable that is explained by the independent variable (s).

**R-Squared ($R^2$)** value of 0.035 shows that about 3.5% have effect on the electronic banking fraud as a result of use of POS while 96.5% is captured by the error term. This shows that the model has a poor fit but 0.915 for online banking which is equivalent to 91.5% and 0.885 for mobile banking which is equivalent to 88.5% have effect on the electronic banking fraud shows that the models have a good fit (Table 12).

**Effect and Relationship between Incidence of Electronic Banking Frauds and People's Usage of Electronic Banking Products using Correlation Method**

**Table 13**. Table Showing the Pearson Correlation

| **Correlations** | | | | | |
|---|---|---|---|---|---|
| | | **POS** | **Mobile App** | **Online Banking** | **Effect of Electronic Fraud** |
| POS | Pearson Correlation | 1 | 0.156 | 0.090 | -0.186 |
| | Sig. (2-tailed) | | 0.844 | 0.910 | 0.814 |
| | N | 4 | 4 | 4 | 4 |
| Mobile App | Pearson Correlation | 0.156 | 1 | 0.996** | 0.941 |
| | Sig. (2-tailed) | 0.844 | | 0.004 | 0.059 |
| | N | 4 | 4 | 4 | 4 |
| Online Banking | Pearson Correlation | 0.090 | 0.996** | 1 | 0.956* |
| | Sig. (2-tailed) | 0.910 | 0.004 | | 0.044 |
| | N | 4 | 4 | 4 | 4 |
| Effect Of Electronic Fraud | Pearson Correlation | -0.186 | 0.941 | 0.956* | 1 |
| | Sig. (2-tailed) | 0.814 | 0.059 | 0.044 | |
| | N | 4 | 4 | 4 | 4 |
| **Correlation is significant at the 0.01 level (2-tailed). | | | | | |
| *Correlation is significant at the 0.05 level (2-tailed). | | | | | |

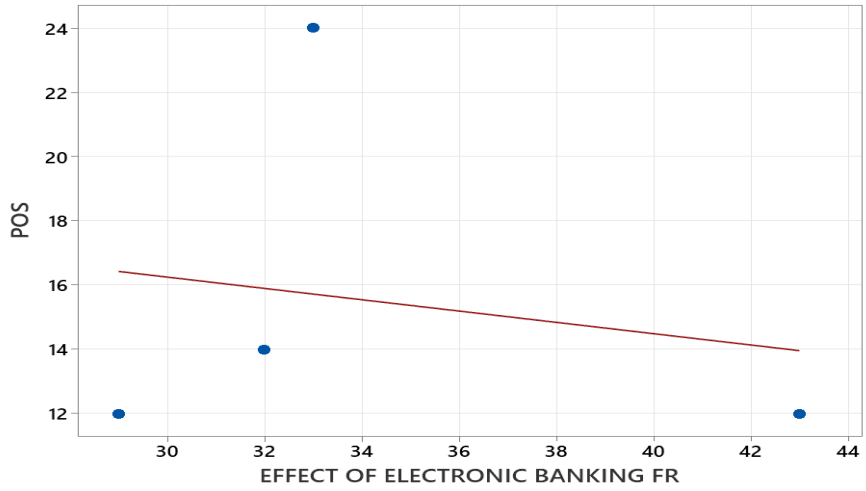


**Figure 5**. Correlation between Effect of Electronic Banking Fraud and POS in Markets of Abeokuta

1. The correlation between the usage of POS and the effect of electronic banking fraud is -0.186 which is a negative correlation in table 13. This means increase in the usage of POS leads to decrease in the effect of electronic banking fraud (0.814 value is greater than 0.05 significant level which show it is statistically insignificant as shown in figure 5.

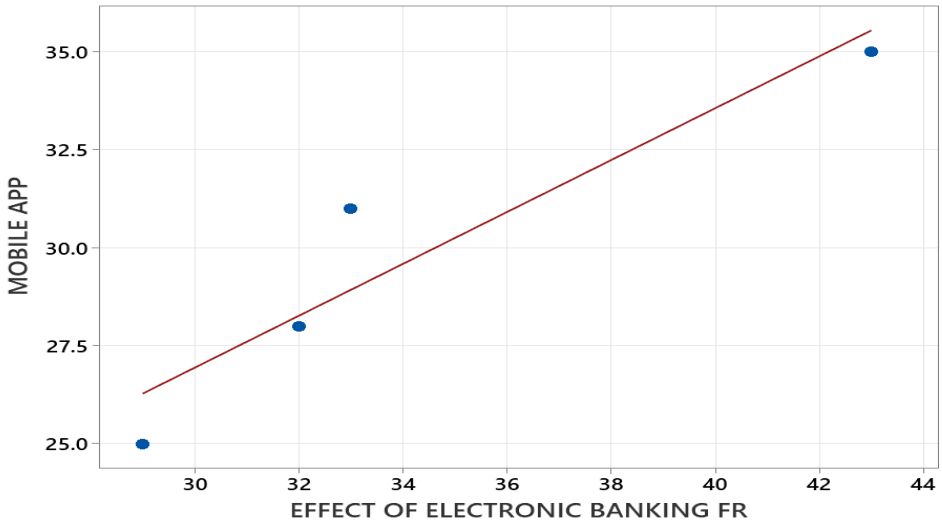


**Figure 6**. Correlation between Effect of Electronic Banking Fraud and Mobile App in Markets of Abeokuta

2. The correlation between the usage of mobile app and the effect of electronic banking fraud is 0.941 which is a positive correlation (table 13). This means increase in the usage of mobile app has strong effect of electronic banking fraud (0.059 value has an equal significant level (0.05) which show that this analysis is statistically significant as shown in figure 6.

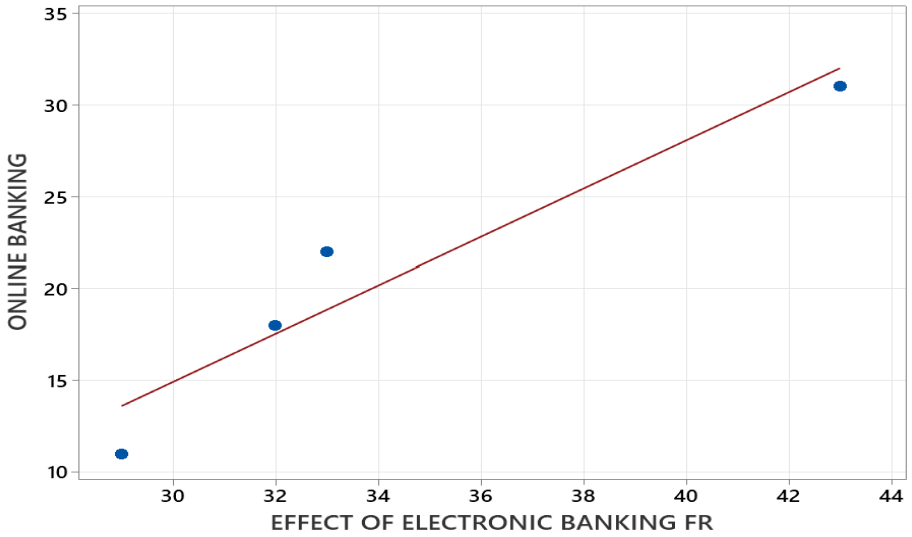


**Figure 7**. Correlation between Effect of Electronic Banking Fraud and Online Banking in Markets of Abeokuta

3. The correlation between the usage of online banking and the effect of electronic banking fraud is 0.956 which is a positive correlation in table 13, this means increase in the usage of online banking has strong effect of electronic banking fraud (0.044 value is less than 0.05 significant level) which show that this analysis is statistically significant shown in figure 7.

## Discussion

Impact of the fear of electronic banking fraud on usage of electronic banking products of buyers and sellers in local market in Abeokuta South local government area, Ogun state Nigeria shows that most of the respondents use mobile banking and online banking in all the market sampled than POS. Based on the choice of people / traders using electronic banking systems in the market. The

findings revealed that 70% of the traders were motivate to use POS terminals in all the markets and 70% of the traders were motivated to use mobile money services. 55% of people in Omida and Paseke markets were using mobile money service but 45% were using mobile money services. 65% of the respondents agreed that there is high effect of electronic banking fraud on electronic banking products. 55% of the people showed that there is high relationship between incidence of electronic banking frauds and usage of electronic banking products. The inferential statistics showing relationship between incidence of electronic banking frauds and usage of electronic banking products reveals that there is negative correlation between the usage of POS and electronic banking fraud, there is positive correlation between the mobile App and electronic banking fraud, there is positive correlation between the usage of online banking and electronic banking fraud. In conclusion, market people did not have the same level of fear for all the products. Result showed people felt safer with POS transactions as compared to other electronic platforms.

## Conclusion and Recommendation

The incident of fraud has a negative effect on the choice of electronic payment methods and there is therefore need for the vendors of the products, to carry out more sensitization on the local users to encourage their confidence in the products. Results suggests that users of electronic banking products in local markets could be vulnerable to attacks due to their personal weaknesses such as illiteracy and failure to conceal banking details. Fraudsters target unknowing victims and exploit their ignorance. The results suggest that usage of electronic products, is not affected equally by the threat of fraud. This could possibly influence a higher level of usage.

## Conflict of Interest

There is no conflict of interest.

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# Evaluating the Need for Competency-based Training Initiatives: To Increase Self-efficacy and Leadership Skills among Middle Managers in Jamaican Public Schools

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***Abstract***

*The study seeks to explore the concepts of self-efficacy, competency-based training and leadership as they relate to middle managers in Jamaican public schools. The overall purpose of this research is to encourage research centred around garnering the perspectives of key stakeholders of education. The research seeks to ascertain whether or not purposeful competency-based training programmes are required for current and prospective middle managers, to increase their levels of self-efficacy and leadership skillsets to perform optimally in their roles. Many studies have purported that leadership in primary and secondary schools in Jamaica is an area which requires much focus and intervention for the desired outcomes to be realized. Priority needs to be placed on leaders building on their repertoire of competencies and self-efficacy so they can be better at what they do. In so doing they will be stronger as leaders and better equipped to lead and ascend to higher levels. The researcher seeks to collect the viewpoints of administrators, middle managers and classroom teachers in Jamaican public schools; using a structured and quantitative research approach, specifically employing a survey method. The research seeks to examine the areas of concern identified and provide support structures and much-needed information about addressing training and competency needs. The research also aims to encourage further research in this area. In so doing, greater awareness will be brought about regarding self-efficacy, competency-based training and leadership of middle managers in public schools in Jamaica.*

***Keywords:*** *Competency-based Training, Jamaican Public Schools, Leadership, Middle Managers, Self-efficacy*

## Introduction

Albert Bandura introduced Social Learning and is seen as the most comprehensive theorist and researcher of social learning. Social Learning Theory explains that individuals learn new behaviours through observing others rather than through direct experience. In 1986, the social learning theory was changed by Bandura to the Social Cognitive Theory to accurately reflect both learning and cognition [4]. This change was proposed by Bandura to better transition and account for a more comprehensive understanding of how individuals learn and behave. Social Cognitive Theory has been predominant in adult learning and human resource development; and is considered to be a dynamic interplay between an individual, the environment and behaviour

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[8]. The components of Bandura's theory, Social Cognitive Theory, have been explored by many and have also been subjected to extensive research over the years. Bandura in his later work, after much research, sought to focus on the concept of self-efficacy [8]. With this new and insightful concept, other researchers have sought to also define and explore the new and enlightening concept of self-efficacy. All in all, the definitions and interpretations of the concept are similar. They can be classified as being similar as they revolve around the same core idea. Self-efficacy as defined by Bandura, is an individual's judgement of their capabilities not only to organize thought processes but also to execute courses of actions required to attain designated types of performance [2]. An Individuals' perception of self-efficacy, meaning how competent they believe they are likely to be in a given situation; influences the effectiveness of their interactions with their environment and with others. Self-efficacy as defined by Cherian is a function of self-belief, thought patterns and emotional reactions of an individual's perception of their ability to achieve a goal [5]. The concept of self-efficacy is associated with the confidence a person reflects, their beliefs, and the impacts of such beliefs on an individual's subsequent actions. It is asserted that self-efficacy has a role as a causal variable in performance and achievement [1]. It is proposed that high achievers are usually individuals with high self-efficacy, having the belief that they can perform tasks well. On the other hand, low self-efficacy is manifested in individuals having doubts in their capabilities; which can have a negative impact on task completion and accomplishment.

Even though much research has been done in education in the area of social cognitive theory, the concept of self-efficacy is relatively new and is considered to be underexplored [1]. Self-efficacy is still in its infancy, even though its prominence is growing in leadership and professional development [1]. Self-efficacy is used to predict behavioural outcomes in many instances and its use is seen especially in the areas of Psychology, Education and leadership. The concept of self-efficacy is considered to be a good measurement as well as an effective way to predict behavioural outcomes when compared to other motivational constructs [3]. This concept holds many prospects and research in this area can lead to meaningful change across sectors. The importance of self-efficacy on leadership levels and development should not be underestimated. Self-efficacy has been credited as a useful concept in assessing how one is likely to perform in key areas. The psychological state of self-efficacy directly promotes effective leader engagement, flexibility and adaptability [9]. As such it requires in-depth research to further explore its effectiveness and application to middle leaders in Jamaican schools.

Exploration of this very important concept can bring about much understanding and application to varying situations. Self-efficacy belief affects how much effort individuals expend, how long they will persist in the face of difficulties, their resilience in dealing with failure and the stress they experience in coping with demanding situations [11]. Now more than ever, individuals in leadership need to be persistent in navigating difficult situations. The importance of self-efficacy on leadership levels and development should not be underestimated. The psychological state of self-efficacy directly promotes effective leader engagement, flexibility and adaptability [9]. Promoting increased self-efficacy is warranted in developing leaders to yield great results. Greater self-efficacy leads to greater effort and persistence, which leads to greater performance, which in turn leads to greater efficacy [11]. Persisting effectively amidst the

varying challenges is what effective leadership calls for. Consequently, high self-efficacy is thus needed among this leadership group. This will give them the willingness to approach and persist on tasks, selection of tasks and situations, focus on problem-solving strategies, reduce fear and anxiety, have positive emotional experiences and have a positive effect on achievement outcomes [11]. Leaders should be persistent in their leadership roles and endeavours; showing perseverance in every situation, not giving up, but rather working consistently to achieve favourable outcomes at all times.

## Human Resource

Middle managers are strategic leaders in organizations, holding the organizations and employees to standards that will support thriving teams and excellent results. Ref. [18] states that the most important element in changing an organization is having the right people on the leadership team. The need for greater self-efficacy is essential in combating the many challenges that may arise in leadership and many middle leaders find it difficult to cope with the challenges that arise. Helping middle managers develop strong efficacy beliefs early in their careers will pay lasting dividends [11]. The dynamic nature of schools calls for human resources who are well-skilled, adaptable and who are continuously developing themselves. Ref. [20] asserts that human resource development is the process of increasing the knowledge, skills and capacities of all people in a society. The development of human resources helps people to lead fuller and richer lives. The process of human resource development unlocks the door to modernization. To guarantee commitment to the intensive transformation of the education system and structures; the human resources chosen must be the best. Effective organizations depend exclusively on the expertise, commitment and service of their greatest resource which is their people [11]. Leaders must be chosen and prepared well, because of the multiplicity and variedness of the roles they occupy and the duties they perform. Leadership does not exist without people; people define, honour or abhor it [12]. Leaders are considered the most precious of all the resources in an organization.

The field of education needs to have a middle leadership core that has high self-efficacy. Leaders with high self-efficacy usually believe that they can have a positive effect thus causing an increase in the effectiveness of the organization in which they serve [11]. This is likely to positively affect the workforce. Organizations need leaders who believe in their work and efforts [16]. When this is so, leaders have greater job satisfaction which leads to positive energy to achieve the organization's goals and objectives. The stronger individuals believe in their capabilities, the greater and more persistent their efforts [11]. Having such a sound belief, such leaders will be able to empower others to feel the same and produce at increased levels as well.

Self-efficacy is an important motivational factor that influences a wide plethora of behavioural and performance outcomes. Self-efficacy is associated with work-related performance such as productivity, coping with difficult tasks, career choice, learning, achievement and adaptability [11]. Self-efficacy is deemed important in the performance of job functions. Self-efficacy beliefs contribute to motivation by determining the goals that middle managers will set for themselves, how much effort they expend, how long they persevere in the face of difficult situations as well as their resilience in the future as well as to failure [11]. Every obstacle overcome and goal achieved by educators equips them to be more efficacious and propels

them to continue on the trajectory of continuous growth and development. In so doing, leaders are thus enabled to achieve the vastness of their truest potential. When people are motivated and inspired, they not only enjoy their work more, they are more creative and productive [16]. Leaders must be able to believe that they contribute to an important cause.

## Training/Professional Development

It is critical that leaders at the middle management level not only be named in a role but possess the required skill sets for excellence. The creation of vigorous and substantive leadership development will lead to the coming together of both authority and classroom credibility to the service of results [14]. Persons who have the same skills but different levels of personal efficacy, combine and sequence their skills in a changing context differently. This is likely to affect how they perform at different levels because of how they use them [11]. This solidifies the projection that complementing skills and self-efficacy is crucial to leadership development and success. If managers lack self-efficacy their capabilities are diminished [10]. Many other researchers have shared findings on the effects such levels can have on leadership effectiveness. Such individuals tend to avoid tasks and situations that exceed their capabilities; they seek activities they judge they are capable of handling effectively [11]. This may mean that leaders with low self-efficacy, may avoid addressing certain situations they are not confident in handling. Such actions can have crippling effects on overall leadership and organizational success. Leadership must have the desire and the belief that better can be done and achieved. Leadership begins with how a person thinks. Self-belief is critical to the journey of leadership. A person's belief system determines their philosophy of life. An individual’s thinking can be their escalator or de-escalator. Many persons in organizations seeking to lead or those who may be in leadership positions may have limiting beliefs. Limiting belief can bring about negative belief in one's abilities. According to [16] limiting belief can put a ceiling on one's success and can also keep expectations low. This can also have negative effects on the organizations they lead. Ref. [19] states that there are growing concerns about whether teachers have the requisite knowledge and skills to adapt to the demands of the profession and its emerging trends. There is a genuine need for intensive efforts relating to leadership competency-based training development, for educators to meet the needs of an ever-changing educational landscape than ever before. Experimental studies have consistently found that changing self-efficacy beliefs can lead to better use of cognitive strategies and higher levels of achievement [11]. Leaders can be trained and developed to achieve greater results however, it requires decisive and collaborative planning and action. Education needs to come into alignment with the wider world and keep abreast of the changes as they occur. Bridging the gap in any organization requires focus and deliberate efforts; as when performance is subpar it is likely a result of inexperience, unclear expectations or a skill gap [16]. As education moves forward policy makers and educators must carry with them the understanding that with vision, commitment and persistence they can collectively move education to a much higher level by equipping and evolving leaders effectively.

More often than not, educators are not asked for their input into educational reforms and high-level policies; instead, such advice is directly sought from business leaders and think-tank researchers. Educators are often defined as a major part of the problem; rather than professionals qualified to offer solutions [7]. Educators are major stakeholders in education

making great shifts and turns in the system. It must not be only noted but also demonstrated that educators are considered experts with valuable opinions about education policy [7]. Educators can have a powerful and valuable impact in creating meaningful change in the education sector at the policy level. As such, the space must be provided for them to be integral in the process.

Many studies have purported that effective leadership is considered paramount to school success, and where it is lacking the necessary support needs to be provided to improve same. Leadership is important in developing effective and innovative schools and in facilitating quality teaching and learning [6]. Leadership is an area which requires much focus and intervention to realize the desired outcomes for all. To increase the level of leadership in any organization it is imperative to raise leaders' ability levels [15]. Leadership development has been purported by many studies as not a simple fix. Researchers have contended that leadership is a complicated and challenging role [13]. It is important to take a collaborative approach to addressing the gaps. True leaders are barrier breakers; they do not think of limitations. They seek to find ways to solve issues and as such they should be provided with the right foundation to unleash and create positive change in any given situation. Effective leadership does not occur by fate or by accident. Organizations, such as schools, often attempt to select individuals with traits and skills associated with effective leadership and subsequently try to provide much-needed professional development activities for further growth [11]. This approach by itself may not be wholesome or the best approach to be taken in promoting middle managers to lead effectively in schools. It is important to note that at one time, middle leaders were chosen based on their years of experience as a class teacher. However, the tide has changed, as an employee's richness of capabilities does not necessarily lie in the years of their experiences but rather in the quality of their circumstances [12]. Leaders can achieve more when their quality of circumstances change for the better. Recent studies purport that age, experience and levels of qualification, though they may be important variables, must never be assumed to be equated with effective leadership [12]. It must be noted that effective leadership is multifaceted and requires much. Leaders and those who desire to lead must consistently find ways to redefine their space and reinvent themselves [12]. This is needed more so than ever before if leaders are to remain relevant in such a rapidly changing tide. Middle leaders must remain lifelong learners to boost their productivity. Leaders need to prioritise building on their repertoire of competencies so that they can be better at what they do [12]. The focus must always be on how to improve themselves; as in so doing they will not only be stronger as leaders but also be better equipped to lead as well as to ascend to higher levels.

A major key in developing highly self-efficacious leaders is assessing where they are versus where they should be. Organizations should incorporate leadership and self-efficacy assessment into the leadership selection process as leadership and self-efficacy skills can be represented on a scale [17]. Nothing is corrected or advanced without leadership. The world needs and values effective leaders. Nothing happens, changes or enhances without leadership. Leaders who know themselves more, give more effective support to their followers. Ref. [16] asserts that the biggest breakthroughs and personal transformations are for leaders doing the work to know themselves more. In so doing they will be better able to know their strengths and weaknesses and will be equally able to work on their limitations. True leadership begins with self-discovery. Self-discovery is a process of gaining

knowledge and understanding of your feelings, character and abilities. Research has shown that assessing leaders' self-efficacy should not only be done at the organizational level but also be executed by the leaders themselves as well. It should be that individual educators be active agents, in consciously and consistently assessing their strengths and weaknesses. This will thus enable them to assume leadership positions based on their self-efficacy, mindset, capabilities and experiences and be willing to work on any identified weaknesses [11]. Identifying additional skill sets, knowledge and experience needed for middle leaders to realize their dreams and maximise their potential is likely to yield positive results; not only for themselves but for the organization as well.

## Materials and Methods

The data for the study was garnered using the survey approach through an online questionnaire instrument, completed by educators; administrators, middle managers and classroom teachers, in public schools across the 7 educational regions in Jamaica. Criteria for inclusion in the study were based on informed consent given by the participants, being employed with the Ministry of Education in their respective roles, for at least one year and being remunerated as such. The participants who did not match the requirements were excluded from the study. The study utilized the stratified sampling technique with a randomized approach. The researcher made significant efforts to increase the sample size by extending the time given so as to acquire additional responders to the questionnaire. The group consists of a total of one hundred sixty (160) responders. Sixty-two (62) being principals, fifty-four (54) being middle managers and forty-four (44) being classroom teachers. The vice principals and middle managers were combined to form the middle managers' grouping. SPSS was the main tool for statistical analysis and data management used to analyze the data and provide meaningful conclusions. The use of mean, median, and mode (descriptive statistics) and inferential statistics were the main methods incorporated in the analysis. Graphs and tables were used to present and assist with the interpretation of the findings.

## Results

The research sought to examine the participants' perspectives on three core questions. The researcher sought to examine the strongly agree and agree responses. As such these levels were combined to form an overall agreement statement. This proved very helpful in providing a general understanding of the perspectives of the responders in analyzing the data sets and identifying possible trends and patterns. The analysis of the survey responses highlighted variations among the respondents and showed variance in the participants' perceptions across the different questions.

### Question # 1

Question 1 examined whether *"Aspiring middle managers should be formally trained by the Ministry of Education or its affiliated agency/ies in leadership, using a competency-based approach."* The data garnered shows that all categories of participants believed that competency-based leadership programmes are needed for aspiring middle managers. The majority of principals, 80.0% to be exact, gave their perspectives as strongly agree and agree (12% and 68% respectively). Similarly, 80% of middle managers gave their perspectives as strongly agree and agree as well; with a breakdown of 36% and 44% respectively. Class teachers had the lowest combined agree and strongly agree percentage of 68.20%, their perspectives when divided as strongly agree and agree showed 36.40% and 31.80% respectively.

See Table 1 and Figure 1.

**Table 1.** Aspiring Middle Leaders should be Formally Trained using a Competency Approach to Take on Leadership

| **Levels** | **Participants** | | |
|---|---|---|---|
| | **Principals** | **Middle Managers** | **Classroom Teachers** |
| Agree | 12% | 36% | 36.40% |
| Strongly Agree | 68% | 44% | 31.80% |
| Neutral/Uncertain | 8% | 12% | 4.50% |
| Disagree | 8% | 8% | 13.60% |
| Strongly Disagree | 4% | 0% | 13.60% |
| **Total** | **100%** | **100%** | **100%** |

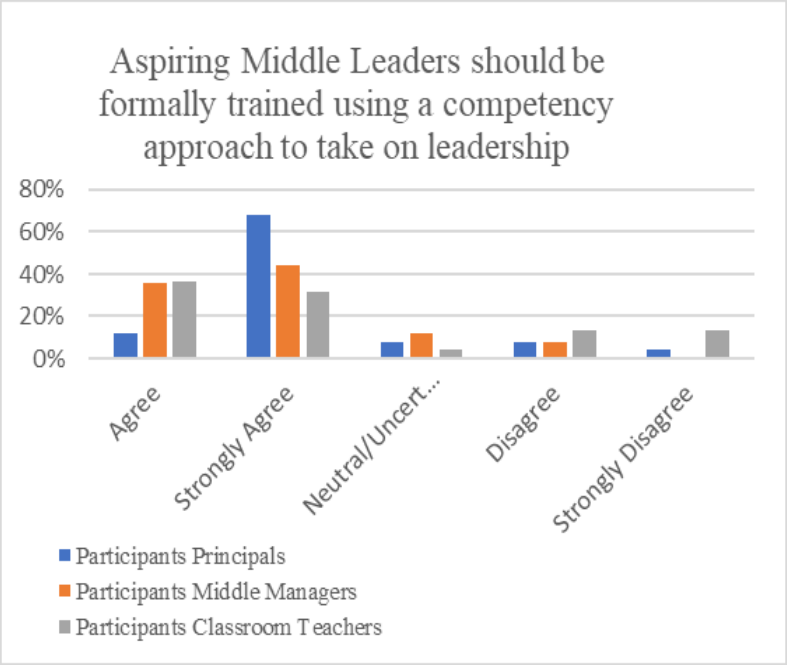


**Figure 1.** Aspiring Middle Leaders should be Formally Trained using a Competency Approach to Take on Leadership

Additionally, it is interesting to note that of all three questions, classroom teachers had their highest overall average as it relates to this question. This question is one that when dissected, directly affects classroom teachers; as they serve from this level and the questions relate to them directly. As aspiring middle leaders would be selected from this very cohort of educators. It would therefore suggest that the average speaks of the level of interest in middle leadership development among this group. Further exploration of the factors contributing to this positive perception could inform future initiatives or strategies for future leadership training and development.

Question 1 had a mean score of the agree and strongly agree levels of all participants being 76.07%, suggesting that respondents rated it favourably. Of the 3 questions examined it had the lowest standard deviation of 5.56%, indicating the least variability in the responses compared to the other research questions. While Question 1 received the second-highest mean score, its low standard deviation indicates that the responses of the participants did not vary widely. This suggests that the participants may have very close and similar perspectives to

this question. Such an analysis is, therefore, a strong indicator that expresses the opinions of all the responders collectively in support of aspiring middle managers to be formally trained by the Ministry of Education or its affiliated agency/ies in leadership, using a competency-based approach.

## Question # 2

Question 2 sought to examine whether *"Compulsory competency-based leadership programmes should be made available by the Ministry of Education."* The data garnered shows that all categories of the participants agree with this statement. The data reveal that 80% of principals gave their perspectives as strongly agree and agree (28% and 52% respectively). 84% of middle managers gave their perspectives as strongly agree and agree (32% and 52% respectively). 54.60% of classroom teachers gave their perspectives as strongly agree and agree (27.3% and 27.30% respectively). See Table 2 and Figure 2.

**Table 2.** Take Full Responsibility for Leadership Training and Development

| **Levels** | **Participants** | | |
|---|---|---|---|
| | **Principals** | **Middle Managers** | **Classroom Teachers** |
| Agree | 8% | 40% | 27.30% |
| Strongly Agree | 84% | 44% | 27.30% |
| Neutral/Uncertain | 0% | 12% | 22.70% |
| Disagree | 0% | 4% | 4.50% |
| Strongly Disagree | 8% | 0% | 18.20% |
| Total | 100% | 100% | 100% |




**Figure 2.** Take Full Responsibility for Leadership Training and Development

Question 2 had a standard deviation of 13.2%, suggesting that some amount of variability exists in the responses. When compared to the other questions, the variability

is less than Question 3. and more than that of Question 1. The responders of the cohort groups both individually and collectively responded greater than 50% that they take full responsibility for their leadership training and development. This is thus indicative of the sense of responsibility that educators believe that the Ministry of Education owes educators in terms of them providing Compulsory competency-based leadership programmes. Notwithstanding this shared sense of belief, they equal belief that they need to take responsibility for their own leadership development. Purposeful competency-based programmes are warranted from a policy level and should also be delivered from such a front based on guided standards.

Middle managers had the highest combined average among the participants as to the need for "Compulsory competency-based leadership programmes being made available by the Ministry of Education". Interestingly to note, that even though they opine that they believe in their leadership development at a combined percentage of 80%, they also asserted at a combined percentage of 84% that such training opportunities should be provided by the Ministry of Education or its affiliated agency/ies. Looking closer at question 2 variability is suggestive of the variedness of the participants' responses. Further exploration as to why middle leaders lead in their perspective for the need for compulsory competency-based leadership being available to middle leaders is an interesting area to carry out further analysis. Further research may be required to better understand the varying supporting perspectives that support this stance. However, one such analogy may examine whether middle leaders are fully satisfied with the self-development programmes they participate in. Or if such programmes are not fully desired due to the lack of competency-based approach.

## Question # 3

Question 3 sought to examine if the respondents, ***"Take full responsibility for leadership training and development."*** The data gathered revealed that 92% of principals gave their perspectives as strongly agree and agree (8% and 84% respectively). 88% of middle managers gave their perspectives as strongly agree and agree (40% and 44% respectively). 54.6% of classroom teachers gave their perspectives as strongly agree and agree (with both levels reflecting a score of 27.30%). See Table 3 and Figure 3.

**Table 3.** Compulsory Competency-based Leadership Programmes should be Made Available by the Ministry of Education

| **Levels** | **Participants** | | |
|---|---|---|---|
| | **Principals** | **Middle Managers** | **Classroom Teachers** |
| Agree | 28% | 32% | 27.30% |
| Strongly Agree | 52% | 52% | 27.30% |
| Neutral/Uncertain | 8% | 16% | 22.70% |
| Disagree | 4% | 0% | 4.50% |
| Strongly Disagree | 8% | 0% | 18.20% |
| Total | 100% | 100% | 100% |

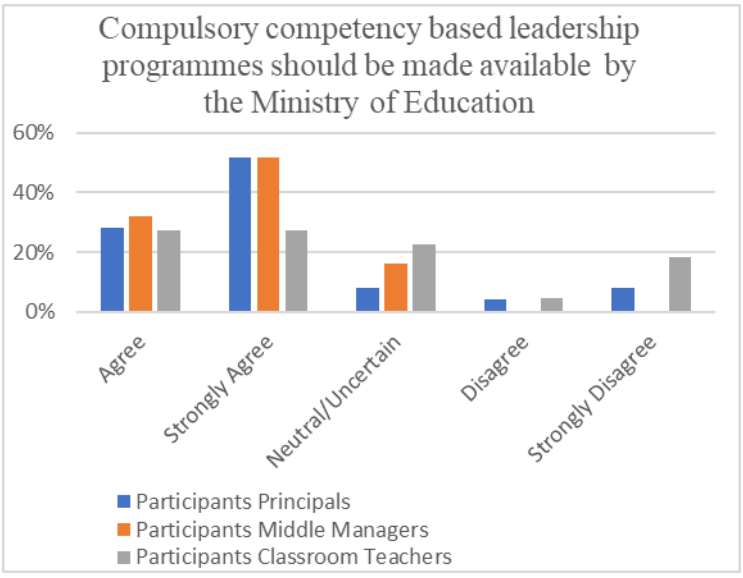


**Figure 3.** Compulsory Competency based Leadership Programmes should be Made Available by the Ministry of Education

Question 3 received the highest mean score of 78.20%, indicating that respondents rated it most positively on average. Question 3, despite having the highest mean score, it also had the highest standard deviation of 16.77%. Indicating the greatest level of variability in responses among the questions 1, 2 and 3. Its high variability in standard deviation would thus indicate a greater disparity in responses, indicating less consistent perceptions among the three response groups. The variation in perspective is seen more so at the classroom level. It would therefore suggest that further research may be needed to better understand what constitutes such variance. Additionally, classroom teachers have the lowest level of overall agreement across the other questions. This may be a result of limited interaction with leadership training needs. This thus warrants further investigation and the application of targeted interventions.

## Question # 4

A further examination was done of the data as it relates to the number of persons each group supervises or leads. The data showed that a large majority of principals, 52% to be exact, supervise more than 20 persons. An analysis of classroom teachers, a group which would constitute aspiring leaders, revealed that 27.20% of this cohort supervised 1 to 9 members of staff. In examining middle managers, it showed that 60% of middle managers supervise 1 to 9, 12% supervise 10 to 20 persons and 16% lead more than 20 persons. The data therefore showed and confirmed that middle managers, sometimes lead large groups of persons in their respective roles and as such competency -based training is of critical importance to their overall effectiveness and can assist them significantly to lead great teams. See Table 4 and Figure 4.

**Table 4.** Total Number of Staff Members Supervised

| **Categories** | **Participants** | | |
|---|---|---|---|
| | **Principals** | **Middle Managers** | **Classroom Teachers** |
| 1-5 Persons | 0% | 32% | 22.70% |
| 6-9 Persons | 8% | 28% | 4.50% |
| 10 -15 Persons | 20% | 4% | 0% |

| | | | |
|---|---|---|---|
| 15-20 Persons | 20% | 8% | 0% |
| More than 20 | 52% | 16% | 0% |
| None | 0% | 12% | 72.00% |
| Total | 100% | 100% | 100% |

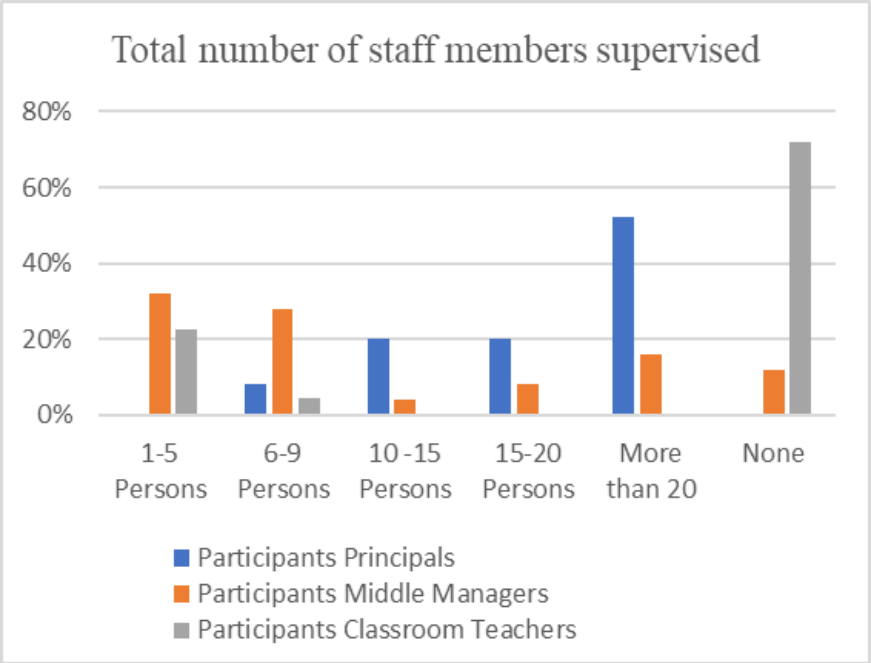


**Figure 4.** Total Number of Staff Members Supervised

## Discussion

The results from this research are in keeping with other research done in the areas of self-efficacy, leadership and competency-based training with other categories of workers and leaders in organizations and in particular, the educational workspace.

It was found that principals and middle managers had similar combined response rates in the strongly agree and agree categories of 80% for Question 1. This highlights the value that is placed on the concept of leadership development by the different demographic groups. The data revealed that principals' and middle managers' response rates were higher than classroom teachers

The results thus show that educators at the leadership level by and large understands the importance of leadership development when compared to classroom teachers

### Question # 1

$$Mean = sum\ of\ all \frac{values}{number} of\ values$$

Mean = (80% + 80% + 68.20%) / 3
Mean = 228.20% / 3
Mean ≈ 76.06%

**Standard Deviation**

$$s = n - 1\sum i = 1n(xi - x^{-})2$$

Where: s=5.56%

### Question # 2

$$Mean = sum\ of\ all \frac{values}{number} of\ values$$

Mean = (80% + 84% + 54.60%) / 3
Mean = 210.6% / 3
Mean ≈ 70.2%

**Standard Deviation**

$$s = n - 1\sum i = 1n(xi - x^{-})2$$

Where: s=13.02%

**Question # 3**

$$Mean = sum\ of\ all\ \frac{values}{number}\ of\ values$$

Mean = (92% + 88% + 54.60%) / 3

Mean = 234.60%/ 3

Mean ≈ 78.20%

**Standard Deviation**

$$s = n - 1\sum i = 1n(xi - x^{-})2$$

Where: s=16.77%

## Conclusion

This research provides much-needed information as it relates to the need for targeted leadership programmes which are offered by the Ministry of Education or its affiliated agencies.

Discrepancies between how middle managers view themselves and how others view them may indicate a need for better alignment of expectations and communication of leadership actions and decisions.

Given the specific focus on self-efficacy, leadership and competency-based training, the data support recommendations for strengthening leadership training and practices within schools.

The research Emphasizes the need for continuous professional development and possibly restructuring leadership training programs to ensure a consistent and high level of confidence across all groups. This will certainly assist in strengthening middle managers' self-efficacy and leadership levels; as well as provide structure for upcoming leaders.

Given the specifics of the study, it is hoped that continued research will take place focusing on other factors.

## Conflict of Interest

I declare that there is no conflict of interest regarding the publication of this paper. I, the corresponding author on behalf of all contributing authors, hereby declare that the information given in this disclosure is accurate and complete to the best of my knowledge and belief.

## Acknowledgement

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# Determinants of Choice Payment Systems in Local Markets, Abeokuta South Local Government Area, Ogun State Nigeria

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***Abstract***

*For cashless economy to be achieved in Nigeria, it must also be successful at the grass root. The local market is one of the basic places where buying and selling takes place and is used by all manners of people in the society. However, this part of the society seems to be slow in adopting electronic payment methods. The researcher employed a structured questionnaire constructed by specialists to study the behaviour of traders (buyers and sellers) in local markets. Data was obtained on the payment behaviour, from traders (buyers and sellers) in the local markets in Abeokuta South local government area of Ogun state (Nigeria) and analysed using descriptive statistics. The result showed that people have high tendency to make payments in cash because their perception favoured cash payments. There was relative ease of usage of cash and ready availability as compared to other payment methods. It was therefore recommended that other payment platforms be made simple enough, for people to naturally prefer them over cash payments.*

***Keywords:*** *Cash Payment, Electronic Banking, Local Markets, Traders.*

## Introduction

Traditionally, items/transactions are paid for mostly by cash, in local markets that are located in Abeokuta South Local government area of Ogun state Nigeria. This situation is also commonly found in any other local commodity market in Nigeria notwithstanding the digital revolution that is taking place in Nigeria and globally. Cash payment still dominates transaction payments in such markets and even where payments for transactions are done vide electronic means or any other alternative means, the use of electronic payment methods often only supports cash payments. The dominance of cash payments in transactions seems to follow the fact that the average trader seems to regard other payment alternatives, as mere sources of cash to be used in paying for transactions rather than as stand-alone alternative payment methods. The dominance of cash-payments in local markets is driven by a biased perception held by traders that fails to see anything other than cash, as money. "Perception is the process by which individuals register and evaluate information detected from the internal or external environment, consciously or unconsciously" [3], Other contributary factors to the preference for cash based payments over alternative payment method is the low level of availability of technological infrastructure to carry out alternative payment and lack of policy that is needful for the traders to engage in electronic payments. Infrastructure in this contest, refers to such electronic services and devices relevant devices to actuate electronic transactions and the possession of the know-how to use such devices. Electronic transactions in the area of study where there is any, is not hitch-free. Rather, it is often limited by system glitches and failed transactions and lack of know-how on the part of the users. Payments in cash is fraught with limitation: both sellers and buyers are constrained by

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costs of carrying cash and the drive by the government to encourage a non-cash based economy is hampered. Besides these costs associated with cash dominance, the world is a global village where cash is becoming a thing of the past and therefore, a system where cash is the dominant mode of payment is archaic.

## Relevance of this Research

Similar studies have not previously been done in this locality so, it is expected that this research would provide academic information on an area that is unknown. As regard the economy, the information provided by this study will be useful in providing academic guidance to authorities, in the move toward a cashless system. This study is also important because local market is a basic part of the society where most basic buying and selling occurs. A further need for this study lies in fact that a successful implementation of the digital economy in local markets would deepen trade. The local market is as microcosm of the markets in the wider economy and events in the local market have ripple effect on the bigger economy and reflects the ongoings in the macroeconomic sectors. The local market has impact on the lives of most people in the area of study. Food items and most other items needful to sustain livelihood come from the local market, in the area of study. Due to this importance of local markets, it is needful to impact the activities that occur there so as to have multiplier effect on the economy.

## Modus Operandi of Cashless Policy in Nigeria

Events in the area of study derive from ongoings in Nigeria. There is no economy all over the world that is absolutely cashless and the Nigerian situation of Cashless Policy or cashless economy is not expected to be a complete absence of cash but, a dominance of alternative method of payment over cash. In a cashless economy, it expected that payments would be made vide cheque, Cards and electronic means. The financial have positioned themselves to render services that benefit the needs of the local businesses and individuals, in the locality. In the drive to achieve cashless economy, Nigerian Banks have rolled out various electronic means of payments. The digital revolution has made available android phones, ATMs, POS machines, digital payment platforms. Customers can now do most transactions that were initially only possible inside banking halls. Transfers can be made from telephones from anywhere there is internet/network. Mass payments can now be made using NEFT, RTGS and various other platforms. Automation of banking services has transformed businesses in Globally. Banks have transformed their banking operations and have also transformed customers experience by means of access to self-service through access to electronic banking. Electronic banking can be described as using the internet as a delivery mode for the provision of services like inquiry, opening a deposit account, electronic bill payment, online transfers, online withdrawals, and in fact, any other online banking transaction. Electronic banking has also been defined as the medium of using electronic devices, like wireless connections, internet, point of sale (POS), networks, automated teller machines (ATM), phones, and cell phones in banking services. This has increased the speed and volume of banking transactions and eased business for entrepreneurs.

Telephone services is the backbone of electronic banking in Abeokuta. “The proliferation of smartphones has led to the rise of mobile banking applications. These applications in mobile phones allow customers to perform various banking transactions from checking balances to transferring funds, at their convenience” [13]. The advent of portable mobile telephones in Nigeria has contributed immensely to the development of her banking system. The progress in electronic

banking system in Abeokuta and in Nigeria in general has been possible by increasing access of people to mobile telephones. With the rise in internet technology, bank customers can now do online, most of the same services that they could only do in the banking halls, before 2002. as cited in [13] suggests that the digital transformation is due to the adaptiveness of the youth and general population in adoption of electronic devices. The telecommunication companies in Nigeria are "MTN Nigeria Communications PLC, Airtel Networks Limited (Airtel Africa PLC), Globacom Limited, BroadBased Communications Limited, 9Mobile (Emerging Markets Telecommunication Services Ltd), Main One Service Company Limited, Fiberone Broadband Limited, Backbone Connectivity Network (Nigeria) Limited, Viasat Inc., SpaceX LLC, ipNX Nigeria Limited, Tizeti Network Limited and Ngcom Networks Solutions" [21].

The benefits of electronic banking in Abeokuta are multidimensional. The continuous automation and innovations in deposit money banks in the area of study has enabled them to play in the global banking industry and has opened greater possibilities to erstwhile brick and mortar banking institutions. Businesses can now be done internationally. Furthermore, automation in DMBs resulted in the influx of financial technology (Fintech). "Fintech is a portmanteau of the words "financial" and "technology". It refers to any app, software, or technology that allows people or businesses to digitally access, manage, or gain insights into their finances or make financial transactions." [22]. The financial system also benefited by the fact that complex banking activities are now done by customers from the comfort of their homes and offices by using digital apps. Staff salaries can now be paid to staff by entrepreneurs, Transfers form accounts of businesses can be done electronically, to customers and others, without going to the bank. The customers' independence has also increased with the usage of automated banking products.

Automation in banks has made it possible for customers to access to Automated Teller Machine (ATM) has made it possible to have access to cash round-the clock, without interface with bank staff. "The application of information and communication technology concepts, techniques, policies, and implementation strategies to banking services has become a subject of fundamental importance and concern to all banks and indeed a prerequisite for local and global competitiveness banking" [16]. "Nigerian banks today are seriously into new electronic delivery channels for banking products and services with a view to delivering better services and satisfying customers the more. Banks that cannot offer these services are increasingly losing their customers" [16].

The Nigerian Cashless Policy was first implemented in Lagos in 2012. It came into limelight in Nigeria when the CBN governor "Mr. Sanusi Lamido Sanusi initiated a form of payment system that limits individual and corporate daily cash transactions in the banking system. Precisely, the CBN cash limit policy requires that, all cash withdrawals and deposits be set at a daily limit of a maximum of N500,000 while pegging that of corporate entities at N3,000,000, with penalty fees of 10%per extra above N500,000 for individual and N3,000,000 for corporate defaulters respectively." [9]. To this end, various means of payments were made available by banks to serve as alternative to cash-based payments. Banks have made various electronic platforms available to enable transfer payments. This includes payments through mobile devices by means of applications, USSD, payments by transfers through ATM, payments by use of POS machines, payments by bank transfers in several forms that exclude cash. "Cashless economy does not mean an outright elimination of cash transactions in the

economic setting but one in which the amount of cash-based transactions are kept to the barest minimum" [1]. "The following among others enhance the functioning of cashless economy; e-finance, e-banking, e-money, e-brokering, e-exchanges etc. [1].

In assessing the success of the cashless Policy, "the progress made in implementation cannot be ignored or overemphasized as there have been a substantial progress in the banking sector due to the ease and convenience the policy has brought in Nigeria". However, the process of the implementation of Cashless Policy in Nigeria has also been criticised by various schools of thought. In the view of [17] the implementation of the cashless policy in Nigeria is not properly done. Literature reports growing complaints from users of the services to banks and government agencies on frauds, unsuccessful transactions, bad charges and other service failures.

## Research Problem

Local markets in Abeokuta South Local government area are influenced by events in Nigeria where the authorities have made moves to shift the nation's economy from cash-based payments to use alternative payment methods. However, it is observed that payments local markets which are key parts of trade in the economy, are still hugely cash-based. It seems that people in the area of study have favourable bias towards usage of cash in making payments, as against using electronic payment methods payment methods. This situation provides the need to unravel the factors that shape perception on the choice of payment method to adopt. Unravelling this gap will enable an academic solution to be proffered to the slow movement from traditional cash-based transactions to electronic payment method.

## Objectives of the Study

The specific objectives of this study are as follows:

1. To analyse the factors that impact the perception market people in deciding on the adoption of electronic payment methods in the local markets in Abeokuta South Local government area of Ogun State, Nigeria.
2. To determine to reduce the prevalence of cash payment in transactions caried out, in local markets in Abeokuta South Local government area of Ogun State, Nigeria.
3. To encourage the adoption of electronic payment system local markets in local markets in Ogun State, Nigeria.
4. To form a general opinion of similar situations

This study relies on both primary and secondary sources of data. The primary source of data is the responses to questions from sample taken while the secondary sources of data refer to the existing information in form of literature by other scholars on previously done similar existing studies.

## Literature Review

### Conceptual Issues

#### *Perception*

"Perception is a personal manifestation of how one views the world which is coloured by many sociocultural elements" [14]. "Perception is a uniquely individualized experience. One can only draw from what is known to oneself" MacDonald, 2011. "The wide variety of subjective instruments to measure perceptions has resulted in a lack of global consensus on any singular best practice. Instruments are usually situation-specific or population-directed which makes finding a general measure of perception challenging" [14]. Perception is studied major in the field of psychology. It is the window through which we see things in life. "Perception refers to interpretation of what we take in through our senses. The way we perceive our environment is what makes us different from other animals and different from each other. Perception

depends on complex functions of the nervous system, but subjectively seems mostly effortless because this processing happens outside conscious awareness" [2]. Perception is influenced the senses of smell, touch, sight and sound.

Ref. [8] broadly divides theories of perception, into two: These are, bottom up and top-bottom theories. "The first is a group of theories which suppose using only bottom–up processes when acquiring and processing sensory data. By bottom–up processes, we mean processes that start at the lowest sensory levels — that means (from the cortex's point of view) at the most distant levels of cognitive apparatus — and then they gradually lead to more complicated and complex processes which take place in higher (cortical) structures which are responsible for more global and abstract ways of thinking. On the contrary, the top–down theories suppose that in the process of discrimination, but mainly when processing sensory stimulus, we start by [8].

The effect of perception is a creation of bias in minds of people such that, they make up their mind, form conclusion before inquiry. "Human judgment and decision making is distorted by an array of cognitive, perceptual and motivational biases" [20]. When people don't have open mind and make their judgment ab initio, it results in wrong perception and "People's perceptions can be biased by their beliefs, expectations and context, as well as by their needs, motives and desires" [14]. Such biases have important consequences. They can compromise the quality of human judgment and decision making, and they can cause misunderstanding and conflict [20].

## Advantage of Cashless Policy in Local Markets in Nigeria

The Cashless policy in Nigeria was meant to give the authorities control to manage monetary policy. It has made it possible to track transactions, their origins and destinations. The Policy has made transactions faster and cheaper for people. It has also provided employment to various people who carry out services using these means. It has also increased income being earned by banks.

### Challenges of Electronic Payments

The introduction of electronic payment has also created so many avenues for fraudsters. Arguably, the biggest challenge facing electronic transactions is the possibility of fraud as fraudsters can attack people from anywhere in the world with being seen. One of the weaknesses of the implementation of cashless Policy is the fact that there is high level of illiteracy on how to manage the risks involved. It was later resumed but that act baked the question if Nigeria was prepared in the first place to commence implementation of the cashless policy. Many Nigerians still believe there is more to be done to gain their confidence or trust in these so-called alternative channels supplied by banks to aid banking transactions, as there seem to be challenges with the system.

Ref. [18] reported that "an investigator with the Economic and Financial Crimes Commission (EFCC) told a Lagos court how four bank officials cloned ATM cards and linked some accounts to them to steal N874 million belonging to Fidelity Bank and its customers in 2019 [18]. That was the equivalent of USD1,950,892.86 at the then exchange rate of N448 to one USD.

## Demand for Money

"Demand for money is an important macroeconomic component, as it is indispensable for monetary policy analysis [12]" people's "The demand for money is the total amount of money that the population of an economy wants to hold" [6] demand for money is influenced by transitionary motive, precautionary motive and speculative motive.

## Empirical Review

Ref. [1] studied the mechanics, benefits and problems cashless policy in Nigeria. Using a sample of 170 customers of commercial banks and secondary data from Central bank of Nigeria, the research revealed that cash-based transactions is endemic in Nigeria. The study also that cash and coins is a major part of the transactions in Nigeria and it benefits the parties in the transaction at a huge cost to greater Nigerian economy. Ref. [1] also stated that "the Nigerian financial system has always had a huge informal sector resulting in financial dualism with its attendant consequences including prevalence of cash transactions". the study further revealed that the primary challenge militating against the implementation of the cashless policy was lack of enabling environment which manifests in infrastructural deficiency. The said researcher therefore recommended stabilization of power supply in Nigeria as a solution.

Ref. [15] studied the effects, challenges and prospect of cashless economy policy in Nigeria using a sample of 1000 respondents consisting of bankers and banking customers in Benin City. The study identified challenges that followed the adoption of cashless policy in Nigeria as economic loses due to cyberattacks, and frauds. The study also revealed however, that there are gains such as less ques in banks, easier transaction process, increased earning and a recommended that the government strengthen electronic banking with adequate policies. The study further revealed the importance and need for people to have positive perception about electronic payments, in order for it to succeed. The said researcher stated specifically that "above all, Nigerians have a greater role in accepting the cashless banking payment system, making use of it with the belief that it would improve their financial and economic life and boost the image of the country leading to booming economy.

Ref. [4] carried out a cross-sectional research on the challenges facing the Cashless Policy Implementation in Nigeria using Unified Theory of Acceptance and Usage of Technology. The study revealed that "facilitating conditions has no direct effect on actual system use and trust has no positive effect on behavioural intention to adopt the system". The study also noted several advantages arising from cashless Policy such as the provision of mobile money, reduction in visit to banks. The study noted that the policy had several advantages but noted the existence of challenges such as lack of security, illiteracy, financial illiteracy and lack of infrastructure. According to the [4], the set out goals (of the Cashless Policy) were not achieved, due to the attendant challenges.

## Theoretical Framework

The Technology Acceptance model is adopted for this research, in view of its relevance and general acceptability in explaining the actions and events caried out by actors in the introduction of technology and technological changes. The technological acceptance model propounded by [2] explains how individuals accept new technology. Basically, the theory shows how a user of a proposed technology welcomes and adapts to a new technology. The theory is based on the assumption that the acceptance of the technology is determined by two beliefs which are, perceived usefulness of the technology and perceived ease of use. The theory teaches that behavioural intention stimulates the usage while behavioural intention itself is stimulated by attitude and attitude is the impression about the technology. The theory upholds certain suppositions such as perceived usefulness. This is the degree to which the user would perceive the technology would enhance his job. Perceived ease of usefulness is another paradigm in the model. This shows the degree that the user expects the technology to be easy to use. The theory also holds that external

variables and gender would affect the behaviour of people.

"The technology acceptance model (TAM) explains the acceptance of information systems by individuals. TAM postulates that the acceptance of technology is predicted by the users' behavioural intention, which is, in turn, determined by the perception of technology usefulness in performing the task and perceived ease of its use" [6].

## Materials and Methods

### Population, Sample Size and Sampling Procedure of the Study

The population of the study consists of all the local markets in Abeokuta South Local government area in Ogun state of Nigeria. Four markets were selected out of the 8 recognizable markets in the area which includes the large gathering of closely associated shops and stores. A sample of 200 persons from market was targeted randomly, and issued structured questionnaire that was constructed by professional, for this research. The questionnaires were distributed and retrieved by the aids of the researcher and analysed using simple percentages.

### Research Methods

The design adopted in this study is descriptive survey design. It obtains information by means of questionnaire from the respondents

## Results

### Demographic Information

**Table 1**. Gender Distribution

| Gender | Percentage |
|---|---|
| Male | 51.20% |
| Female | 48.80% |

The gender distribution of the sample is almost balanced, with a slight male majority in table 1. Males make up 51.20% of the group, while females represent 48.80%. The nearly equal distribution of males and females suggests a balanced representation of gender within the sample. This balance may indicate a more equitable environment or field, where both genders have significant representation.

**Table 2**. Age Distribution

| Age | Percentage |
|---|---|
| Under 20 Years | 12.00% |
| 21 -30 Years | 14.40% |
| 31 – 40 Years | 43.20% |
| 41 – 50 Years | 20.80% |
| 51 and above | 8.00% |

The age distribution in table 2 reveals a predominantly middle-aged population. Individuals aged 31 to 40 years are the largest group, constituting 43.20% of the sample. Those aged 41 to 50 years follow, comprising 20.80%. The 21 to 30 years age bracket accounts for 14.40%, while individuals under 20 years represent 12.00%. The smallest group is those aged 51 and above, at 8.00%. The predominant age group of 31 to 40 years highlights a mature and potentially experienced population. This could imply that the majority of participants are in their prime working years, likely possessing substantial industry knowledge and experience. The relatively small proportion of younger and older individuals might indicate a dynamic,

evolving field that is less represented by those at the extreme ends of the age spectrum.

**Table 3**. Education Level Distribution

| Education Level | Percentage |
|---|---|
| No Formal Education | 28.80% |
| Primary Education | 20.00% |
| Secondary Education | 28.80% |
| Tertiary Education | 20.80% |
| Postgraduate Education | 13.60% |

In terms of educational attainment, table 3 shows that 28.80% of participants have no formal education, and an equal 28.80% have completed secondary education. Primary education is held by 20.00% of the group, while 20.80% have pursued tertiary education. Postgraduate education is the least common, with 13.60% of participants achieving this level. The high percentage of participants without formal education and those with only primary or secondary education suggests that the field may be accessible to individuals with varying educational backgrounds. However, the presence of tertiary and postgraduate education among a portion of the sample indicates that higher education also plays a role, potentially reflecting the complexity or specialized nature of certain roles within the field.

**Table 4**. Participant Engagement

| Years | Percentage |
|---|---|
| Less than 1 Year | 24.00% |
| 1 – 5 Years | 13.60% |
| 6 – 10 Years | 50.40% |
| More than 10 Years | 10.40% |

Regarding engagement duration, table 4 reveals that a significant proportion of 50.40% have been engaged for 6 to 10 years. Those with less than 1 year of engagement make up 24.00%. Individuals engaged for 1 to 5 years account for 13.60%, and those engaged for more than 10 years are 10.40%. The data showing that half of the participants have been engaged for 6 to 10 years indicates a stable and experienced workforce. The significant proportion of individuals with less than 1 year of engagement might suggest a degree of turnover or recent entry into the field, which could influence the overall dynamics and institutional knowledge.

**Table 5**. Participant Distribution

| Participant | Percentage |
|---|---|
| Trader/Owner | 78.5% |
| Consumer | 6.63% |
| Others | 6.63% |
| Missing | 9.5% |

Table 5 reveals that majority of participants are traders or owners, comprising 78.5% of the total. Consumers and others each make up 6.63%, with 9.5% of data classified as missing. The dominance of traders or owners among the participants indicates that the

majority are directly involved in the core business activities. The smaller proportions of consumers, others, and missing data suggest that the primary focus is on individuals who are actively engaged in the trade or business aspects, rather than peripheral or indirect roles.

**Table 6**. Other Part Distribution

| Other Part | Percentage |
|---|---|
| Sales rep | 1.5% |
| Learner | 0.5 |
| Trainer | 0.5% |
| Worker | 3% |

Table 6 shows that among other roles, workers constitute the largest group at 3%. Sales representatives make up 1.5%, while learners and trainers each represent 0.5% of the sample. The limited representation of roles such as sales representatives, learners, trainers, and workers highlight that these positions might be less prevalent or less emphasized within the sample. This could reflect a focus on roles that are central to the primary activities of the field, with less emphasis on support or training roles.

In sum, these suggest a field characterized by a stable, experienced core with diverse educational and engagement backgrounds.

## Payment Method Usage in Transactions

**Table 7**. Payment Method Usage in Transactions

| Payment Method | Yes (%) | No (%) | Other (%) | Total (%) |
|---|---|---|---|---|
| Cash | 96.50% | 3.00% | 0.50% | 100% |
| POS | 29.10% | 70.90% | - | 100% |
| Mobile Money | 77.90% | 21.60% | 0.50% | 100% |
| Online Banking | 57.80% | 42.20% | - | 100% |

Table 7 reveals that most commonly used payment method by a large margin is cash, with 96.50% of transactions being carried out in this manner. This suggests that cash remains the dominant form of payment, likely due to its simplicity, widespread availability, and trust among users. Only 3.00% of respondents report not using cash, and 0.50% use other methods, confirming that alternatives to cash are minimal in day-to-day transactions. Mobile money is the second most commonly used method, with 77.90% of participants indicating usage. This signifies the growing importance of mobile money, potentially driven by its convenience and accessibility, particularly in regions where access to formal banking services may be limited. Online banking is used by 57.80%, reflecting a strong, though not universal, adoption. The reliance on internet access and trust in digital banking security likely affects its penetration. POS (Point of Sale) systems are the least frequently used, with only 29.10% of transactions completed through them. This may indicate limited availability of POS systems or concerns about transaction fees and accessibility.

## Frequency of Usage of Payment Methods

**Table 8**. Frequency of Usage of Payment Methods

| Frequency | Cash (%) | POS (%) | Mobile Money (%) | Online Banking (%) |
|---|---|---|---|---|
| Daily | 69.50% | 5.20% | 24.90% | 6.70% |
| Weekly | 23.00% | 13.10% | 34.90% | 12.50% |
| Monthly | 5.80% | 36.20% | 28.60% | 29.40% |
| Occasionally | 1.70% | 45.50% | 11.60% | 51.40% |
| Never | - | - | - | - |

Table 8 reveals that cash is used daily by a significant majority (69.50%), further supporting its role as the primary means of transaction. Mobile money is also used regularly, with 24.90% reporting daily usage, and an additional 34.90% using it weekly, indicating that it plays a significant role in routine financial transactions. POS systems, however, are mostly used occasionally (45.50%) or monthly (36.20%). This pattern may indicate that POS systems are mainly reserved for specific types of purchases or larger transactions. Online banking is primarily used occasionally (51.40%) or monthly (29.40%), suggesting that it may be preferred for planned or higher-value transactions rather than day-to-day purchases.

## Proportion of Total Transactions by Payment Methods

**Table 9**. Proportion of Total Transactions by Payment Methods

| Proportion of Transactions | Cash (%) | POS (%) | Mobile Money (%) | Online Banking (%) |
|---|---|---|---|---|
| 0% - 25% | 5.70% | 22.90% | 7.30% | 15.80% |
| 26% - 50% | 6.20% | 20.00% | 19.40% | 19.80% |
| 51% - 75% | 26.80% | 25.70% | 32.70% | 24.80% |
| 76% - 100% | 61.30% | 31.40% | 40.00% | 39.60% |
| Total Transactions | 100.00% | 100.00% | 100.00% | 100.00% |
| Missing System | 2.50% | 64.80% | 17.10% | 49.20% |

The distribution of transactions by payment method highlights cash's dominance shown in table 9, with 61.30% of participants conducting 76% to 100% of their transactions using cash. Mobile money follows, with 40% of users completing the majority of their transactions via this method. Online banking and POS transactions fall behind, with most users conducting less than 50% of their transactions through these methods. This indicates that while digital payment systems are gaining ground, they still have not overtaken cash for most users. The high percentage of missing data for POS (64.80%) and online banking (49.20%) could imply limited access or adoption among certain

users, highlighting gaps in payment infrastructure.

## Overall Adoption of Payment Method

**Table 10**. Overall Adoption of Payment Methods in the Market

| Rating | Cash (%) | POS (%) | Mobile Money (%) | Online Banking (%) |
|---|---|---|---|---|
| Very High | 66.50% | 26.80% | 53.00% | 50.00% |
| High | 20.10% | 25.40% | 29.90% | 23.50% |
| Moderate | 8.80% | 31.00% | 12.80% | 11.80% |
| Low | 1.50% | 8.50% | 0.60% | 5.90% |
| Very Low | 3.10% | 8.50% | 3.70% | 8.80% |
| Total Valid | 100.00% | 100.00% | 100.00% | 100.00% |
| Missing | 2.50% | 64.30% | 17.60% | 48.70% |

Table 10 reveals that the cash is rated "Very High" by 66.50% of respondents, confirming its deep-rooted role in the payment landscape. Mobile money (53%) and online banking (50%) also show substantial "Very High" adoption, reflecting the increasing shift towards digital payments. POS terminals, in contrast, have lower adoption, with 26.80% rating it "Very High" and most participants indicating moderate or low use. The lower usage of POS may be linked to barriers such as infrastructure availability and cost.

## Factors Influencing Cash Transactions

**Table 11**. Factors Influencing Cash Transactions

| Factor | Very High (%) | High (%) | Moderate (%) | Low (%) | Very Low (%) | Total Valid (%) | Missing (%) |
|---|---|---|---|---|---|---|---|
| No Additional Transaction Fees | 71.4 | 12.5 | 11.9 | 1.2 | 3 | 100 | 15.6 |
| Familiarities and Ease of Use | 86.6 | 9.1 | 3.7 | 0 | 0.6 | 100 | 17.6 |
| Lack of Access to Digital Payment Systems | 40.4 | 18.2 | 20.2 | 11.1 | 10.1 | 100 | 50.3 |
| Immediate Transaction Settlement | 91.5 | 6.1 | 1.8 | 0.6 | 0 | 100 | 17.1 |
| Security Concerns with Digital Systems | 20.5 | 22.7 | 6.8 | 27.3 | 22.7 | 100 | 77.9 |

Table 11 shows several key factors drive the continued preference for cash:

1. No Additional Transaction Fees: A significant 71.4% rate this factor as "Very High," demonstrating that the absence of fees strongly motivates users to rely on cash.
2. Familiarity and Ease of Use: This is another critical factor, with 86.6% rating it "Very High." People tend to stick with cash because they understand how to use it, and it requires no learning curve.
3. Immediate Transaction Settlement: Cash's ability to provide instant transaction

completion is important to 91.5% of respondents, making it an attractive option.

4. Lack of Access to Digital Payment Systems: About 40.4% cite this as a "Very High" reason for using cash, highlighting infrastructure gaps in digital access.

Security concerns with digital systems seem less impactful, with only 20.5% rating it as a "Very High" factor. This suggests that while digital payment security is a concern, it may not be the primary reason people choose cash.

## Factors Encouraging Use of POS Terminals

**Table 12**. Factors Encouraging Use of POS Terminals

| Factor | Very High (%) | High (%) | Moderate (%) | Low (%) | Very Low (%) | Total Valid (%) | Missing (%) |
|---|---|---|---|---|---|---|---|
| Convenience of Card Payments | 64.6 | 10.8 | 16.9 | 1.5 | 6.2 | 100 | 67.3 |
| Perceived Security | 32.4 | 10.8 | 27 | 13.5 | 16.2 | 100 | 81.4 |
| Availability of POS Terminals in the Market | 59.3 | 24.1 | 14.8 | 0 | 1.9 | 100 | 72.9 |
| Acceptance by a Majority of Traders | 50.8 | 27.9 | 13.1 | 3.3 | 4.9 | 100 | 69.3 |
| Lower Transaction Fees Compared with Digital Methods | 18.9 | 27 | 21.6 | 16.2 | 16.2 | 100 | 81.4 |

Table 12 reveals that the top factors promoting the use of POS terminals include:

1. Convenience of Card Payments: 64.6% view this as a "Very High" advantage, emphasizing that POS systems make card-based payments straightforward and efficient.
2. Availability of POS Terminals: 59.3% rated this factor as "Very High," suggesting that greater availability in retail environments encourages usage.
3. Lower Transaction Fees: Fees are less of a motivator, with only 18.9% citing it as "Very High," potentially explaining POS's slower adoption.

## Reasons for Using Mobile Money Services

**Table 13**. Reasons for Using Mobile Money Services

| Reason | Very High (%) | High (%) | Moderate (%) | Low (%) | Very Low (%) | Total Valid (%) | Missing (%) |
|---|---|---|---|---|---|---|---|
| Ease of Use | 85.4 | 9.8 | 4.3 | 0 | 0.6 | 100 | 17.6 |
| Lower Transaction Costs | 50 | 27.2 | 17.5 | 2.6 | 2.6 | 100 | 42.7 |
| Availability of Mobile Money Agents | 32.9 | 22 | 28 | 14.6 | 2.4 | 100 | 58.8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ability to Perform Transactions Remotely | 73.5 | 17 | 7.5 | 2 | 0 | 100 | 26.1 |
| Financial Inclusion for Those Without Bank Accounts | 16.3 | 27.9 | 23.3 | 20.9 | 11.6 | 100 | 78.4 |

Table 13 reveals that mobile money is popular for several reasons:

1. Ease of Use: A whopping 85.4% rated this as a "Very High" reason, showing that its user-friendly nature is a major draw.
2. Remote Transaction Capability: 73.5% appreciate the ability to perform transactions from any location, which likely fuels its widespread adoption, particularly in areas with less banking infrastructure.
3. Lower Transaction Costs: 50% view this as a "Very High" reason, indicating that cost-efficiency is a key factor in mobile money's success.

## Factors Driving the Use of Online Banking

**Table 14**. Factors Driving the Use of Online Banking

| Factor | Very High (%) | High (%) | Moderate (%) | Low (%) | Very Low (%) | Total Valid (%) | Missing (%) |
|---|---|---|---|---|---|---|---|
| Availability from Anywhere with Internet | 63.6 | 20.2 | 12.1 | 1 | 3 | 100 | 50.3 |
| Convenience of Online Transactions | 61.3 | 32.5 | 3.8 | 0 | 2.5 | 100 | 59.8 |
| Security Features Provided by Banks | 23.6 | 36.1 | 29.2 | 6.9 | 4.2 | 100 | 63.8 |
| Integration with Other Financial Services | 29.4 | 23.5 | 26.5 | 16.2 | 4.4 | 100 | 65.8 |
| Ease of Managing Multiple Accounts | 41.4 | 12.1 | 17.2 | 22.4 | 6.9 | 100 | 70.9 |

Table 14 shows that online banking is driven by factors such as:

1. Accessibility from Anywhere: 63.6% rate this as "Very High," reflecting the appeal of being able to bank online regardless of location.
2. Convenience: With 61.3% rating this as "Very High," convenience emerges as a critical factor for online banking adoption.
3. Security: While security features provided by banks are important, only 23.6% rate them as "Very High," indicating that trust in the safety of online banking still has room for improvement.

## Influence on Choice of Payment Methods

**Table 15**. Influence on Choice of Payment Methods

| Factor | Major (%) | Moderate (%) | Indifferent (%) | Minor (%) | None (%) | Total Valid (%) | Missing (%) |
|---|---|---|---|---|---|---|---|
| Transaction Cost | 52 | 38.2 | 7.9 | 2 | 0 | 100 | 23.6 |
| Availability of Payment Infrastructure | 53 | 36.1 | 7.8 | 2.4 | 0.6 | 100 | 16.6 |
| Financial Literacy | 47.7 | 36.6 | 12.4 | 2.6 | 0.7 | 100 | 23.1 |
| Security Concerns | 33.5 | 46.5 | 16.8 | 1.9 | 1.3 | 100 | 22.1 |
| Cultural Preference | 5.3 | 18.4 | 18.4 | 28.9 | 28.9 | 100 | 80.9 |

Table 16 shows that several key factors shape payment method preferences:

1. Transaction Cost: 52% cite this as a "Major" factor, showing that cost is a decisive element in choosing payment methods.
2. Availability of Payment Infrastructure: The presence of necessary infrastructure is another crucial factor, with 53% viewing it as "Major."
3. Financial Literacy: Understanding how to use different payment methods is also important, with 47.7% rating it as "Major."
4. Cultural Preferences: Only 5.3% view this as a "Major" factor, indicating that cultural habits play a minor role in shaping payment preferences compared to more practical concerns like cost and infrastructure.

## Discussion

Thus, Cash continues to dominate the payment landscape due to its ease of use, immediate settlement, and lack of fees. Mobile money is gaining traction, especially for remote transactions and its accessibility for individuals without bank accounts. POS and online banking, though growing, face barriers related to infrastructure, security concerns, and less frequent usage in day-to-day transactions. Adoption of digital payment systems is encouraged by ease of use, convenience, and the availability of infrastructure, but concerns about fees and security still inhibit wider adoption. These insights suggest a gradual shift toward digital payment methods, though cash remains deeply entrenched due to its practical benefits. The expansion of digital infrastructure and addressing security concerns will be key to accelerating this transition.

The data on payment methods reveals several key implications regarding the adoption of different payment systems and the factors influencing their usage. Here's a breakdown of the implications: With 96.5% of transactions being conducted in cash, it remains the most trusted and accessible form of payment. This dominance reflects the entrenched role of cash in daily transactions, particularly where users prefer familiarity and simplicity. The high daily usage (69.5%) of cash reinforces its place as the go-to payment method for quick, immediate transactions without additional costs. Despite cash's dominance, digital payment systems such as mobile money and online banking are making headway. The high adoption of mobile money (77.9%) reflects its utility, especially in regions with limited access to formal banking. Online banking's 57.8% usage shows the growing importance of secure and convenient digital platforms. This suggests a transition

towards digital payments is underway but is still far from replacing cash as the primary payment method. The widespread use of mobile money indicates that financial inclusion efforts are succeeding, but the adoption of POS systems and online banking is slower, likely due to infrastructure limitations or security concerns. With 69.5% of cash users transacting daily, this implies that for everyday, low-value transactions, cash is seen as the most practical and efficient option. The absence of transaction fees and immediate settlement are key drivers for its usage. Mobile money, online banking, and POS systems are mostly used weekly, monthly, or occasionally, suggesting that digital methods may be reserved for higher-value or less frequent transactions. For example, online banking is used by 51.4% occasionally, indicating that it's more suited to planned transactions that require larger sums or remote payments. Digital payment systems are perceived as complementary to cash, especially for larger or less frequent transactions. The reliance on cash for day-to-day spending highlights the need for digital payment solutions to be as simple and immediate as cash to achieve wider daily adoption.

Only 29.1% of participants use POS systems, with most users utilizing it occasionally (45.5%) or monthly (36.2%). This indicates that POS systems may not be readily available or widely accepted by merchants, or that users find transaction fees prohibitive. Lower transaction fees compared to digital methods (18.9%) are not seen as a compelling advantage for POS use. This, coupled with low perceived convenience (5.2% daily usage), implies that consumers and businesses alike still face barriers to full adoption. To boost POS usage, there must be a focus on improving availability, reducing transaction fees, and enhancing consumer confidence in the system's ease of use. Without addressing these factors, POS adoption is likely to remain limited. The fact that mobile money services are frequently used (34.9% weekly, 24.9% daily) and valued for financial inclusion for those without bank accounts (16.3% rating it "Very High") highlights its role in reaching unbanked populations. Mobile money's ability to facilitate remote transactions is a major advantage, with 73.5% rating this feature as "Very High." This suggests that mobile money offers users a vital means of conducting transactions in areas with limited banking infrastructure. Mobile money is an effective tool for driving financial inclusion and reaching underserved communities. However, to further enhance its role, mobile money services need to ensure that fees remain low and that the network of agents continues to expand.

Although online banking is gaining traction, only 23.6% of users rate security features as "Very High." Concerns over digital security remain a barrier to its full adoption, despite the convenience of online transactions (61.3% rating convenience "Very High"). Integration with other financial services is moderately important, with only 29.4% seeing it as a "Very High" benefit. Users may be less motivated to engage in online banking unless it clearly integrates with other services they use. Security concerns need to be addressed more robustly to drive greater adoption of online banking. Banks should prioritize enhancing security features and educating users on safe digital practices. Additionally, banks can better promote integration with financial services to encourage more widespread use of online banking for a variety of needs.

Transaction costs are a major factor for 52% of users when selecting a payment method, and infrastructure availability is crucial for 53%. This underscores that both cost and convenience are critical to driving the adoption of non-cash payment methods. Financial literacy is also a major driver, with 47.7% rating it as "Major." This indicates that users need better understanding and education to

adopt digital methods confidently. Security concerns remain significant, with 33.5% viewing it as a major influence, suggesting that any perception of vulnerability could prevent adoption. Reducing transaction fees and improving infrastructure for digital payments will likely encourage greater adoption. Financial literacy programs that demystify digital payments could also help alleviate concerns, while promoting trust in digital payment security will be crucial for sustained growth.

Only 5.3% see cultural preference as a "Major" factor in payment choice, suggesting that tradition or habit is not a significant barrier to adopting new payment methods. Practical factors like cost, convenience, and security are far more influential. Efforts to promote digital payment adoption should focus on addressing practical barriers rather than cultural resistance. Since users are willing to adopt new systems if they meet their needs, ensuring ease of use and trust in the systems will have a more meaningful impact than cultural factors.

The data highlights a payment landscape where cash still dominates, particularly for small, frequent transactions. However, mobile money and online banking are making inroads, largely due to their convenience and accessibility. POS systems lag behind due to infrastructure gaps and cost concerns. To foster broader digital payment adoption, efforts must focus on reducing fees, expanding infrastructure, and enhancing user education and trust in digital security. This transition holds particular promise for financial inclusion, with mobile money playing a vital role in reaching unbanked populations.

## Conclusion and Recommendations

The findings of the study strongly indicate that the strongest driving force behind the choice of the traders and market people is the ease with which channel could be used to settle payments. Cash payment was noted to be dominant due to no additional transaction fees, familiarity, ease of use, immediate transaction settlement and lack of access to digital payment systems. Therefore, if the alternative payment channels are to be adopted, these features have become part of them too. The drive to cashless economy has to be made simple to the literate and illiterate, the rich and the poor. People will likely adopt easy methods .

The availability of network also was observed to be likely determinant of the perception of the of the local traders. Hence, it is recommended that tools that would make the use of payment platforms be made readily available to the local markets.

The results indicate that the perception of the people which favours cash payment is built on ease of payment and availability of cash. This result shows that if these variables (ease of payment and availability) is well manipulated for the alternative payment methods, the same success can be achieved in getting market people to make use of them. This should encourage the authorities to make electronic banking platforms as easy and available to the market people to encourage a change of preferred payment option.

## Conflict of Interest

There is no conflict of interest.

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# The Prevalence of Cervical Cancer among Females Living with HIV/AIDS in Wuse District Hospital, Abuja, Nigeria: Epidemiological Trends and Health Outcomes

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***Abstract***

*Cervical cancer remains a significant public health challenge, particularly among women living with HIV/AIDS. This paper aims to explore the prevalence and health outcomes associated with cervical cancer among females living with HIV/AIDS in Abuja, Nigeria. To achieve this objective, a cross-sectional retrospective study design was used to determine the prevalence of cervical cancer in females living with HIV between January 2022 to December 2023. Data was collected by use of folders and clients' records, well-articulated personal interviews, questionnaires and forms. A random sampling method was adopted to make sure that all important groups are captured including different age grades, socioeconomic status, cultural beliefs, tribe, marital status, educational level, religion, sexual behavior, and parity. Data extracted was inputted in Microsoft Excel 2010, analysis was done using statistical software SPSS (Statistical Package for Social Sciences). At the end of this analysis, the result showed that the prevalence of cervical cancer among females living with HIV/AIDS in Abuja is 4% which indicates that cervical cancer is a significant public health issue among HIV-positive women in Abuja. While this rate may appear modest, it is considerably higher than the general population, underscoring the heightened risk faced by females living with HIV.*

***Keywords:*** *Abuja, Cervical Cancer, Females Living with HIV/AIDS.*

## Introduction

Cervical cancer is the second most common cancer in Nigeria and second to breast cancer among its female population [6]. Cervical cancer remains an important challenge in global health especially affecting women in low- and medium-income countries where there is limited or even, no access to screening and treatment services. Among the vulnerable populations, females living with Human Immunodeficiency Virus (HIV) are at a higher risk of cervical cancer because of immunosuppression and persistent infection with high-risk Human Papillomavirus (HPV) strains. Abuja, the Federal Capital Territory of Nigeria, constitutes a minute part of this issue, where both issues of HIV and cervical cancer pose a substantial health burden on these individuals and an excessive demand on the limited healthcare resources. A systematic review on cervical cancer incidence and mortality rate shows that the scarcity of information reveals a substantial need for further studies on cervical cancer prevalence and mortality with associated risk factors [14]. Human Immunodeficiency Virus (HIV) continues to be a major global public health issue, affecting millions worldwide. Sub-Saharan Africa remains the region most severely affected, with Nigeria being one of the countries with a high HIV burden. In Nigeria, approximately 1.8 million people were living with HIV as of 2019, with a national prevalence rate of about 1.4% [27]. Abuja, the Federal

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Capital Territory, also reflects these statistics, with a significant number of people living with HIV, many of whom are women. HIV can be transmitted through sexual contact, mother-to-child transmission, blood transfusions, needle sharing, and occupational exposure. Antiretroviral therapy (ART) is the cornerstone of HIV treatment, aimed at reducing the viral load in the body, maintaining immune function, and preventing opportunistic infections and transmission. The introduction of ART has transformed HIV from a fatal disease to a manageable chronic condition. According to [26], females living with HIV have higher risk of having cancer of the cervix as against women without HIV and globally, about 6% of women with cancer of the cervix have HIV and less than 5% of people that have cancer of the cervix are due to HIV. Studies conducted by [11] shows that the main determinant of having cancer of the cervix is the presence of HPV infection. Females living with HIV have a higher risk of having this HPV infection thereby causing cervical distortion and malignancy. This is because the immune system has already been compromised by this virus which has led to an immunosuppressive state. Understanding the comorbidities helps medical practitioners to know the essence of proper and complete health delivery to this vulnerable population. The comorbidities include coinfection with other sexually transmitted infections, chronic inflammation and opportunistic infections, non communicable diseases and nutritional deficiencies. There should be targeted care and intervention which include yearly cervical cancer screening, yearly or frequent monitoring of CD4 count and viral loads of this population and ensure proper adherence to ARVs. This is because co-morbid conditions commonly seen in HIV-positive women significantly impact the outcomes and prognosis of cervical cancer. National health policies and programs that support integrated care for HIV and cervical cancer are crucial. This includes training healthcare providers, ensuring the availability of screening and treatment supplies, and monitoring and evaluation to track progress and outcomes [29]. Integrating cervical cancer screening and treatment into existing HIV care services in hospitals can improve access and adherence to screening guidelines. This approach leverages the existing infrastructure and resources of HIV clinics to provide comprehensive care [5]. Providing education and counselling on the importance of cervical cancer screening and the availability of services can enhance uptake and adherence. Cervical cancer remains one of the most significant health issues affecting women worldwide. According to the Global Cancer Incidence, Mortality and Prevalence (GLOBOCAN), approximately 570,000 cases and 311,000 deaths of cervical cancer were estimated to have occurred in 2018 worldwide [30]. The disease predominantly affects women in the prime of their lives, with the majority of cases occurring in women aged 35-44

years. The incidence and mortality rates of cervical cancer vary significantly across different regions of the world. High-income countries have seen a significant reduction in cervical cancer incidence and mortality due to effective screening programs and the widespread use of HPV vaccines. In contrast, low and middle-income countries (LMICs) continue to bear the highest burden of the disease, accounting for nearly 90% of cervical cancer deaths [8]. In Sub-Saharan Africa (SSA), cervical cancer is the leading cause of cancer deaths amongst women. The region carries the greatest burden, with 24.55% of the global mortality from cervical cancer [20]. There are some risk factors contributing to the increased prevalence of cervical cancer both in general population and in this vulnerable group. They include HPV infection, immunosuppression, income and access to health care, education and literacy, geographic location, behavioural factors (smoking, sexual behaviour), coinfection with other sexually transmitted infections (STI), socioeconomic

and demographic factors. Human Papillomavirus (HPV) is the primary etiological agent of cervical cancer. In most cases, persistent infection with highly infectious types of human papillomavirus (HPV) such as HPV 16 and 18 is believed to be the cause of the disease [21]. Immunosuppression is a critical factor in the increased risk of cervical cancer. HIV infection leads to the depletion of CD4+ T cells, which play a crucial role in the immune response against HPV [9]. Low CD4 counts are associated with higher rates of HPV persistence and progression to cervical intraepithelial neoplasia (CIN) and cervical cancer [9]. Smoking is an independent risk factor for cervical cancer. It contributes to immune suppression and enhances the persistence of HPV infections. Smoking damages cervical DNA and impairs local immune responses, facilitating carcinogenesis [25]. Due to the hardship Nigerian citizens face, most females, both young and old resort to having sex in exchange for money in a bid to make ends meet. The main risk factors correlated with HPV infection are early sexual debut, the number of partners, frequency and type of sexual contact and partner's sexual histories. [24]. Lower income levels limit access to healthcare services, including cervical cancer screening and treatment [10]. Financial barriers can delay diagnosis and treatment, leading to worse outcomes. Also, education level is directly linked to health literacy and awareness about cervical cancer. Women with higher education levels are more likely to participate in screening programs and adhere to medical advice [19]. Urban-rural disparities significantly affect healthcare access. Globally, cervical cancer (CC) incidence is higher in rural areas than in urban areas that could be explained by the influence of many factors, including inequity in accessibility of the CC prevention measures [31]. Finally, HIV infection leads to chronic immune activation and inflammation, which creates an environment that supports cancer development. Although antiretroviral therapy effectively controls human immunodeficiency virus (HIV) replication, a residual chronic immune activation/inflammation persists throughout the disease [16]. These mechanisms above lead to increased susceptibility to infections and cancers in females living with HIV. Research conducted in Ibadan and Abuja between 2009 and 2010 showed that with about 20% of the people in Africa, and a bit above half of the West African people, 15% of about 681,000 recent cancers in 2008 came from Nigeria [4]. Another research carried out in Enugu showed that in 2007, 36.59million females greater than 15years in Nigeria develop cancer of the cervix and there are 9,922 annual cases with 8,030 mortality [6]. Ref. [6] also goes on to say that there are more than 560,000 recent cases and about 275,000 mortalities documented yearly, globally with 80% happening in the third world countries. HIV-positive women have higher human papillomavirus (HPV) prevalence and cervical cancer (CC) incidence than HIV-negative women, partly due to HIV's modifying effect on HPV pathogenesis [15]. The immunosuppressive nature of HIV impairs the body's ability to clear HPV, leading to persistent infections that are more likely to progress to cervical cancer [23]. HIV and HPV co-infection lead to synergistic effects that exacerbate the oncogenic potential of HPV. HIV-induced immune suppression allows for the unchecked activity of HPV's oncogenes, accelerating the progression from infection to malignancy [3]. Antiretroviral therapy (ART) has significantly improved the prognosis of HIV-positive individuals via immune reconstitution. ART improves immune function by increasing CD4 counts and reducing HIV viral load [19]. This immune reconstitution can help control HPV infections and reduce the progression to cervical cancer [10]. The effectiveness of ART in reducing cervical cancer risk is highly dependent on adherence. The widespread use of ART has improved the

overall health and life expectancy of HIV-positive individuals. However, even with ART, the risk of cervical cancer remains elevated. Studies indicate that while ART helps in partial immune reconstitution, it does not completely eliminate the increased risk of cervical cancer in HIV-positive women [10].

## Methodology

This study used cross sectional retrospective and descriptive prospective designs with a mixed methods approach, combining quantitative and qualitative techniques. The cross-sectional retrospective study design was used to determine the prevalence of cervical cancer in females living with HIV between January 2022 to December 2023. The descriptive prospective designs was used to determine the risk factors amongst the study participants. Inclusion criteria for study participants include HIV positive female clients already on anti-retroviral drugs, ages between 24 and 49 years old, if less than 24 years, should be sexually active, non pregnant, not menstruating, living in Abuja, Nigeria, ability to give informed consent. Exclusion criteria include males, females not sexually active/virgins, pregnant, menstruating, HIV negative individuals, females undergoing cervical cancer treatment, females that have their cervices removed for one reason or the other, inability to give informed consent, not living in Abuja. A random sampling method was adopted to make sure that all important groups are captured including different age grades, socioeconomic status, cultural beliefs, tribe, marital status, educational level, religion, sexual behavior, and parity. The sample size calculation was based on the Lorenz formula: $n= z^2.p.q./e^2$ (where n is the sample size, p the past prevalence of the disease under investigation ($p + q = 1$), z the value corresponding to the significant criterion of 95% confidence which is equal to 1.96 and e the minimal expected difference. Therefore, to calculate the sample size with a prevalence rate of 6% [18] and to achieve a 95% confidence level with 5% margin error for research on prevalence of cervical cancer among females in people living with HIV in Abuja, Nigeria, a sample size of 86 clients is needed. Sources of data (e.g., medical records, cancer registries, national surveys): Well-articulated personal interviews were conducted, questionnaires and forms were used to achieve information for consent, HIV status, cervical cancer screening data and information. Clients' records and folders were checked to authenticate their HIV status, duration of HIV infection, latest viral load results, cervical cancer screening results including positive and negative results. Hospital facility was also informed so we can get every information concerning cervical cancer screening and outcomes among this vulnerable population and age group. Data extracted was inputted in Microsoft Excel 2010, analysis was done using statistical software SPSS (Statistical Package for Social Sciences). Result representation was in percentages, frequency distribution tables, figures, and charts. The Chi square test was used to determine the risk factors and relationship between HIV and cervical cancer prevalence.

## Results

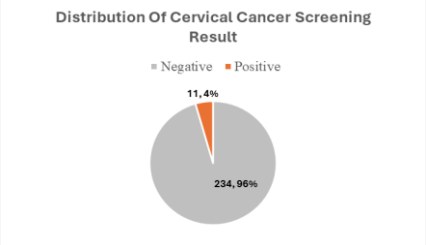


**Figure 1**. Pie Chart of Prevalence of Cervical Cancer in Wuse District Hospital

Survival rates and prognosis for HIV-positive women with cervical cancer are generally poorer compared to HIV-negative women due to several factors related to both their HIV status and the progression of cervical cancer. Studies have shown that HIV-positive women with cervical cancer have lower survival rates compared to their HIV-negative counterparts which is because of an already compromised immune system. The degree of immunosuppression, as measured by CD4+ T cell counts, significantly affects prognosis. Lower CD4 counts are associated with higher mortality and poorer outcomes. HIV-positive women with CD4 counts below 200 cells/μL have a significantly increased risk of cervical cancer-related mortality compared to those with higher CD4 counts [17]. ART improves immune function by increasing CD4 counts and reducing HIV viral load [23]. This immune reconstitution can help control HPV infections and reduce the progression to cervical cancer [13]. With the availability of antiretroviral therapy (ART) coupled with early diagnosis, people living with HIV (PLHIV) now live longer. [18]. The effectiveness of ART in reducing cervical cancer risk is highly dependent on adherence. Introduction of antiretroviral therapy (ART) decreased risks of opportunistic infections and improved overall survival [11]. The quality of life of this vulnerable population will be reduced if treatment challenges and comorbidities are not properly managed. These challenges include delays in diagnosis, limited access to specialized oncology care, and complications related to HIV co-morbidities and treatment interactions [12]. Additionally, HIV-positive women may experience more severe side effects from cancer treatments such as radiotherapy and chemotherapy, which can further impact their prognosis [2]. Studies have shown that the prevalence of cervical cancer is 2-4 times higher in HIV-positive women. Women infected with human immunodeficiency virus (HIV) suffer from precancerous cervical lesions and severe invasive cervical cancer (ICC) at rates that far exceed those of their HIV-free counterparts [7].

## Discussion

The pie chart presented above (Figure 1) shows the distribution of cervical cancer screening results among HIV-positive females in Abuja, Nigeria. Out of the total screened population, 4% tested positive for cervical cancer, while 96% tested negative. This result provides critical insights into the prevalence of cervical cancer and its associated risk factors within this vulnerable group. The prevalence rate of 4% indicates that cervical cancer is a significant health issue among HIV-positive females living in Abuja. While this rate may appear modest, it is considerably higher than the general population, underscoring the heightened risk faced by females living with HIV. HIV-positive females are more susceptible to cervical cancer due to several risk factors like immunosuppression, persistent HPV infections, coinfections and comorbidities and so on. HIV weakens the immune system, reducing the body's ability to clear HPV infections, which are the primary cause of cervical cancer. The overall reduction in immune surveillance due to HIV allows HPV-infected cells to evade immune detection and destruction. This escape from immune control facilitates the accumulation of genetic mutations and the transformation of normal cells into cancerous ones [17]. The compromised immune system of HIV-positive women leads to persistent HPV infections, increasing the risk of developing cervical cancer. HIV-positive women often have other infections and health conditions that can further weaken their immune response and contribute to cancer development. In women with HPV, one factor that increases the risk of progression to cervical cancer is co-infection with a different STI [28]. The socio-demographic data of the screened population, highlights several risk factors associated with cervical cancer

prevalence. A substantial proportion of the women are in the age groups (35-44 years) where the risk of cervical cancer is higher. These age groups are more likely to have a longer duration of HPV infection and multiple childbirths, both of which are risk factors. The high percentage of unemployed women and those with low income suggests limited access to healthcare services. Financial constraints may prevent these women from accessing regular screenings and timely treatments. Low levels of education are linked to reduced health literacy. Low education levels and low financial status are among the two significant social risk factors of cervical malignancy as it leads to poor access to disease screening services and resistance against screening visits [21]. Women with little or no formal education may lack awareness about cervical cancer prevention and the importance of regular screenings. A majority reside in rural areas where healthcare infrastructure is often inadequate. Rural women face barriers such as distance to healthcare facilities, lack of transportation, and fewer healthcare providers trained in cervical cancer screening. High rates of early marriage and multiple childbirths (parity) also increase the risk of cervical cancer. Early marriage leads to early sexual activity and higher exposure to HPV, while multiple childbirths cause repeated trauma to the cervix. Several barriers contribute to the lower screening rates and delayed treatment among HIV-positive women. A study carried out by [1] says that proper screening allows for early detection and effective management of cervical cancer, but limited awareness and various barriers hinder women's access to screening services. HIV-positive women may face stigma, discouraging them from seeking medical help. Also, cultural norms and misconceptions about cervical cancer and its screening and limited availability of screening programs and trained healthcare personnel in rural areas can deter women from undergoing screenings. To address the high prevalence of cervical cancer among HIV-positive women in Abuja, targeted interventions are essential. Increase awareness about the importance of cervical cancer screening, especially among less educated and rural populations. Expand cervical cancer screening services, particularly in rural areas, through mobile clinics and integrating screenings with HIV care. Provide financial assistance or subsidies for cervical cancer screening and treatment to overcome economic barriers. Involve community and religious leaders in health education campaigns to change cultural attitudes and reduce stigma. There are recommendations for early detection and screening programs that aim to enhance early diagnosis, improve treatment outcomes, and reduce the overall burden of cervical cancer in this vulnerable population. They include integrating routine cervical cancer screening into standard HIV care protocols for all HIV-positive women. This should include Pap smears, Visual Inspection with Acetic Acid (VIA), or Visual Inspection with Lugol's Iodine (VILI) every 6 months to 1 year. Introduce HPV DNA testing as a primary screening tool for HIV-positive women to identify high-risk HPV types that significantly increase the risk of cervical cancer. Develop comprehensive educational campaigns to raise awareness about the importance of cervical cancer screening and the increased risk for HIV-positive women. These programs should target both healthcare providers and patients. Use community health workers to educate women in rural and underserved areas about cervical cancer risks and the benefits of regular screening. Implement mobile clinics to provide screening services in remote and underserved areas where access to healthcare facilities is limited. Ensure that cervical cancer screening services are free and available in all HIV care and treatment clinics to facilitate easy access for women attending these clinics. To address the prevalence and associated risk factors of cervical cancer among females living with HIV in Abuja, Nigeria, it is crucial to implement

integrated care strategies. These strategies focus on combining HIV and cervical cancer services to enhance prevention, early detection, and treatment, thereby improving health outcomes for this vulnerable population. These include providing subsidized or free screening and treatment services for cervical cancer to reduce financial barriers for women living with HIV. Offer incentives, such as transport stipends or food vouchers, to encourage women to attend screening and follow-up appointments. Advocate for policies that support integrated HIV and cervical cancer care. This includes policies that ensure funding, training, and resources are allocated for comprehensive women's health services. Improve healthcare facilities to provide both HIV and cervical cancer services under one roof. This includes equipping clinics with the necessary tools for screening and treatment of cervical cancer. Train healthcare providers on the integrated approach to managing HIV and cervical cancer. This includes training on screening techniques, patient education, and management of co-morbid conditions. There are some limitations in this study which include reluctance to fill in the questionnaire because they are in a hurry to leave the facility, difficulty filling the questionnaire because of illiteracy and language barrier. Some respondents are illiterates and cannot speak English and translators are difficult to find sometimes. Also, there was sampling bias, problem in data Collection, confounding factors, resource constraints, ethical and privacy concerns. The study was hospital-based research; therefore, the sample was not a true representative of the broader population of HIV-positive females living in Abuja, leading to biased prevalence and risk factor estimates. It was also limited by access to certain populations, especially those in rural areas or those not engaged in regular HIV care, which can skew results. The study mostly relied on self-reported data, which could lead to inaccuracies due to recall bias or social desirability bias. The study faced the challenge in controlling for all potential confounders, such as co-infections, other health conditions, and lifestyle factors, which might also influence cervical cancer risk. The present work was carried out in the hospital settings and there were challenges in ensuring participant confidentiality and managing sensitive health information, obtaining informed consent and ensuring ethical conduct throughout the study was complex, particularly in vulnerable populations. Limited funding and resources constrained the scope of the study, including sample size, duration, and data collection methods. These resource limitations affected the depth and breadth of the analysis.

## Future Research Perspectives

Comparative research can be conducted to explore differences in cervical cancer prevalence and risk factors between HIV-positive and HIV-negative women, enhancing the understanding of HIV's impact. Long term Studies can be done to monitor the process of transmission of HPV infection to cancer of the cervix in females living with HIV. Also, new innovative interventions can be formed by observing over a period of time the prevalence and risk factors to have some knowledge on how it evolves. Research can be widened to add a greater and wider topographical area outside Abuja to distinguish between urban and rural dwellers while exploring differences by region in prevalence and risk factors to tailor public health interventions appropriately. Religious and cultural factors can be researched to have a detailed study on the impact of cultural beliefs, and religious practices on the uptake of cervical cancer screening and treatment among HIV-positive women to explore more hinderances to healthcare access and develop interventions to overcome them. Interventional Studies like assessing and devising means to the effectiveness and possibility of targeted interventions, such as mobile screening units for community use. Evaluate the effect of different intervention plans on increasing

screening rates and early detection. New innovative interventions can drive the development of new preventive and therapeutic interventions, including vaccines and novel screening technologies. Health system enhancement, to research the possibility and effectiveness of incorporating free cervical cancer screening with routine HIV care services in all hospitals in Nigeria all year round and evaluate the impact of improving healthcare infrastructure on screening uptake and patient outcomes. Study the quality of life and psychosocial aspects of HIV-positive women diagnosed with cervical cancer. Carry out policy and Health Economics research to investigate the policy implications of cervical cancer screening and treatment programs for HIV-positive women and analyse the economic burden of cervical cancer in HIV-positive populations and the potential savings from preventive measures. Carry out community-based participatory research to engage communities in the research process to better understand their needs and preferences and develop community-led initiatives to increase awareness and participation in cervical cancer screening programs.

## Conclusion

The result of 4% prevalence of cervical cancer among HIV-positive females living in Abuja highlights the urgent need for comprehensive public health strategies. These strategies should focus on improving access to cervical cancer screening, enhancing health education, and addressing socio-economic and cultural barriers by healthcare providers, policymakers, and researchers. By implementing targeted interventions, integrating health care services, providing education and awareness campaigns, advocating for policy changes, prioritizing this vulnerable population, and strengthening global health systems, the healthcare system can reduce the prevalence of cervical cancer and improve the health outcomes for HIV-positive females living in Abuja, Nigeria.

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## Conflict of Interest

We, the authors declare that we do not have any conflict of interest.

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# Risk Factors of Cervical Cancer and Improving Access to Preventive Care among Females Living with HIV/AIDS in Wuse District Hospital, Abuja, Nigeria

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***Abstract***

*Cervical cancer remains a significant public health issue, especially among women living with HIV/AIDS. This dissertation explores the risk factors contributing to the increased prevalence and severity of cervical cancer in this population. To achieve this objective, a cross-sectional retrospective study design was used to determine the risk factors of cervical cancer in females living with HIV between January 2022 to December 2023. Data was collected by use of folders and clients' records, well-articulated personal interviews, questionnaires and forms. A random sampling method was adopted to make sure that all important groups are captured including different age grades, socioeconomic status, cultural beliefs, tribe, marital status, educational level, religion, sexual behavior, and parity. Data extracted was inputted in Microsoft Excel 2010, analysis was done using statistical software SPSS (Statistical Package for Social Sciences). At the end of this analysis, the result showed that the risk factors of cervical cancer among females living with HIV/AIDS in Abuja include age (25-29 and 40-44), non-employment, no source of income, living in rural areas, illiteracy, low CD4 count/unsuppressed viral load, Muslim religion, marriage and large number of children. This indicates that cervical cancer is a significant public health issue among HIV-positive women in Abuja. By preventing these risk factors in this vulnerable population, cervical cancer prevalence can be reduced to the barest minimum.*

***Keywords:*** *Abuja, Cervical Cancer, Preventive Care, Risk Factors, Women Living with HIV/AIDS.*

## Introduction

Cervical cancer is the fourth most common cancer among women globally. Its incidence and mortality rates are disproportionately high in low- and middle-income countries, where access to preventive measures and treatment is limited. Among women living with HIV/AIDS, the risk of developing cervical cancer is significantly elevated. Cervical cancer is the type of cancer seen in females only and is seen occurring in the cervical cells. Cervical cancer is the second most common cancer in women worldwide and the leading cause of cancer deaths in developing countries [2]. In Sub-Saharan (SSA) cervical cancer is the leading cause of cancer deaths amongst women. The region carries the greatest burden, with 24.55% of the global mortality from cervical cancer [17]. Cervical cancer is the second most common cancer in Nigeria and second to breast cancer among its female population [3]. Cervical cancer remains an important challenge in global health especially affecting women in low- and medium-income countries where there is limited or even, no access to screening and treatment services. According to the Global Cancer Incidence, Mortality and Prevalence (GLOBOCAN), approximately 570,000 cases and 311,000 deaths of cervical cancer were estimated to have occurred in 2018 worldwide

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[27]. Among the vulnerable populations, females living with Human Immunodeficiency Virus (HIV) are at a higher risk of cervical cancer because of immunosuppression and persistent infection with high-risk Human Papillomavirus (HPV) strains. Abuja, the Federal Capital Territory of Nigeria, constitutes a minute part of this issue, where both issues of HIV and cervical cancer pose substantial health burden on these individuals and an excessive demand on the limited healthcare resources. A systematic review on cervical cancer incidence and mortality rate shows that the scarcity of information reveals a substantial need for further studies on cervical cancer prevalence and mortality with associated risk factors [10]. The relationship between HIV and cervical cancer presents a compound health outline. Females living with HIV are at a very high risk of having cervical cancer as against the general population. Studies show that the prevalence of cervical cancer among HIV-positive women is much higher than among HIV-negative females. According to [25], females living with HIV have higher risk of having cancer of the cervix as against women without HIV and globally, about 6% of women with cancer of the cervix have HIV and less than 5% of people that have cancer of the cervix are due to HIV. This high propensity is mainly due to the compromised immune system in HIV-positive individuals, which facilitates persistent HPV infection leading to the development of precancerous lesions and eventually cervical cancer. Studies have shown that the prevalence of cervical cancer is 2-4 times higher in HIV-positive women. Women infected with human immunodeficiency virus (HIV) suffer from precancerous cervical lesions and severe invasive cervical cancer (ICC) at rates that far exceed those of their HIV-free counterparts [4]. The widespread use of ART has improved the overall health and life expectancy of HIV-positive individuals. However, even with ART, the risk of cervical cancer remains elevated. Studies indicate that while ART helps in partial immune reconstitution, it does not completely eliminate the increased risk of cervical cancer in HIV-positive women [9].

## The Biological Mechanisms Linking HIV/AIDS to Cervical Cancer

HIV-positive women have higher human papillomavirus (HPV) prevalence and cervical cancer (CC) incidence than HIV-negative women, partly due to HIV's modifying effect on HPV pathogenesis [11]. HIV and HPV co-infection lead to synergistic effects that exacerbate the oncogenic potential of HPV. HIV-induced immune suppression allows for the unchecked activity of HPV's oncogenes, accelerating the progression from infection to malignancy [1]. Cervical cancer development is primarily initiated by persistent infection with high-risk types of human papillomavirus (HPV), particularly HPV 16 and 18. The progression from HPV infection to cervical cancer involves several mechanisms one of which are, viral oncogenes. HPV's high-risk types encode oncogenes E6 and E7, which interfere with tumour suppressor proteins p53 and retinoblastoma (pRb) respectively [5]. E6 promotes the degradation of p53, leading to the inhibition of apoptosis, while E7 binds to pRb, releasing E2F transcription factors that drive cell cycle progression and proliferation. Also, persistent HPV infection causes chronic inflammation, which promotes a microenvironment conducive to cancer development. Studies carried out by [14] says that reactive oxygen species (ROS) are crucial signaling molecules in inflammatory disorders, where increased ROS production by polymorphonuclear neutrophils (PMNs) at inflammation sites lead to endothelial dysfunction and tissue injury.

## Increased Susceptibility to HPV Infection in HIV-Positive Individuals

The interaction between HIV and HPV significantly increases the risk of cervical cancer in HIV-positive females due to increased

HPV persistence. HIV-positive women have a higher prevalence of persistent HPV infections. The immunosuppressive nature of HIV impairs the body's ability to clear HPV, leading to persistent infections that are more likely to progress to cervical cancer [22]. Immunosuppression is a critical factor in the increased risk of cervical cancer among HIV-positive women via CD4+ T Cell depletion. HIV infection leads to the depletion of CD4+ T cells, which play a crucial role in the immune response against HPV [6]. Low CD4 counts are associated with higher rates of HPV persistence and progression to cervical intraepithelial neoplasia (CIN) and cervical cancer [13]. The compromised immune system in HIV-positive individuals play a crucial role in the progression of cervical cancer. HIV targets and depletes CD4+ T cells, which are essential for maintaining an effective immune response against infections, including HPV. Low CD4 counts are associated with an increased risk of HPV persistence and progression to cervical intraepithelial neoplasia (CIN) and cervical cancer [6]. Again, the overall reduction in immune surveillance due to HIV allows HPV-infected cells to evade immune detection and destruction. This escape from immune control facilitates the accumulation of genetic mutations and the transformation of normal cells into cancerous ones [13]. HIV infection also leads to chronic immune activation and inflammation, which creates an environment that supports cancer development. Although antiretroviral therapy effectively controls human immunodeficiency virus (HIV) replication, a residual chronic immune activation/inflammation persists throughout the disease [12]. CD4 cell count has been reported to have a strong association with progression to AIDS-related illness or death [15]. HIV-positive women have higher risk of acquiring HPV, with risk inversely associated with CD4 count [11].

## Risk Factors

There are behavioral and socioeconomic risk factors that significantly influence the risk of cervical cancer among HIV-positive women. They include smoking, income and access to health care, education and literacy, geographic location and sexual behaviour. Smoking is an independent risk factor for cervical cancer. It contributes to immune suppression and enhances the persistence of HPV infections. Smoking damages cervical DNA and impairs local immune responses, facilitating carcinogenesis [24]. Socioeconomic factors play a significant role in the prevalence of cervical cancer among HIV-positive women. Lower income levels limit access to healthcare services, including cervical cancer screening and treatment [7]. Financial barriers can delay diagnosis and treatment, leading to worse outcomes. Educational level is directly linked to health literacy and awareness about cervical cancer. Women with higher education levels are more likely to participate in screening programs and adhere to medical advice [16]. Urban-rural disparities significantly affect healthcare access. Globally, cervical cancer (CC) incidence is higher in rural areas than in urban areas that could be explained by the influence of many factors, including inequity in accessibility of the CC prevention measures [28]. Due to the hardship Nigerian citizens face, most females, both young and old resort to having sex in exchange for money in a bid to make ends meet. This involves both having sex early and having multiple sexual partners. The main risk factors correlated with HPV infection are early sexual debut, the number of partners, frequency and type of sexual contact and partner's sexual histories [23]. Early sexual debut increases the risk of HPV infection and subsequent cervical cancer due to prolonged exposure to HPV [26]. Nigerian government has a huge role to play in combating cervical cancer among women living with HIV. They need to build more accessible and well-equipped hospitals, especially in rural

communities and finally, subsidize or better still, make health care free. Cervical cancer screening in a few available hospitals is expensive and most people that are susceptible, especially in this vulnerable group cannot afford it. In a bid to preventive care, there are educational and economic barriers that limit this people access to health care. Geographic and financial barriers limit access to healthcare services. Moreover, many rural areas around the globe face a lack of medical and social facilities and this limits the possibility of obtaining sound advice and guidance [28]. A lack of awareness about cervical cancer and the importance of regular screening is a critical barrier. Many women do not receive adequate health education to understand the need for screening, especially in the context of HIV [16]. Healthcare systems in resource-limited settings face challenges like lack of financial resources, lack of training for healthcare professionals, and a lack of supply of essential consumables and equipment which can affect implementation of cervical cancer screening. HIV-positive women often face stigma and discrimination particularly in low- and middle-income countries like Nigeria, which can deter them from seeking medical care, including cervical cancer screening. Stigma in health facilities undermines diagnosis, treatment, and successful health outcomes. Addressing stigma is fundamental to delivering quality healthcare and achieving optimal health [18]. These women can be supported in various ways in a bid to assist them in managing both HIV and cervical cancer. Emotional support from family, friends, and support groups can alleviate stress, anxiety, and depression, which are common among women living with HIV and cervical cancer. Emotional well-being is crucial for maintaining adherence to treatment and regular medical check-ups. Access to accurate and relevant information about HIV and cervical cancer, including prevention, treatment options, and self-care practices, is vital. Informational support helps women make informed decisions about their health and encourages proactive health-seeking behaviours. Community-based education programs can disseminate information about the importance of regular screening and early detection of cervical cancer among HIV-positive women. These programs can demystify the diseases and reduce stigma associated with both conditions.

## Public Health Interventions and Policy Recommendations

These aim to enhance prevention, early detection, and treatment, thereby improving health outcomes for this vulnerable population. Capacity building to train healthcare providers on cervical cancer screening techniques, HPV vaccination, and the importance of integrated care for HIV-positive women. Implement quality assurance programs and measures to ensure high standards in screening and diagnostic services. Promote and provide free or subsidized HPV vaccines for girls and young women, including those living with HIV. Focus on increasing vaccination coverage in both urban and rural areas. Educate the community about the benefits of HPV vaccination and dispel myths and misconceptions. Establish policies that mandate regular cervical cancer screening for all HIV-positive women as part of their routine HIV care. Implement national policies to provide free or low-cost HPV vaccination for all eligible girls and women. Advocate for increased government and donor funding for cervical cancer prevention, screening, and treatment programs. Ensure equitable distribution of resources to urban and rural areas to bridge the gap in healthcare access.

## Screening and Early Detection

It is important to regularly do cervical screening for HIV-positive women. Early detection is key to the management and treatment of cervical cancer. This is achieved by regular screening especially for this population that are already at risk of having cervical

cancer. As indicated by [25], to reduce new cases of cervical cancer, screening is key to help discover lesions that are likely to develop into cancers.

### Integration of Cervical Cancer Screening into HIV Care Programs and Vaccination

Implementing these guidelines in Nigeria poses challenges due to limited resources and healthcare infrastructure. However, some nongovernmental organizations operating in some Nigerian hospitals and working together with the Nigerian government have succeeded in integration of free, regular, yearly cervical cancer screening using VIA (visual inspection with acetic acid) /VILI (visual inspection with Lugol's iodine) into the HIV program which is advantageously cheap and affordable. However, integrating cervical cancer screening into HIV care services can enhance access and adherence to screening recommendations [2]. Human Papillomavirus (HPV) vaccination is a critical preventive measure against cervical cancer. The vaccines target high-risk HPV types, particularly HPV 16 and 18, which are responsible for the majority of cervical cancer cases. HPV vaccines, such as Gardasil and Cervarix, have been shown to be highly effective in preventing infections with HPV types 16 and 18. Clinical trials have demonstrated that these vaccines can reduce the incidence of cervical intraepithelial neoplasia (CIN) grades 2 and 3, which are precursors to cervical cancer [21]. Strategies can be put in place to increase vaccine uptake among HIV-positive populations. Policies that advocate and ensure that HPV vaccination can be included in national immunization programs. Fundings can be secured from government and international donors to support HPV vaccination programs. Resources can also be allocated to train healthcare providers, purchase vaccines, and run vaccination campaigns. Finally, encourage healthcare providers to routinely recommend the HPV vaccine to their HIV-positive patients. A strong recommendation from a trusted healthcare provider can significantly increase vaccine uptake. There are holistic approaches to managing HIV and cervical cancer as a co-morbidity. They include implementing free, routine cervical cancer screening (Pap smears, VIA, or VILI) for all HIV-positive women as part of their standard HIV care protocol. Regular screening helps in early detection and treatment of precancerous lesions. Also, develop and deliver targeted educational programs in communities as well to raise awareness about the link between HIV and cervical cancer. These programs should inform women about the importance of regular screenings, HPV vaccination, and early treatment. Finally, improve healthcare facilities and train health personnels to provide both HIV and cervical cancer services under one roof. This includes equipping clinics with the necessary tools for screening and treatment of cervical cancer. In the process of community outreaches, use of community health workers and peer educators to reach women in rural and underserved areas is very important. These workers can provide information, encourage screening, and assist with navigating the healthcare system.

## Results

**Table 1**. Risk Factors Associated with Cervical Cancer

| Variables | Total | Cervical Cancer Outcome | | p-value |
|---|---|---|---|---|
| | | Negative | Positive | |
| | N = 245 | N = 234 | N = 11 | |
| **Age Category** | | | | 0.28 |
| 15 – 19 yrs | 45 (18.4%) | 45 (19.2%) | 0 (0.0%) | |
| 20 – 24 yrs | 20 (8.2%) | 19 (8.1%) | 1 (9.1%) | |
| 25 – 29 yrs | 28 (11.4%) | 25 (10.7%) | 3 (27.3%) | |

| | | | | |
|---|---|---|---|---|
| 30 – 34 yrs | 31 (12.7%) | 29(12.4%) | 2 (18.2%) | |
| 35 – 39 yrs | 49 (20.0%) | 48 (20.5%) | 1 (9.1%) | |
| 40 – 44 yrs | 45 (18.4%) | 42 (17.9%) | 3 (27.3%) | |
| 45 – 49 yrs | 27 (11.0%) | 26 (11.1%) | 1 (9.1%) | |
| **Gender** | | | | |
| Female | 245 (100.0%) | 234 (100.0%) | 11 (100.0%) | |
| **Employment Status** | | | | 0.047 |
| Self Employed | 41 (16.7%) | 41 (17.5%) | 0 (0.0%) | |
| Employed | 44 (18.0%) | 44 (18.8%) | 0 (0.0%) | |
| Not Employed | 160 (65.3%) | 149 (63.7%) | 11 (100.0%) | |
| **Religion** | | | | <0.001 |
| Christian | 155 (63.3%) | 155 (62.2%) | 0 (0.0%) | |
| Muslim | 90 (36.7%) | 79 (33.8%) | 11 (100.0%) | |
| **What is your average monthly income?** | | | | 0.003 |
| Not earning | 110 (45.1%) | 99 (42.5%) | 11 (100.0%) | |
| #1,000 - #10,000 | 73 (29.9%) | 73 (31.3%) | 0 (0.0%) | |
| #11,000 - #20,000 | 13 (5.3%) | 13 (5.6%) | 0 (0.0%) | |
| #21,000+ | 48 (19.7%) | 48 (20.6%) | 0 (0.0%) | |
| **Type of Residence** | | | | 0.02 |
| Rural | 167 (68.2%) | 156 (66.7%) | 11 (100.0%) | |
| Urban | 78 (31.8%) | 78 (33.3%) | 0 (0.0%) | |
| **What is your family size** | | | | <0.001 |
| No birth | 56 (22.9%) | 56 (23.9%) | 0 (0.0%) | |
| 1 - 4 | 30 (12.2%) | 30 (12.8%) | 0 (0.0%) | |
| 5 - 9 | 127 (51.8%) | 122 (52.1%) | 5 (45.5%) | |
| 10+ | 32 (13.1%) | 26 (11.1%) | 6 (54.5%) | |
| **Marital Status** | | | | 0.016 |
| Single | 82 (33.5%) | 82 (35.0%) | 0 (0.0%) | |
| Married | 163 (65.5%) | 152 (65.0%) | 11 (100.0%) | |
| **What is your highest level of Education?** | | | | <0.001 |
| No formal education | 67 (27.3%) | 58 (24.8%) | 9 (81.8%) | |
| Primary | 101 (41.2%) | 99 (42.3%) | 2 (18.2%) | |
| Secondary | 39 (15.9%) | 39 (16.7%) | 0 (0.0%) | |

| | | | | |
|---|---|---|---|---|
| Tertiary | 38 (15.5%) | 38 (16.2%) | 0 (0.0%) | |

**Table 2**. ART Status

| ART Status | Number | Percentage |
|---|---|---|
| Positive | 294 | 100% |
| Negative | 0 | 0% |

**Table 3**. Results of Last Viral Load

| Latest Viral load | Number (294) | Percentage |
|---|---|---|
| Suppressed (<1000copies/ml) | 181 | 62% |
| Unsuppressed (>1000copies/ml) | 113 | 38% |

**Table 4**. Duration of HIV Infection

| Duration of HIV infection | Number (294) | Percentage |
|---|---|---|
| <1year | 31 | 11% |
| 1 -4 years | 40 | 14% |
| 5 – 9 years | 80 | 27% |
| 10 years and above | 143 | 49% |

## Discussion

Table 1 above shows the distribution of cervical cancer cases across different age groups indicates that women aged 25-29 and 40-44 years have the highest percentages of positive cases (27.3%). This suggests that women in these age categories are at a higher risk, potentially due to longer exposure to risk factors such as HPV and the cumulative effects of immunosuppression caused by HIV. Unemployment is significantly associated with cervical cancer positivity, as all positive cases were among those who are not employed. This indicates that economic insecurity and lack of employment are critical risk factors, possibly due to reduced access to healthcare services, including regular screenings and timely treatments. Other factors, including poor health care infrastructure, lack of resources and competing needs for limited health care resources, also mitigate against widespread adoption of cervical cancer screening in low resource countries [20]. All positive cases were among Muslim women, highlighting a significant association between religious affiliation and cervical cancer prevalence. This may be attributed to cultural or religious barriers that affect health-seeking behaviour, awareness, and access to preventive healthcare services. Income level is a significant risk factor, with all positive cases being among women with no earnings. This underscores the role of economic status in accessing healthcare services, including cervical cancer screenings. Women with no income are less likely to afford medical services, contributing to delayed diagnosis and treatment. All positive cases were from rural areas, highlighting the disparity in healthcare access between rural and urban settings. Rural areas often lack adequate healthcare infrastructure, trained personnel, and necessary medical supplies, making it challenging for women to receive regular screenings and timely treatment. Studies carried out by [28] says that women in rural areas are least likely to get cervical cancer screenings due

to a lack of awareness about its risks. Socioeconomic deprivation, inadequate hygiene, poor sanitation, early marriages, and multiple pregnancies increase their susceptibility to cervical cancer. Additionally, the lack of medical and social facilities in these areas limit access to proper advice and guidance. High parity is a significant risk factor, with positive cases predominantly among women with large families (5-9 and 10+ children). Frequent childbirth can cause cervical trauma, increasing the risk of cervical cell changes and cancer development. The economic burden of large families may also limit resources for healthcare. All positive cases were among married women, suggesting that marital status, which often correlates with increased sexual activity and higher parity, is a significant risk factor. Married women may also face cultural expectations that prioritize family size over health screenings. Lack of formal education is strongly associated with positive cervical cancer cases. Women with no formal education constitute 81.8% of positive cases, highlighting the critical role of education in health awareness and access to preventive services. Low education levels and low financial status are among the two significant social risk factors of cervical malignancy as it leads to poor access to disease screening services and resistance against screening visits [19]. Educated women are more likely to understand the importance of regular health check-ups and screenings. An important indicator of risk factors for cervical cancer, sexual behaviour, was dropped as a question because information was difficult to extract from these respondents in the questionnaire as they were finding it shy to answer the question of how many sexual partners they have, if or not they are wayward and so on. Most respondents claimed they had no sexual partners both single and married while some refused to answer even after confidentiality and secrecy were assured. The tables (2, 3, 4) and data presented above provide a detailed overview of the ART status, results of last viral load, and duration of HIV infection among the study population of HIV-positive females living in Abuja. This information is crucial for understanding the prevalence and associated risk factors of cervical cancer in this vulnerable group. All 294 participants are HIV-positive, indicating that the entire cohort is already compromised by the immunosuppressive nature of HIV. This universal positivity underscores the importance of monitoring and managing cervical cancer risks in HIV-positive populations, as HIV infection itself is a significant risk factor for persistent HPV infection and subsequent cervical cancer development. Viral load is a critical indicator of the effectiveness of ART and the overall immune status of HIV-positive individuals. In this cohort, 62% have a suppressed viral load, which is encouraging as it suggests effective ART management for the majority. Suppression of the viral load reduces the immunosuppressive impact of HIV, potentially lowering the risk of persistent HPV infection and cervical cancer. 38% have an unsuppressed viral load, indicating poor ART adherence or resistance. This group is at a higher risk for cervical cancer due to ongoing immunosuppression, which facilitates persistent HPV infections and the progression to cervical cancer. The duration of HIV infection is a significant factor in the risk of developing cervical cancer: 49% of the participants have been living with HIV for 10 years or more. Prolonged HIV infection leads to chronic immunosuppression, increasing the likelihood of persistent HPV infections and the development of cervical cancer. As heterosexual transmission is a key pathway for HIV spread in Sub Saharan Africa, younger women were diagnosed with HIV, setting them at increased risk for cervical cancer, particularly as the number of years of immunosuppression lengthened [8]. 27% have been infected for 5-9 years. This group also faces substantial risks as they have been living with compromised immunity for an extended period. 14% have

been infected for 1-4 years, and 11% for less than a year. While these groups are relatively newer infections, they still face significant risks, especially if ART adherence is poor or if they have other co-morbid conditions.

## Conclusion

This paper has highlighted the multifaceted nature of cervical cancer risk among women living with HIV/AIDS in Abuja. By addressing these risk factors and improving access to preventive care, enhancing screening programs, and fostering supportive policies, it is possible to reduce the burden of cervical cancer in this vulnerable population.


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## Conflict of Interest

We, the authors declare that we do not have any conflict of interest.

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# Rare Encounter of Intramuscular Solitary Cysticercosis of Extremity

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***Abstract***

*The patient was diagnosed with cysticercosis which is caused by a larval form of the tapeworm Taenia Solium, or cysticercus. This case presented with solitary muscular involvement without any neurological or systemic symptoms. Typically diagnosed via histopathology or MRI, this was identified using CT scanning. Treatment involved successful surgical excision followed by traditional medications such as anthelmintics and steroids.*

***Keywords****: Albendazole, Cysticercosis, Solitary Intramuscular, Taenia Solium.*

## Introduction

### Life cycle of Taenia

Movement of emigration of population is the root cause of spread of Taenia Solium worldwide. Cysticercosis affects low to middle-income countries like Asia and Africa (e.g, China, India, Nepal) [1, 2, 3].

1. The parasite needs two hosts for its life cycle to be completed.
2. Definitive host being the man, and intermediate host pig, but man occasionally being an intermediate host [4].
3. Adult worms reside in the small intestine of humans and gravid segments come out with faeces.
4. The eggs are ingested by the pig.
5. After reaching the duodenum, eggs rupture with release of oncospheres.
6. They use their hooklets to rupture the intestinal wall and enter portal vessel and mesenteric lymph system once inside the general circulation they reach the left side of the heart via liver, Right side of heart through lungs.
7. They are separated in muscles within 7 weeks to 9 weeks and develop into bladder worms also known as cysticercus.
8. The body of mature cysticercus has scolex, 2 sets of suckers and rostellum with two limbs of large and small hooklets.
9. Humans get infected by eating fully or partially cooked pork containing enclosed larva [5].
10. The larvae come out in the small bowel attaches to the inner surface of intestine with suckers to form full grown.
11. Segments pass out in faeces as chains of five to six and the cycle is repeated.
12. Cysticercus also develops in humans by ingesting eggs which are contaminated by water and food.
13. Poor sanitation which causes faecal contamination being a major factor in transmission.
14. A Human having mature worms can self-infect himself by unclean personal habits or by overturning peristalsis in the intestine. After that the segments are moved into the stomach which is equal to consuming 1000 eggs. In humans the formation of cysticercus is very similar to that in pigs.
15. Human cysticercosis is caused by ingesting T.solium eggs which is shed in the faeces of a human cystode (e.g. infected food ) and therefore occurs in population that don't eat pork or share the same space

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with animals like pigs where a carrier is active.

## Case Report

1. A 29-year-old male is an engineer by profession with non-vegetarian dietary habits. He complained of pain and swelling for two months on the posterior medial side of left leg.
2. Swelling was initially smaller and slowly increasing in size. With a vague dull aching type of pain which persisted throughout the day. Pain was more on walking.
3. On Examination- There was no swelling in that area but there was localized pain on the posteromedial side of the left leg. The skin over the swelling was normal.
4. On deep palpation a 2 cm X 2 cm soft or firm in consistency circular, swelling which was non pulsating and with ill-defined margins and was non-adherent to the surrounding skin [Figure 1].
5. General physical examination of patients was normal with a slight increase in eosinophil count on hemogram.



**Figure 1**. Pre-operative picture of posterior aspect of left leg swelling (black arrow)



**Figure 2**. Intra-Operative picture showing cyst intraoperative. (Black Arrow)



**Figure 3.** Post-operative picture after closure of skin



**Figure 4**. Specimen picture post excision

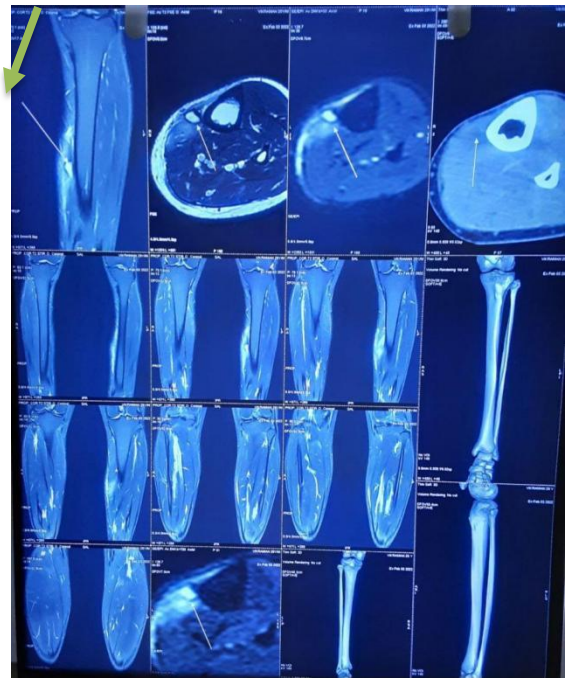

**Figure 5**. CT Axial plane [Green arrow] showing intramuscular cysticercus

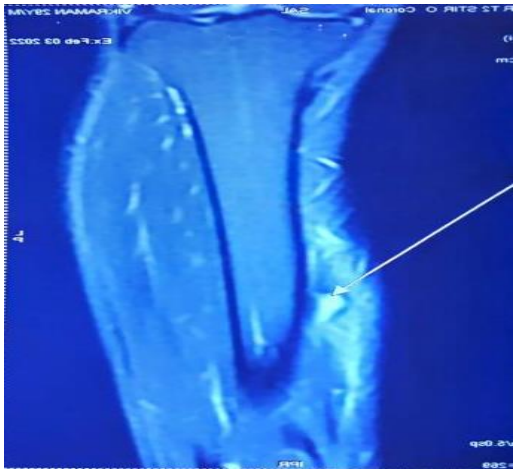

**Figure 6**. CT Coronal plane [white arrow] showing cysticercus

CT scan was done- Well Defined thin walled cystic lesion with surrounding edema visualized in the posteromedial aspect of middle 3rd of left leg probably involving the flexor digitorum longus muscle suspicious isodense mural nodules within the cystic lesion Cysticercosis [Figure 5; Figure 6].

Patient was taken for Excision and biopsy where a linear incision was made and deepened, swelling was identified [Figure 2] and removed totally [Figure 4] and sent for Histopathology after achieving perfect hemostasis skin was closed using 2-0 Ethylon and sterile dressing was done [Figure 3]. Histopathology showed cysticercosis.

Medical treatment with Praziquantel or Albendazole which are Anti-helminthic was also given [6].

## Discussion

It has been noted that muscular cysticercosis is asymptomatic, but the patient came in complaining of pain. Intramuscular surgery with only one cyst is very rare. A diagnosis has to be made to rule out conditions like:

1. Lipoma (round or oval shaped lump of tissue fat that grows beneath the skin) [7].
2. Neurofibromas (consisting of overgrowth of the nerve tissue along the blood vessels and other types of cells and also fibres).
3. Epidermoid cyst (also called sebaceous cysts which are encapsulated sub-epidermal nodules that are filled with keratin)
4. Polymyositis (It's a type of inflammatory myopathy in which a group of muscles are characterized by chronic muscle inflammation and also weakness) [8].
5. Tubercular lymphadenitis results from the reactivation of tuberculosis at a site where the infection was initially spread through the bloodstream during primary tuberculosis infection.

There was no history of cough, fever, or TB in the patient or among his family members.

There are three different types of muscular cysticercosis that includes:

1. Myalgic or myopathic type
2. Nodular or mass like
3. Pseudohypertrophic type [6].

Blood tests are not useful for diagnosing cysticercosis, as the complete blood count typically shows normal results with an increase in eosinophil count. Ultrasonography can reveal the presence of an eccentric echogenic scolex within the cysticercus. Plain radiographs rarely indicate cysticercosis unless the cysticerci has undergone degeneration and calcification. MRI is effective in detecting live cysts.

## Conclusion

The significance of this report lies in ensuring accurate diagnosis for patient welfare, and also optimizing the time and public

expenditure, preventing errors, and implementing suitable treatment strategies for the benefit of the patients.

## Conflict of Interest

There is no conflict of interest.


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We also Thank our patient cooperating with us and sincerely following The treatment protocol.


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# Survival After Recurrent Cardiac Arrest and Prolonged Hours of Resuscitation: A Case Report

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***Abstract***

*The maximum duration of cardiopulmonary resuscitation remains unknown. Hyperkalemia, hypokalemia, hypovolemia, acidosis, hypoxia, hypothermia, thrombosis-coronary and pulmonary, cardiac tamponade, toxins, and tension pneumothorax are the reversible causes of cardiac arrest. We report a case of successful prolonged resuscitation for cardiac arrest due to severe hyperkalemia and severe metabolic acidosis in a patient with diabetic ketoacidosis. Our patient is unique in that he had multiple long-standing comorbidities in prolonged cardiac arrest with multiple reversible causes, such as hyperkaliemia and severe metabolic acidosis, and was successfully resuscitated. Patients who undergo prolonged CPR can survive with good outcomes. Young age, myocardial infarction, and potentially reversible causes of cardiac arrest such as hypothermia and pulmonary emboli predict favorable results, especially when the arrest is witnessed, followed by prompt and good resuscitative efforts.*

***Keywords:*** *Acidosis, CPR, Cardiac arrest, ECHO, Hyperkalemia.*

## Introduction

Sudden cardiac arrest (SCA) is the leading worldwide cause of death [1]. It is estimated that annually about 7-lakh SCA cases occur annually in India. Cardiopulmonary resuscitation (CPR) is associated with a high mortality rate and poor neurological recovery. Cardiopulmonary resuscitation can cause ischemia–reperfusion injury to the whole body and brain. CPR with standard techniques after CA (Cardiac Arrest ) restores normal cerebral and myocardial function, provided that it occurs within the first 3 to 5 minutes after circulatory standstill. Attempts to start CPR after 10 minutes of CA will result in mortality rates greater than 70%. Although successful resuscitation is possible in 20–40% of patients, hospital discharge after initial successful resuscitation is only approximately 10%.

Another 25–40% of patients experience an unwitnessed arrest with prolonged periods of Cardiac Arrest only approximately 1–2% of patients can be discharged from the hospital [2]. Time is a critical factor in determining patient outcomes after CPR, as long as normal blood is restored under normal conditions. In general, outcomes after cardiac arrest remain poor, especially inpatients with risk factors such as unwitnessed arrest, unfavorable initial rhythm, older age and prolonged resuscitation without return of spontaneous circulation (ROSC) [3,4]. Guidelines therefore exist for terminating resuscitative efforts in cases of cardiac arrest that are deemed futile [5]. Nonetheless, successful resuscitation and good recovery after recurrent arrest have been documented [6]. As the field of cardiopulmonary resuscitative medicine evolves, new techniques are being implemented to improve outcomes in patients with cardiac arrest [7]. We present a case of how recent research findings in resuscitative medicine improved a patient's chances of survival.

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## Case Report

A 51-year-old Chinese male patient was brought by paramedics from the airport to the emergency department with ongoing CPR, intubated, and connected to a ventilator in an ambulance. He was seizing & unresponsive and had an episode of seizures on the way to the hospital. He was shifted to bed with ongoing CPR. He was diagnosed with end-stage kidney disease leading to hypertension at the age of 41 years and was on a 2-weekly hemodialysis (HD) regimen, but skipped dialysis for 2 weeks prior to the incident. He had hyperthyroidism and was administered carbimazole three times daily. No relevant family history was observed. As soon as the patient arrived, blood samples were collected for routine investigations. He had a history of triple vessel disease diagnosed 2 weeks prior, had undergone CAG, and was later advised to undergo CABG; however, the patient refused.

The patient's vital signs were as follows: pulse rate, 81 beats/min; respiratory rate: 20 breaths/min, blood pressure 148/79 mmHg , temperature: 97.5 °F, SpO 2 : 100%. On arrival to the hospital, his creatine level were 26, Potassium 8 mmol/L , HCO 3 was 10 mEq/L and taken for respectively. There was no gag or cough reflexes , and CT Brain sowed calcified focus in the left centrum semiovale with no perifocal edema, possibly representing a calcified granuloma.

CPR was administered as per AHA Guidelines with multiple shocks more than 100 times (50 in the ICU within 3 h of arrival to the emergency department and countless shocks from the airport to arrival and many times thereafter). Transthoracic Echocardiography revealed a left ventricular ejection fraction (LVEF) of approximately 30% beats that was moderately impaired, abnormal, or reduced, and it was difficult to assess the view of frequent extra. Septal hypokinesia with moderate mitral valve regurgitation (MR), right ventricular dilation, and absence of pericardial effusion were noted.

His Blood Gas Analysis (ABG ) showed acidosis with hyperkalemia (8 mmol/L); hence, the reversible causes of cardiac arrest, such as severe metabolic and lactic acidosis and hyperkalemia with a creatinine level of 26, were considered and treated after carefully excluding others with Sodium Bicarbonate, IV Calcium and Insulin dextrose intravenous. After the ROSC (Return of Spontaneous Circulation), patient who was ventilator sedated with Continuous infusions of Inj.Fentanyl (50µg/mL) and midazolam (Versed) (1-15 mg/hr) to keep the Ramsay score of 5-6. Inj.Norepinephrine (Levophed) at 0.01-1µg/kg/min to keep the MAP more than 65 mmHg , sodium bicarbonate at 50 mEq/h, and 0.9% sodium chloride at 40 mL/h were administered. He had a normal sinus rhythm (NSR) with a central pulse. Insulin dextrose, calcium (30mL) and daily dialysis were initiated. Started with piperacillin/tazobactam (Tazocin) 2.25 gm 3 times a day. He had multiple episodes of unstable ventricular tachycardia (VT) and about 14 VT shocks were administered. In view of the history of triple-vessel disease, patients were advised to continue aspirin (75 mg) unless any contraindication was present.

On the 2nd day of his hospital stay, the patient complained of chest pain, ECG was performed, and ischemic changes were observed, as previously seen on ECG. Cardiac markers and troponin levels were also analyzed. The patient was maintained on oral renal diet. On the 5 th day of the patient's hospital stay, coronary angiography was performed, which showed critical stenosis of the proximal left anterior descending coronary artery, involving the origin of the first diagonal artery (bifurcation lesion), chronic total occlusion of the ostium of the small first obtuse marginal coronary artery, critical stenosis of the ostium of the ramus intermedius coronary artery, and chronic total occlusion of the proximal right coronary artery.

On 6th day of the patient's hospital stay, his ECHO report showed mildly dilated LV cavity dimensions with markedly impaired left ventricular (LV) systolic function. An ejection fraction (EF) of 30-35% with prominent trabeculations was seen in the apex, normal LV mass indexed to body surface area was 101 gms/m2, and Grade I and LV diastolic dysfunction was observed. The left atrial (LA) size and right ventricular (RV) cavity dimensions were normal with normal RV systolic function, mild MR, sclerotic aortic valve with trace aortic regurgitation (AR), inadequate tricuspid regurgitation (TR) to calculate pulmonary arterial (PA) pressure, intact with no evidence of a shunt on Doppler studies, no clot, no vegetation, and normal aortic arch. The patient was advised to undergo CABG but refused to say that he wanted to do it in his home country and was discharged from the hospital on day 8, when he was ambulatory.

## Discussion

Prolonged cardiac arrest is associated with poor outcome. A systematic and effective team approach in performing CPR and early recognition and treatment of reversible causes of cardiac arrest is vital in achieving the best outcome in the event of cardiac arrest [8]. Unwitnessed, out of hospital cardiac arrests with non-shockable cardiac rhythm (Asystole and PEA) has the worst out come when compared to the witnessed, in the hospital cardiac arrests with shockable rhythm (VF and pulseless VT).

In our reported case, the patient survived resuscitation for as long as 1:30 hours. We recently found a few published reports of survival after prolonged resuscitation for cardiac arrest. A59-year-old male patient who was at bed rest for several days due to trauma, which resulted in femoral and rib fractures and a lung contusion. The patient was scheduled for femoral fracture reduction and internal fixation under general anesthesia. After disinfection and surgical towel laying, there was a sudden occurrence of severe PE and cardiac arrest; the patient was successfully resuscitated [9].

A 49-year-old male who suffered from myocardial infarction with subsequent cardiac arrest. The emergency medical team began cardiopulmonary resuscitation, including defibrillation of the ventricle. Although a return of spontaneous circulation was achieved after approximately 30 min of continued effort, the patient went back into cardiac arrest on the way to the hospital, and resuscitation had to be resumed. The patient survived with good neurologic outcome with myocardial infarction, cardiac arrest, and pH of under 6.7 on admission at the clinic [10]. In Okamoto case series observed that in case 1, a 58-year-old man presented with cardiac arrest and ventricular fibrillation (VF). Gasping was observed when the patient arrived at hospital. Extracorporeal cardiopulmonary resuscitation (ECPR) was initiated 82 minutes after cardiac arrest. Therefore, the patient was diagnosed with hypertrophic cardiomyopathy. Extracorporeal membrane oxygenation (ECMO) was discontinued on day 4, and the patient was discharged without neurological impairment [11]. In Case 2, a 49-year-old man experienced cardiac arrest with VF, and his gasping was preserved during transportation. On arrival, VF persisted, and gasping was observed; therefore, ECMO was initiated 93 min after cardiac arrest. The patient was diagnosed with acute myocardial infarction. ECMO was withdrawn on day 4 and he was discharged from the hospital without any neurological impairment [12].

As the field of cardiopulmonary resuscitative medicine develops, new techniques have been implemented to improve survival outcomes in patients with cardiac arrest [13]. The following are some of the techniques that we believe contributed to our patients successful outcomes. All rescuers, whether trained or not, should administer chest compressions to victims of cardiac arrest. High-quality compression involves pushing hard to a depth

of at least 2 in (5 cm) at a rate of at least 100 compressions/min, allowing full chest recoil after each compression and minimizing the interruption of the process. In addition, trained rescuers should provide ventilation at a compression–ventilation ratio of 30:2. Compression should resume immediately after defibrillation, without pauses, to analyze rhythm. Evidence suggests that minimizing pauses during CPR improves the chance of recovery from shock.

Multiple case reports have described successful resuscitation when thrombolytic agents are used after other interventions fail. The rationale behind this therapy is the high prevalence of cardiopulmonary arrest triggered by pulmonary embolism or acute coronary syndrome [14, 15]. Early prospective controlled trials associated this technique with low complication rates. However, subsequent larger trials have revealed no such benefit. As a result, the current American Heart Association guidelines report no convincing evidence that routine use of thrombolytic agents during resuscitation improves survival rates.

A meta-analysis associated out-of-hospital cardiac arrest with survival rates of 24% for the time of hospital admission and 8% for hospital discharge [16,17]. Higher survival rates were associated with daytime cardiac arrest, younger age, shorter CPR duration, primary cardiac disease as the cause, cardiac monitoring, no intubation requirement, favorable initial rhythm, and witnessed arrest. Sex differences were not significantly associated with mortality rates.

The survival rates after cardiac arrest remain low. However, despite poor overall outcomes, case reports of successful resuscitation after prolonged cardiac arrest provide hope for improved overall outcomes (18). Several factors contributed to our patient's recovery, and the obvious preservation of his neurological function throughout the arrest period was pivotal in our decision to continue resuscitative efforts and pursue advanced cardiopulmonary support (19,20).Our case is different from previously described cases of prolonged cardiac arrest, and the hope for patient survivability without substantial morbidity should be tempered with realistic expectations on an individual-patient basis. We submit our case report as an example of how advances in resuscitative medicine can be used to promote survival in an appropriate setting.

## Conclusion

The efficiency of resuscitation depends largely on the time elapsed between the point of cardiac arrest and return of spontaneous circulation, and the quality of post-resuscitation care. New technologies promise to improve the resuscitation process: mechanical devices standardize chest compressions, capnography guides resuscitation efforts and signals the return of spontaneous circulation, and intraosseous devices minimize interruptions to gain vascular access. This reinforces the need for training and certification of all healthcare workers, ranging from paramedics and nursing to doctors on basic and advanced life support, and periodic retraining. Hospitals should be equipped with a dedicated rapid response team to attend to cardiac arrests, prearranged equipment such as airway equipment, emergency drugs, and provisions for quick and accurate laboratory services to avoid any delay in commencing and delivering effective cardiopulmonary resuscitation.

## Conflict of Interest

None.


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# Investigating the Use and Sustainable Adoption of Digital Health Tools for Public Health Emergencies in Primary Healthcare Centres in Northern Nigeria

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***Abstract***

*There is a dearth of information on factors affecting the use and sustainable adoption of digital health tools by primary healthcare workers. Improved digital health frameworks require more field evidence. We assessed factors affecting the use and sustainable adoption of the digital health tools in primary healthcare centres in Northern Nigeria. A cross-sectional facility-based study was conducted among PHC staff in Abuja, Niger and Nasarawa States. Purposive and simple random sampling were used to collect data from healthcare practitioners using a pretested, semi-structured questionnaire. The study used a Chi-square test for bivariate analysis and Structural Equation Modeling (SEM) for complex relationships between variables. A p-value of less than 0.05 indicated statistical significance and a 95% confidence level. The results showed that age ($\chi^2 = 203.64$, $p < 0.001$), sex ($\chi^2 = 136.92$, $p < 0.001$), marital status ($\chi^2 = 44.64$, $p < 0.001$), education level ($\chi^2 = 8.37$, $p = 0.007$), rate of IT knowledge ($\chi^2 = 228.22$, $p < 0.001$), profession ($\chi^2 = 151.55$, $p < 0.001$), geographical location ($\chi^2 = 212.79$, $p < 0.001$) were factors that influenced adoption. There is a significant relationship between perceived usefulness, relative advantage, awareness, data security and the adoption of digital health tools ($\chi^2 = 39.57$, $p < 0.001$), ($\chi^2 = 123.55$, $p < 0.001$), ($\chi^2 = 102.29$, $p < 0.001$), ($\chi^2 = 48.26$, $p < 0.001$) respectively. This study found enabling and hindering elements affecting digital health systems. To promote use and sustainable adoption, all stakeholders must actively overcome challenges.*

***Keywords:*** *Adoption, Digital Health, Nigeria, Primary Healthcare.*

## Introduction

The 2030 United Nations Sustainable Development Goals (SDGs) agenda serves as a blueprint for attaining improved health for all, therefore indicating a more sustainable future for worldwide population [1]. Target 3.8 of SDG 3 states, "Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all" [2]. On the one hand, one way to make progress towards achieving universal health coverage (UHC) is through health systems strengthening and sustainable development, and this can be achieved through evidence informed decision-making via the use of innovative digital interventions in accordance with Target 3.9d of SDG 3 to "Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks" [1]. On the other hand, UHC contributes to the SDGs by promoting global public health security and it does so by increasing the comprehensiveness and resilience of health systems to respond to health threats that spread within as well as across national borders [3, 4, 5]. Currently, Africa has achieved only 5%–25% UHC coverage [6]. The WHO has developed a Global Strategy on

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Digital Health for the period 2020-2025, with the goal of promoting healthy living and wellbeing for everyone, everywhere, and at all ages [7].

Behind good health for every person is a health system reliant on information that is shared and used in a timely manner. The 75th World Health Assembly (WHA) has prioritized its drive towards UHC, and it has also renewed its commitment to strengthen the systems and tools for epidemic and pandemic preparedness and response at all levels [8]. Health information and service delivery systems facilitate the assessment and evaluation of health system performance and advancements towards UHC. Hence, it is imperative to enhance these two functions in order to attain universal health and optimize health outcomes. Employing contextual and data-driven evidence to bolster local health systems and advocate for policies that promote UHC is critical.

It is obvious that the health sector is becoming a fast-changing field with new technologies emerging with time. And the health workforce must be duly empowered in the digital health revolution which is fast becoming a norm and transforming the culture of traditional healthcare where disruptive innovation of any form of technology is causing radical changes in any existing public health system; coupled with the perceived reluctance of healthcare stakeholders in healthcare settings to change [9, 10].

The application of digital technologies to enhance health systems, health services, and health outcomes is referred to as digital health. It possesses the capacity to facilitate the achievement of universal health coverage, particularly in settings with limited resources [11]. Digital health is a dynamic domain within the health sector that has the potential to aid in achieving health objectives by providing timely, accurate, and comprehensive health information to inform decision-making and service provision.

Reference [12] conducted a scoping review which identified 983 digital health tools that have been implemented in sub-Saharan Africa to enhance health systems during the previous decade. However, the review also identified deficiencies in the region regarding investments in digital health, including coordination, integration, scalability, sustainability, and equitable distribution. Digital health interventions in Africa encounter several obstacles, including substandard infrastructure, insufficient digital literacy, inadequate policies and regulations, concerns regarding ethics and privacy, and a scarcity of evidence regarding their efficacy and cost-effectiveness [13].

Nevertheless, the implementation of digital health in Nigeria encounters numerous obstacles, including inadequate coordination of pilot initiatives, decrepit healthcare systems, insufficient awareness and understanding, substandard infrastructure, and non-compatibility [11, 12, 14]. To enhance healthcare services, the Federal government of Nigeria is working to enhance digital health technology applications. It is evident that Nigeria is currently grappling with fragmented digital health deployment endeavors. In order to effectively bridge this existing void, this research posits contextual, and practical strategies that delineates the intricate processes and factors influencing the use and sustainable adoption of digital health tools, especially in Northern Nigeria.

Primary Healthcare is the foundation of universal health coverage, and for Africa to achieve universal health coverage, it is crucial to introduce new and innovative approaches. Africa's grassroots use of digital health technologies is low, which hinders healthcare delivery. And access, quality, efficiency, and resilience of PHC in Africa, particularly for hard-to-reach populations and low-resource settings, could be enhanced through the use of digital health [15].

Given the above, understanding the landscapes, challenges, and barriers to digital

health use and adoption in primary care is critical. Yet, there is a dearth of data to assist evidence-based decision making about complete adoption of digital health services across the continent while taking into account country-specific factors [15]. So, primary healthcare providers across the continent must be assessed for their knowledge, abilities, attitude, practise, and preparedness to use digital health in service delivery. Despite the Northern region of Nigeria exhibiting favorable attitudes and perceptions towards digital health, health workers exhibited a pervasive lack of knowledge in this area [16].

In sub-Saharan Africa, digital health tools have not been widely adopted or implemented, according to a review of electronic health records (EHR) adoption in Africa [17].

Moreover, the community structure is mostly under tapped. Although communities are generally the focus of public health interventions, and they are rarely considered a valuable resource [18]. However, healthcare professionals voiced their concerns about not being sufficiently involved in the planning process of digital health interventions [19, 20]. We need to figure out how to do this, so that our programmes can more effectively involve potential users and reach the people who could benefit from them.

Large-scale, high-priority health care programmes need to be evaluated more thoroughly. It was at Alma-Ata that primary health care was established as a cornerstone tactic for enhancing people's health all over the world with greater understanding of the value of primary healthcare in international health and its potential to play an even larger role in enhancing population health [21], [22].

Yet, by of the end of 2021, it was estimated that almost 15 million people worldwide had died as a direct result of COVID-19. Several crucial health services were interrupted as global health systems were strained to their limits, creating serious health risks and damaging years of progress in the battle against other fatal diseases [23] The effective utilization and management of digital health epidemic tools is a vital public health skill to obtain and disseminate reliable, timely information [24]. To detect communicable diseases, we need a good surveillance system. If we don't detect these developing communicable diseases, we could have a huge outbreak and be unprepared to deal with its effects on the community [25].

Without a competent health care workforce, universal health coverage will not be realized, and without healthcare providers, health care systems would collapse. Inadequate skills are often cited as an impediment to effective ICT use by health and care workers, who continue to be at the forefront of epidemic or pandemic response [26], [27].

Health care delivery is being radically altered by a number of factors, including but not limited to globalization, deregulation, and technology advancement.

In instances where the efficacy of digital health systems has been demonstrated, the realization of their full potential in enhancing public health is contingent upon the willingness of individuals to embrace, place confidence in, and actively participate with these technological advancements [7]. Increased demands and issues with health resources may arise; hence, the system is designed to offer support to individuals through a universal coverage approach. This can be a serious issue in community settings. Northern Nigeria serves as an illustration of this, as internally displaced persons due to conflict and compromised security issues have high service needs but most of the nation's available health care services are heavily prioritized and competitive, especially at the community levels. It's immediately crucial that we gather data so that we can track the changing demands of people, and they will undoubtedly evolve as an emergency progresses. Nigeria may go forward by adopting and deploying a robust and custom-built digital health infrastructure that meets our

particular demands [28] also recounted that on November 20-30, 2019, Nigeria held a digital health capacity development workshop in Abuja-FCT, Nigeria and acros the country's six geo-political zones to examine these issues and provide solutions for the quick, sustainable, scalable, and cost-effective deployment of digital health in Nigeria. The digital health capacity building workshop provided a good platform to discuss stable and cost-effective digital health ideas that could scale to improve health service delivery in Nigeria. The workshop concluded that while digital health technologies might boost Nigerian health systems for UHC and the health SDGs, donor-driven pilot initiatives should then be replaced by resilient, sustainable, cost-effective, and nationally owned projects.

Too frequently, technical features of community-based digital interventions have received more attention than the approaches and support networks required to make them effective on-the-ground. It is obvious that new programmes and strategies are required in places where rates of public health emergencies and child mortality are still high, health systems are underdeveloped, and resources are scarce.

Epidemic, gross violations of human rights, economic instability, and war are just a few of the ever-evolving threats we face today. The threat posed by these factors fluctuates sporadically over time, and therefore, should be monitored in order to identify the tipping point when the risk becomes significant to trigger public health actions.

Primary healthcare professionals conveyed their concerns about not being sufficiently involved in the planning process coupled with the absence of a contextual and comprehensive national policy and plans for e-health, and down-sized implementation at the local levels, which also depends on the active participation of all stakeholders in the planning and implementation process [20]. In addition, there is a lack of information regarding the factors that influence the utilization and long-term adoption of digital health tools in primary healthcare settings in a sustainable manner, where they are intended to be utilized by healthcare professionals. Therefore, this research aimed at examining the factors that influence the utilization and sustainable adoption of digital health tools. It also aimed to provide practical suggestions for the effective and sustainable adoption of these tools in Nigeria. The research will contribute to the existing body of knowledge by identifying key areas where the findings can be beneficial to healthcare policymakers in Nigeria and other developing nations with similar settings. This can help individuals, and the government understand their areas of focus and weaknesses while planning for the use and sustainable adoption of digital health tools.

Ultimately, this will result in enhanced epidemic preparedness and response, at the zonal, State, LGA, PHC, and community levels settings.

This investigation is primary research that offers a more comprehensive understanding of the enablers and barriers to the utilization of digital health. This research can be highly beneficial in areas with weak health systems and high rates of child mortality, as earlier depicted in the Northern Nigeria setting.

Challenges, with respect to insecurity issues widespread in the Northcentral part of Nigeria affected on-the-ground logistics. For the purpose of gaining a more in-depth comprehension of the cultural and contextual factors that have an effect on the implementation and utilization of digital health tools, future research should aim to investigate the potential of qualitative research methods. This will allow for a more comprehensive understanding of the implementation and utilization of digital health tools in a variety of settings. Furthermore, the scope of our research was limited to Nigeria; consequently, its conclusions may not be applicable to other populations or sub-Saharan Africa.

## Materials and Methods

### Research Design

A cross-sectional facility-based study was conducted among PHC personnel drawn from Abuja (Federal Capital Territory), Niger and Nasarawa States. We utilized a multistage sampling technique, incorporating both purposive sampling and simple random sampling, in order to meticulously select a sample size that would aptly represent the entire population under study.

### Study Area

This study was conducted in three States, namely, Nasarawa, Niger, and FCT-Abuja of the Northcentral region of Nigeria. This region exhibits a high degree of volatility and is particularly vulnerable to incursions by non-state armed groups as well as the emergence of conflicts along sectarian lines [29]

### Study Population

The study's sample consisted of doctors/nurses, disease surveillance and notification officers (DSNOs), monitoring and evaluation Officers (M&EOs), record officers, community health extension workers (CHEWs), and community health workers (CHWs) within the State Primary Healthcare Development Agency (SPHCDA). These individuals are based within the jurisdiction of the SPHCDA located in the three States (Abuja-Federal Capital Territory, Niger, and Nasarawa) in the Northcentral region of Nigeria.

## Sampling Technique

**Stage 1:** One geopolitical zone (Northcentral) was purposively selected from the six geopolitical zones in Nigeria considering the level of security risks, particularly armed insurgency.

**Stage 2:** Three States, namely, Abuja, Niger and Nasarawa States were selected from the seven States in the Northcentral geopolitical zone through a simple random sampling by balloting.

**Stage 3:** Two local government areas (LGAs) per senatorial district in each of the chosen State with the highest number of accessible PHCs where digital health tools for public health emergencies have been deployed and implemented were randomly selected by balloting, with the number of PHCs per LGA as the sampling frame. This process was repeated until the required sample size was obtained from each LGA.

**Stage 4:** A purposive sampling was used to select accessible PHCs where digital health tools are implemented from the selected LGAs.

### Inclusion Criteria

Recruitment for the study was limited to healthcare professionals under the jurisdiction of the SPHCDA, who are 18 years and above and have given their consent to participate.

### Study Instruments

The collection of quantitative data was conducted using a pretested, semi-structured questionnaire. The questionnaire was adapted in accordance with prior research [20]. The questionnaire constituted socio-demographic characteristics and assessed the participants' proficiency and implementation of digital health.

### Theoretical Basis

The utilization of the Technology Acceptance Model (TAM) to forecast and elucidate end-user responses to health IT is among the most noteworthy [30].

The initial TAM constructs have undergone modifications and expansions through extensive research, involving the inclusion of additional variables. These variables can largely be categorized into two main groups: (1) perceived variables and (2) external variables [31].

These supplementary independent variables augment the predictive capability of the TAM. The theoretical model under consideration is a

straightforward flowchart that illustrates the correlation between several independent variables—perceived usefulness, attitude towards digital health, ease of use, awareness, risk, data security concerns, infrastructure, gender, age, experience, relative advantage, and critical success factors—and the dependent variable of intention to use and sustainably adopt e-health technology. The theoretical framework was the primary model for this investigation.

Perceived usefulness of digital health tools by healthcare workers, ease of use, relative advantage, awareness, risk, data security, infrastructure, critical success factors, staff IT experience, information sharing, and technical infrastructure were assessed.

## Data Collection Methods and Procedure

The study data were collected from July 2024 to August 2024. Ethical clearance was obtained from the National Health Research Ethics Committee of Nigeria (NHREC), with the NHREC approval number: NHREC/01/01/2007-28/06/2024. From each state, research assistants were recruited and provided with training on the data collection instrument following the translation of the questionnaire into ODK (Open Data Kit). For effective data collection, each research assistant was equipped with an Android device with the ODK installed. The digital health survey instrument was validated using Cronbach's alpha. In general, the Cronbach alpha value range of the e-value scale demonstrated a satisfactory validation estimate of 0.93. In addition, the Cronbach alpha value was within a comparable range when an item is deleted.

The instrument's reliability was determined by utilizing a subset of the sample size, specifically 10% of it, and the questionnaire was administered to a population that is similar to the sample population in another State. Necessary adjustments were made after the pre-test.

## Sample Size Determination

The sample size for the quantitative sample was calculated using the standard formula for estimating a single population proportion:

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}}\right)^2 P(1-P)}{d^2}.$$

$Z_{1-\frac{\alpha}{2}}$= Standard normal variate (at 5% type 1 error ($\hat{P}$<0.05) is 1.96)

P = Expected proportion in population based on previous studies implementing digital health=27.3% [32]

d = Absolute error or precision=0.05

$$n = \frac{(1.96)^2 0.273 \times (0.727)}{0.05^2} = 305.$$

$$n = 113\ per\ group.$$

Non-response rate: Individuals may decline to participate while they have been selected through random methods.

By accounting for a 10% non-response rate:

*Final sample size*=Effective sample size/1-NR anticipated

$$n = \frac{305}{0.9} = 339.$$

## Data Management and Analysis

### Dependent Variable

The dependent variable or outcome includes "intent to use digital health tools" and "intent to adopt digital health tools."

### Independent Variables

The independent variables include perceived usefulness, ease of use, awareness, risk, data security concerns, IT infrastructure, critical success factors, relative advantage, experience, age, and gender.

### Analysis Methods/Data Collection Tools

The data underwent a thorough examination to verify their comprehensiveness and identify any error, assigned specific codes, and then entered into Statistical Package for the Social Sciences (SPSS) version 25.0. Data analyses involved the utilization of both descriptive and

inferential statistical methods. A Chi-square test was employed for the bivariate analysis. Structural Equation Modeling (SEM), a multi-variate technique was used to estimate and test complex relationships between the dependent and independent variables, as well as to show how different variables influence each other.

In this research, statistical significance was determined by a p-value of less than 0.05, indicating a 95% confidence level.

## Ethical Considerations

Ethical clearance was obtained from the National Health Research Ethics Committee of Nigeria (NHREC) with the following approval number: NHREC/01/01/2007-28/06/2024. The study participants provided informed verbal and documented consents prior to the administration of the questionnaire. The objectives and significance of the study were effectively communicated to the participants. The information that was gathered was handled with the utmost confidentiality. In order to guarantee that the consenting participants had a comprehensive understanding of the research study's objectives, processes, and inquiries, all protocols utilized, including data collection procedures, were communicated to them in the language that was most easily comprehensible to them. Consequently, the questionnaire was composed in the English language, which is the language that is comprehensible to the participants of the study area. No individual names were recorded, and no publication or report resulting from this research will include any name or identifier. Code numbers were designated to all information gathered for this study.

## Results

**Table 1.** Descriptive Statistics of the Respondents' Characteristics

| Variable | Frequency | Percentage |
|---|---|---|
| Age | | |
| 21-30 | 57 | 18.4 |
| 31 – 40 | 105 | 34.0 |
| 41 – 50 | 101 | 32.7 |
| 51 Above | 46 | 14.9 |
| Sex | | |
| Male | 195 | 63.1 |
| Female | 114 | 36.9 |
| Marital Status | | |
| Single | 63 | 20.4 |
| Married | 243 | 78.6 |
| Separated/Divorced | 3 | 1.0 |
| Level Education | | |
| Primary/secondary | 4 | 1.3 |
| Tertiary | 305 | 98.7 |
| Rate of IT Knowledge | | |
| Fairly | 109 | 35.3 |
| Minimum | 120 | 38.8 |
| Maximum | 77 | 24.9 |
| None | 3 | 1.0 |
| Profession | | |
| Doctor/Nurse | 90 | 29.1 |
| CHEW/DSNO | 82 | 26.5 |

| | | |
|---|---|---|
| Record officers | 137 | 44.3 |
| PHC Location | | |
| Rural | 168 | 54.4 |
| Semi-Urban | 88 | 28.5 |
| Urban | 53 | 17.2 |

The majority of participants were aged between 31-40 years, totaling 105 (34.0%), and most health practitioners were male, accounting for 195 (63.1%). In addition, a significant number of participants were married, with 243 (78.6%), and 305 (98.7%) had attained at least tertiary education respectively. Furthermore, 109 (35.3%) demonstrated minimum knowledge of IT. Most PHCs were located in rural areas, with 168 (54.4%), and the majority of these health centers utilized one digital health tool.

In total, approximately 11 digital health tools have been utilized within the primary healthcare over the last five years. The primary tools utilized during this timeframe include: ODK 77 (24.9%), succeeded by OpenLMIS 70 (22.7%), then survey CTO 56 (18.1%), E-health card 34 (11.0%), NIPDS 29 (9.4%) and SORMAS 9 (2.9%). The tool that saw the least usage was RI SMS, accounting for only 0.6%.

**Table 2.** Socio-Demographic Factors that Influences The Adoption of Digital Health Tools

| Variable | Logistics & Supply Chain Management n (%) | Disease Surveillance & Response Systems n (%) | Data Collection & Health Information Management n (%) | Chi-square | p-value |
|---|---|---|---|---|---|
| Age | | | | | |
| 21-30 | 0 (0.0) | 9 (22.0) | 48 (25.5) | 203.64 | <0.001 |
| 31 – 40 | 10 (12.5) | 32 (78.0) | 63 (33.5) | | |
| 41 – 50 | 24 (30.0) | 0 (0.0) | 77 (41.0) | | |
| 51 Above | 46 (57.5) | 0 (0.0) | 0 (0.0) | | |
| Sex | | | | | |
| Male | 10 (12.5) | 41 (100.0) | 144 (76.6) | 136.92 | <0.001 |
| Female | 70 (87.5) | 0 (0.0) | 44 (23.4) | | |
| Marital Status | | | | | |
| Single | 0 (0.0) | 9 (22.0) | 54 (27.7) | 44.64 | <0.001 |
| Married | 77 (96.3) | 32 (78.0) | 134 (71.3) | | |
| Separated/Divorced | 3 (3.8) | 0 (0.0) | 0 (0.0) | | |
| Level of Education | | | | | |
| Primary/secondary | 4 (5.0) | 0 (0.0) | 0 (0.0) | 8.37 | 0.007 |
| Tertiary | 76 (95.0) | 41 (100.0) | 188 (100.0) | | |
| Rate of IT Knowledge | | | | | |
| None | 3 (3.8) | 0 (0.0) | 0 (0.0) | 228.22 | <0.001 |
| Fairly | 0 (0.0) | 11 (26.8) | 98 (52.1) | | |
| Minimum | 10 (12.5) | 30 (73.2) | 80 (42.6) | | |
| Maximum | 67 (83.8) | 0 (0.0) | 10 (5.3) | | |
| Profession | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Doctor/Nurse | 0 (0.0) | 9 (22.0) | 81 (43.1) | 151.55 | <0.001 |
| CHEW/DSNO | 10 (12.5) | 32 (78.0) | 40 (21.3) | | |
| Record officers | 70 (87.5) | 0 (0.0) | 67 (35.6) | | |
| PHC location | | | | | |
| Rural | 10 (12.5) | 41 (100.0) | 117 (62.2) | 212.79 | <0.001 |
| Semi-Urban | 17 (21.3) | 0 (0.0) | 71 (37.8) | | |
| Urban | 53 (66.3) | 0 (0.0) | 0 (0.0) | | |

Table 2 outlines the socio-demographic factors that affect the adoption of digital health tools, analyzed within three domains: Logistics & Supply Chain Management, Disease Surveillance & Response Systems, and Data Collection, analytics, visualization & use.

The analysis revealed a highly significant relationship between age and adoption across all three domains ($\chi^2 = 203.64$, $p < 0.001$). Within the Logistics & Supply Chain Management field, those aged 51 and older comprised the majority at 57.5%, whereas younger age groups, specifically those between 21 and 30, were not represented. Conversely, the Disease Surveillance & Response Systems saw a predominant adoption rate among respondents aged 31-40, reaching 78.0%. The tools for Data Collection & Health Information Management were mainly utilized by respondents in the 41-50 age range, accounting for 41.0% of users. The Disease Surveillance & Response Systems were entirely dominated by males (100.0%), who also constituted the majority of users in Data Collection & Health Information Management (76.6%).

In addition, sex had a significant effect on the adoption of digital health tools ($\chi^2 = 136.92$, $p < 0.001$). Individuals in marital relationships were the main users of all three systems, especially in Logistics & Supply Chain Management (96.3%) and Data Collection & Health Information Management (71.3%) ($\chi^2 = 44.64$, $p < 0.001$). The level of education emerged as a significant factor affecting adoption ($\chi^2 = 8.37$, $p = 0.007$). Those with tertiary education demonstrated nearly complete adoption in all areas, achieving 100% adoption in both Disease Surveillance & Response Systems and Data Collection & Health Information Management, along with 95.0% adoption in Logistics & Supply Chain Management. The respondents possessing the highest level of IT expertise were the primary adopters of Logistics & Supply Chain Management at 83.8%, whereas those with the least knowledge predominantly engaged in Disease surveillance and response, which was statistically significant ($\chi^2 = 228.22$, $p < 0.001$). The role of profession played a crucial part in influencing the adoption of digital health tools ($\chi^2 = 151.55$, $p < 0.001$). Record officers mainly utilized Logistics & Supply Chain Management (87.5%), whereas Disease Surveillance & Response Systems were chiefly adopted by CHEW/DSNO professionals (78.0%). Healthcare professionals showed a greater tendency towards utilizing Data Collection & Health Information Management (43.1%). Rural primary health centers were the leading implementers of Disease Surveillance & Response Systems (100.0%), whereas semi-urban regions showed a significant adoption of Data Collection & Health Information Management (37.8%). Urban centers showed a significant representation in the adoption of Logistics & Supply Chain Management, with a percentage of 66.3% and $p < 0.001$.

**Table 3.** Assessing the Relationship Between Responses From The Digital Health Survey and Digital Health Tools

| Variable | Logistics & Supply Chain Management n (%) | Disease Surveillance & Response Systems n (%) | Data Collection & Health Information Management n (%) | Chi-square | p-value |
|---|---|---|---|---|---|
| Perceived Usefulness | | | | | |
| Not useful | 13 (16.3) | 28 (68.3) | 98 (52.1) | 39.57 | <0.001 |
| Useful | 67 (83.8) | 13 (31.7) | 90 (47.9) | | |
| Ease of use | | | | | |
| Not easy | 12 (15.0) | 13 (31.7) | 98 (52.1) | 33.57 | <0.001 |
| Easy to use | 68 (85.0) | 28 (68.3) | 90 (47.9) | | |
| Relative Advantage | | | | | |
| Not advantageous | 41 (51.2) | 0 (0.0) | 0 (0.0) | 123.55 | <0.001 |
| Advantageous | 39 (48.8) | 41 (100.0) | 188 (100.0) | | |
| Awareness | | | | | |
| Not aware | 50 (62.5) | 5 (12.2) | 10 (5.3) | 102.29 | <0.001 |
| Aware | 30 (37.5) | 36 (87.8) | 178 (94.7) | | |
| Risk | | | | | |
| High risk | 0 (0.0) | 9 (22.0) | 55 (29.3) | 40.71 | <0.001 |
| Low risk | 80 (100.0) | 32 (78.0) | 133 (70.7) | | |
| Data Security | | | | | |
| No data security | 0 (0.0) | 9 (22.0) | 63 (33.5) | 48.26 | <0.001 |
| Data security is available. | 80 (100.0) | 32 (78.0) | 125 (66.5) | | |
| Infrastructure | | | | | |
| Poor infrastructure | 10 (12.5) | 14 (34.1) | 98 (52.1) | 40.61 | <0.001 |
| Good infrastructure | 70 (87.5) | 27 (65.9) | 90 (47.9) | | |
| Critical Success | | | | | |
| Not successful | 0 (0.0) | 9 (22.0) | 25 (13.3) | 20.48 | <0.001 |
| Successful | 80 (100.0) | 32 (78.0) | 163 (86.7) | | |
| Staff IT | | | | | |
| Low experience | 10 (12.5) | 14 (34.1) | 98 (52.1) | 40.61 | <0.001 |
| High experience | 70 (87.5) | 27 (65.9) | 90 (47.9) | | |
| Information Sharing | | | | | |
| Does not enhance information sharing | 50 (38.5) | 32 (78.0) | 48 (25.5) | 57.34 | <0.001 |
| Enhance information sharing | 30 (37.5) | 9 (22.0) | 140 (74.5) | | |
| Technical Infrastructure | | | | | |
| Not Available | 0 (0.0) | 9 (22.0) | 38 (20.2) | 27.42 | <0.001 |
| Available | 80 (100.0) | 32 (78.0) | 150 9.8) | | |

Table 3 shows the relationships between the digital health survey responses and the adoption of digital health tools.

There was a significant relationship between perceived usefulness and the adoption of digital health tools ($\chi^2 = 39.57$, $p < 0.001$). Most respondents found digital health tools useful for Logistics & Supply Chain Management (83.8%), but a smaller proportion (31.7%) their usefulness in Disease Surveillance & Response Systems. Also, awareness emerged as a significant factor ($\chi^2 = 102.29$, $p < 0.001$). A greater proportion of respondents were aware of the tools for Data Collection & Health Information Management (94.7%) compared to Logistics & Supply Chain Management (37.5%). In a similar vein, the perception of relative advantage strongly influenced adoption ($\chi^2 = 123.55$, $p < 0.001$). All respondents found digital health tools advantageous for Disease Surveillance & Response Systems (100%), while only 48.8% perceived them as advantageous for Logistics & Supply Chain Management. Moreover, the significance of data security was evident, and hence, considered an important factor ($\chi^2 = 48.26$, $p < 0.001$). All respondents reported data security was available for Logistics & Supply Chain Management (100%) in contrast to Disease Surveillance & Response Systems (78%).

**Table 4.** Association between the Digital Health Tools Domains and Adoption of Digital Health Tools

| Independent variables | Dependent variables Digital health tools in used | Estimate | p-value |
|---|---|---|---|
| Perceived Usefulness | Disease Surveillance & Response Systems | .032 | 0.012 |
| Perceived Usefulness | Data Collection & Health Information Management | -.054 | <0.001 |
| Perceived Usefulness | Logistics & Supply Chain Management | .021 | 0.005 |
| Ease of Use | Disease Surveillance & Response Systems | .199 | <0.001 |
| Ease of Use | Data Collection & Health Information Management | -.129 | <0.001 |
| Ease of Use | Logistics & Supply Chain Management | -.051 | <0.001 |
| Awareness | Disease Surveillance & Response Systems | .000 | 0.988 |
| Awareness | Data Collection & Health Information Management | .039 | 0.018 |
| Awareness | Logistics & Supply Chain Management | -.022 | <0.002 |
| Risk | Disease Surveillance & Response Systems | .184 | <0.001 |
| Risk | Data Collection & Health Information Management | -.151 | <0.001 |
| Risk | Logistics & Supply Chain Management | -.033 | <0.001 |
| Data security | Disease Surveillance & Response Systems | .347 | <0.001 |
| Data security | Data Collection & Health Information Management | .709 | <0.001 |
| Data security | Logistics & Supply Chain Management | -.690 | <0.001 |
| Relative Advantage | Disease Surveillance & Response Systems | .209 | <0.001 |
| Relative Advantage | Data Collection & Health Information Management | .000 | 0.977 |
| Relative Advantage | Logistics & Supply Chain Management | -.120 | <0.001 |
| Infrastructure | Disease Surveillance & Response Systems | -.694 | <0.001 |
| Infrastructure | Data Collection & Health Information Management | -.210 | <0.001 |
| Infrastructure | Logistics & Supply Chain Management | .550 | <0.001 |
| Critical Success | Disease Surveillance & Response Systems | -.070 | <0.001 |
| Critical Success | Data Collection & Health Information Management | -.108 | <0.001 |
| Critical Success | Logistics & Supply Chain Management | .107 | <0.001 |
| Staff IT Experience | Disease Surveillance & Response Systems | .370 | <0.001 |
| Staff IT Experience | Data Collection & Health Information Management | .402 | <0.001 |
| Staff IT Experience | Logistics & Supply Chain Management | -.226 | <0.001 |
| Information Sharing | Disease Surveillance & Response Systems | -.191 | <0.001 |

| | | | |
|---|---|---|---|
| Information Sharing | Data Collection & Health Information Management | .196 | <0.001 |
| Information Sharing | Logistics & Supply Chain Management | -.001 | 0.877 |
| Technical Infrastructure | Disease Surveillance & Response Systems | -.229 | <0.001 |
| Technical Infrastructure | Data Collection & Health Information Management | -.336 | <0.001 |
| Technical Infrastructure | Logistics & Supply Chain Management | .351 | <0.001 |

Table 4 presents the relationship between digital health tools and their usage across various domains of the digital health survey.

**Perceived Usefulness** was positively associated with Disease Surveillance & Response Systems (Estimate = 0.032, p = 0.012), indicating that higher perceived usefulness leads to greater utilization of these systems. Similarly, for Logistics & Supply Chain Management, a slight positive relationship was observed (Estimate = 0.021, p = 0.005).

**Ease of Use** demonstrated a strong positive relationship with Disease Surveillance & Response Systems (Estimate = 0.199, p < 0.001), emphasizing the importance of ease of use in adopting these systems. Conversely, there was a negative relationship with Data Collection & Health Information Management (Estimate = -0.129, p < 0.001) and Logistics & Supply Chain Management (Estimate = -0.051, p < 0.001), showing that simpler systems were less likely to be used in these domains.

**Awareness** had no significant association with Disease Surveillance & Response Systems (Estimate = 0.000, p = 0.988), but it was positively correlated with Data Collection & Health Information Management (Estimate = 0.039, p = 0.018) and negatively associated with Logistics & Supply Chain Management (Estimate = -0.022, p = 0.002), suggesting that increased awareness may lead to higher usage of data collection tools but decreasing the utilization of logistics & supply management tools.

**Risk perception** was positively associated with Disease Surveillance & Response Systems (Estimate = 0.184, p < 0.001), while negative associations were observed for Data Collection & Health Information Management (Estimate = -0.151, p < 0.001) and Logistics & Supply Chain Management (Estimate = -0.033, p < 0.001).

**Data Security** was a strong predictor of increased usage for Disease Surveillance & Response Systems (Estimate = 0.347, p < 0.001) and Data Collection & Health Information Management (Estimate = 0.709, p < 0.001), although a negative relationship was observed with Logistics & Supply Chain Management (Estimate = -0.690, p < 0.001).

**Relative Advantage** was positively associated with Disease Surveillance & Response Systems (Estimate = 0.209, p < 0.001), but it had no significant association with Data Collection & Health Information Management (Estimate = 0.000, p = 0.977). A negative relationship was found for Logistics & Supply Chain Management (Estimate = -0.120, p < 0.001).

**Infrastructure** emerged as a key barrier, showing a strong negative association with Disease Surveillance & Response Systems (Estimate = -0.694, p < 0.001) and Data Collection & Health Information Management (Estimate = -0.210, p < 0.001), while it was positively associated with Logistics & Supply Chain Management (Estimate = 0.550, p < 0.001).

**Critical Success Factors** were negatively associated with both Disease Surveillance & Response Systems (Estimate = -0.070, p < 0.001) and Data Collection & Health Information Management (Estimate = -0.108, p

< 0.001), but they were positively related to Logistics & Supply Chain Management (Estimate = 0.107, p < 0.001).

**Staff IT Experience** had a strong positive association with Disease Surveillance & Response Systems (Estimate = 0.370, p < 0.001) and Data Collection & Health Information Management (Estimate = 0.402, p < 0.001), but a negative association with Logistics & Supply Chain Management (Estimate = -0.226, p < 0.001).

**Information Sharing** was negatively associated with Disease Surveillance & Response Systems (Estimate = -0.191, p < 0.001) but positively related to Data Collection & Health Information Management (Estimate = 0.196, p < 0.001), with no significant association observed for Logistics & Supply Chain Management (Estimate = -0.001, p = 0.877).

Finally, Technical Infrastructure was negatively associated with Disease Surveillance & Response Systems (Estimate = -0.229, p < 0.001) and Data Collection & Health Information Management (Estimate = -0.336, p < 0.001), but it was positively associated with Logistics & Supply Chain Management (Estimate = 0.351, p < 0.001).

These results emphasize the critical factors influencing the adoption and utilization of digital health tools across different domains. The significant positive associations for ease of use, data security, and staff IT experience suggest that these are essential drivers for successful implementation. However, infrastructure limitations and risk perceptions may serve as barriers, particularly in systems requiring high technical inputs.

**Table 5.** Association between users' Perceptions, Literacy, and Experiences In Implementing and Adopting the Digital Health Tools

| Independent variables | Dependent variables<br>Digital health tools in used | Estimate | p-value |
|---|---|---|---|
| Perceived Usefulness | Disease Surveillance & Response Systems | -.116 | 0.04 |
| IT Knowledge | Disease Surveillance & Response Systems | .082 | 0.15 |
| Education | Disease Surveillance & Response Systems | .017 | 0.77 |
| Perceived Usefulness | Data Collection & Health Information Management | .183 | <0.001 |
| IT Knowledge | Data Collection & Health Information Management | -.205 | <0.001 |
| Education | Data Collection & Health Information Management | .155 | 0.004 |
| Perceived Usefulness | Logistics & Supply Chain Management | -.002 | 0.96 |
| IT Knowledge | Logistics & Supply Chain Management | .712 | <0.001 |
| Education | Logistics & Supply Chain Management | -.317 | <0.001 |

Table 5 shows the associations between users' perceptions, IT knowledge, and education levels with the implementation of digital health tools. User perception of the usefulness of digital health tool was significantly associated with the use of tools for data collection and health information management (Estimate: 0.183, p-value: <0.001) but shows no significant effect in the area of Logistics and Supply Chain Management (Estimate: -0.002, p-value: 0.96). In addition, IT Knowledge demonstrates a positive association (Estimate: 0.082, p-value: 0.15) with Disease Surveillance & Response Systems tools, and a stronger association (Estimate: 0.712, p-value: <0.001) with Logistics & Supply Chain Management tools; however, this pattern does not apply to Education.

**Table 6.** Access Actual Users' Perceptions, Literacy, And Experiences In The Implementation And Critical Success Factors Archived In Adopting The Digital Health Tools

| Independent variables | Dependent variables<br>Digital health tools in used | Estimate | p-value |
|---|---|---|---|
| Perceived Usefulness | Disease Surveillance & Response Systems | -.116 | 0.04 |
| IT Knowledge | Disease Surveillance & Response Systems | .082 | 0.15 |
| Education | Disease Surveillance & Response Systems | .017 | 0.77 |
| Perceived Usefulness | Data Collection & Health Information Management | .183 | <0.001 |
| IT Knowledge | Data Collection & Health Information Management | -.205 | <0.001 |
| Education | Data Collection & Health Information Management | .155 | 0.004 |
| Perceived Usefulness | Logistics & Supply Chain Management | -.002 | 0.959 |
| IT Knowledge | Logistics & Supply Chain Management | .712 | <0.001 |
| Education | Logistics & Supply Chain Management | -.317 | <0.001 |
| Disease Surveillance & Response Systems | Ease of use | .413 | <0.001 |
| Data Collection & Health Information Management | Ease of use | .697 | <0.001 |
| Logistics & Supply Chain Management | Ease of use | .697 | <0.001 |
| Ease of use | Critical Success | .720 | <0.001 |

The findings in Table 6 showcases the relationships among the independent variables—perceived usefulness, IT knowledge, and education—and their influence on Paths to Ease of Use and Critical Success. The model shows that disease surveillance, data collection, and logistics & supply chain management are each strongly associated with ease of use (Estimates: 0.41, 0.70, and 0.70 respectively). This suggests that adoption in these areas positively contributes to the perceived ease of using digital health tools. Finally, ease of use has a direct and strong positive relationship with critical success (Estimate: 0.72).

This implies that the more user-friendly the digital health tools are, the more likely they are to achieve critical success in their implementation.

**Table 7.** The Association Of Infrastructure And The Adoption Of Digital Health Tool And How It Relates To The Critical Success Factors Archived

| Independent variables | Dependent variables<br>Digital health tools in used | Estimate | p-value |
|---|---|---|---|
| Perceived Usefulness | Disease Surveillance & Response Systems | -.158 | 0.005 |
| Infrastructure | Disease Surveillance & Response Systems | .125 | 0.025 |
| Technical Infrastructure | Disease Surveillance & Response Systems | .001 | 0.989 |
| Perceived Usefulness | Data Collection & Health Information Management | -.190 | <0.001 |
| Infrastructure | Data Collection & Health Information Management | .329 | <0.001 |
| Technical Infrastructure | Data Collection & Health Information Management | -.026 | 0.616 |
| Perceived Usefulness | Logistics & Supply Chain Management | .244 | <0.001 |
| Infrastructure | Logistics & Supply Chain Management | .547 | <0.001 |

| | | | |
|---|---|---|---|
| Technical Infrastructure | Logistics & Supply Chain Management | -.263 | <0.001 |
| Disease Surveillance & Response Systems | Ease of use | .349 | <0.001 |
| Data Collection & Health Information Management | Ease of use | .594 | <0.001 |
| Logistics & Supply Chain Management | Ease of use | .597 | <0.001 |
| Ease of use | Critical Success | .778 | <0.001 |

The results from Table 7 present the association between Infrastructure and the implementation of digital health tools. Infrastructure was positively associated with adoption of disease surveillance & response systems ($\beta = 0.12$, $p = 0.025$), suggesting that improving infrastructure enhances the effectiveness of disease surveillance systems and data collection & health information management ($\beta = 0.33$, $p < 0.001$). Also, showed a strong positive association with adoption ($\beta = 0.55$, $p < 0.001$) of logistics & supply chain management tool**.** Furthermore, Ease of Use was associated with disease surveillance & response systems ($\beta = 0.35$, $p < 0.001$), data collection and health information management ($\beta = 0.59$, $p < 0.001$), and logistics and supply chain management ($\beta = 0.60$, $p < 0.001$). Similarly, Ease of use positively impacted critical success factors ($\beta = 0.78$, $p < 0.001$).

## Discussion

A strategy to advance UHC involves enhancing health systems and promoting sustainable development, achievable through evidence-based decision-making utilizing innovative digital interventions, in alignment with Target 3.9d of SDG 3 [33], which aims to "Strengthen the capacity of all countries, particularly developing nations, for early warning, risk reduction, and management of national and global health risks" [34].

The use and adoption of digital health tools in low- and middle-income countries (LMICs) such as Nigeria offer considerable prospects and challenges. It is essential to guarantee that Nigeria's digital health systems are integrated, adaptable, sustainable, and supported by robust policies and leadership. There is insufficient knowledge concerning factors that affect the use and sustainable adoption of digital health tools in primary healthcare settings, where their use is intended by healthcare practitioners.

### Descriptive Statistics of the Respondents' Characteristics

This study engaged a varied cadre of participants from multiple primary healthcare centers across three States in Northern Nigeria to ensure comprehensive insights.

The demographic characteristics of the respondents from various primary health facilities across three states in Northern Nigeria are notably significant.

The majority of participants, 105 (34.0%), were between the ages of 31 and 40. This finding is consistent with the research conducted by [35]. The age group of 31- 40 is particularly significant because it frequently represents a techno-savvy and professionally active segment of the population, which is essential for the sustainable adoption of digital health tools. Most of the health practitioners, 195 (63.1%), were male.

This finding is typical in other developing countries [36], [37], but it is not the case in developed countries, where people of both sexes have rights that are nearly equivalent to one another [38], [39].

An adequate, well-distributed and motivated health workforce is essential for achieving UHC and numerous SDGs, including health (SDG3), decent employment and economic

growth (SDG8), gender equality (SDG5), and migration (SDG10). Achieving SDG3 requires not just an augmentation of healthcare staff but also a targeted strategy and tailored policies that correspond with the distinctive characteristics and behaviors of the health workforce [40]. This requires improved accessibility, quality, analysis, and utilization of health workforce data to inform advocacy, planning, policy development, governance, and accountability at national, regional, and global levels.

The World Health Organization reports that 70% of the worldwide health workforce comprises females, a phenomenon referred to as the feminization of healthcare occupations. In Nigeria, women represent the predominant demographic among medical doctors and nursing and midwifery personnel, according to data from 2018 indicating that 65% of physicians and 87% of nursing staff were female [41]. Nonetheless, trained healthcare workers on the frontlines in Northern Nigeria are predominantly male because of insufficient educational attainment among girls. The gender imbalance among healthcare professionals in Northern Nigeria is a critical concern. The region encounters obstacles, including less educational achievement among girls, which constrains their prospects of becoming skilled healthcare professionals. Consequently, the majority of skilled healthcare professionals are male [42].

Conversely, a significant number of unskilled healthcare workers, including community health volunteers, are primarily female. This circumstance is shaped by cultural norms and the restricted presence of female healthcare practitioners [42].

Initiatives to rectify this discrepancy encompass enhancing educational possibilities for girls and fostering community involvement to endorse the acceptance of healthcare services provided by male frontline health workers [43].

In addition, a substantial proportion of participants were married, with 243 (78.6%) and 305 (98.7%) having completed at least tertiary educations. This indicates a well-educated and potentially stable demographic, which may positively influence the sustained use of these tools. The adoption and sustainable use of digital health instruments in primary healthcare centers in Nigeria can be influenced by a variety of factors, including the marital status of healthcare workers. Healthcare professionals who are married frequently balance their professional obligations with their family obligations. This dual role can have an impact on their capacity to engage with and implement new technologies, particularly if these tools necessitate additional training or time investment [44]. Furthermore, the tension associated with the adoption of new technologies may be mitigated by the fact that married individuals may have more robust support systems at home. This assistance may be provided by spouses or extended family members who assist in the management of domestic responsibilities.

Marriage can offer a sense of motivation and stability. Healthcare professionals may be more inclined to adopt digital health tools that can enhance their work efficiency and patient care when they feel supported at home [44]. It is interesting to note that the adoption of digital health instruments is contingent upon the availability of training and ongoing professional development. Healthcare professionals who are married may encounter difficulties in attending training sessions as a result of family obligations, which may impact their proficiency with these tools.

The success of the adoption of digital health tools is also contingent upon the policies and support supplied by healthcare institutions. Married healthcare professionals can more effectively engage with digital health initiatives and balance their responsibilities by utilizing flexible work schedules, on-site childcare, and other supportive measures.

In general, the key to sustainable adoption is the establishment of an environment that accommodates the diverse needs and

circumstances of healthcare workers, despite the fact that marital status can present both challenges and advantages.

In addition, 109 respondents (35.3%) exhibited a minimum level of IT knowledge. There is a similarity between this and a study that was carried out in one of the Northern States of Nigeria [36]. A number of factors have an impact on the minimum level of information technology proficiency of primary health workers in Northern Nigeria: The majority of primary health care institutions in Northern Nigeria are confronted with considerable resource limitations, such as insufficient financing for information technology infrastructure and training [45]. This makes it more difficult to provide health staff with the appropriate information technology skills and tools. It is common for there to be a dearth of all-encompassing training programs that are centered on information technology skills for those who work in the health care industry. It's possible that the training programs that are currently available don't effectively address the utilization of digital tools and technology that are necessary for the delivery of modern healthcare [45].

It is feasible that the region has limited access to dependable internet and energy, both of which are essential for the efficient utilization of information technology in the healthcare industry. In addition, the development and utilization of information technology solutions are both hampered by this infrastructure gap.

Although there are national standards and policies that are aimed at enhancing primary healthcare, the implementation of these policies and standards at the local level might be inconsistent.

It is necessary to develop targeted interventions in order to address these difficulties. These interventions should include greater financing, enhanced training programs, improved infrastructure, and effective policy implementation in order to strengthen the information technology capabilities of primary health workers in Northern Nigeria.

The majority of health centers, 168 (54.4%), were situated in rural areas and utilized at least one digital health tool. It is generally accepted that a sizeable percentage of PHCs in northern Nigeria are situated in villages and other rural areas. In comparison to metropolitan inhabitants, rural populations frequently encounter more obstacles while attempting to gain access to healthcare. The purpose of this distribution is to improve access to healthcare services for rural populations.

As part of broader efforts to improve health equity and guarantee that marginalized groups access vital health services [46], the focus on rural areas is a component of those general efforts. Nevertheless, the availability of services and the quality of such services might substantially fluctuate from one region and facility to another [47].

**Descriptive Statistics of the Digital Health Tools**

The digital health tool questionnaire was used to assess the perceived usefulness, ease of use, relative advantages, awareness of digital health tools, risk, data security, infrastructure, critical success factor, staff experience, information sharing, and technical infrastructure of digital health tool adoption among participants.

The subscale that evaluated the perceived usefulness of the digital health tool found that approximately 150 (48.5%) respondents agreed that these tools improved their ability to complete tasks. This result represents some concerns over the efficacy of digital health technologies intended for primary healthcare providers, which are understandable and should be accepted. However, many other studies illustrate the positive impacts that these technologies can have, despite the fact that there are obstacles of their own.

One recent study conducted by the WHO discovered that digital health technologies have

the potential to improve the mental health and performance of healthcare workers by enhancing the accuracy of decision-making, decreasing the amount of time required to complete tasks, and increasing productivity [48]. Not only can these tools increase communication among healthcare workers, but they also enable improved access to data that is updated every moment.

However, it is essential to keep in mind that the efficacy of these tools might vary depending on a number of circumstances, such as the particular setting in which they are utilized, the severity of the training that is offered, and the infrastructure that is already in place [49]. There are still gaps in the evaluation and impact of these technologies in many nations, particularly in LMICs. Furthermore, the relationship between training and perceived barriers to digital health access, current usage of digital tools, and beliefs regarding digital impact among a multi-country sample of community health workers (CHWs) was examined [44]. The analysis revealed no significant correlation between the frequency of training sessions and the current utilization of digital devices, indicating that an increase in training does not inherently influence a Community Health Worker's likelihood of employing digital devices in their professional activities.

In our study, a larger proportion 202 (65.4%) acknowledged that digital health tools facilitated their work processes or made their work easier. This is consistent with the findings from this research, where a variety of digital health tools that are utilized in primary care settings across Africa, including Nigeria, are studied and discussed. It sheds light on the difficulties encountered and the strategies that were successful, indicating that mobile health solutions have the potential to be useful provided that healthcare professionals receive sufficient training, and the applications are built to integrate with preexisting workflows [50] resulting in a well-integrated and effective delivery of primary health care services, according to a scoping review in LMICs [51].

Moreover, the digital health tools subscale indicated that 79 (25.6%) participants found digital health tools/systems to be generally frustrating, while 228 (73.8%) indicated that they find these tools/systems easy to use. It was not necessary to have a high level of technical expertise in order to use the user-centered platforms because they were meant to be as simple to comprehend as feasible. Individuals are less inclined to use a technology if they do not believe that it would significantly improve their job performance. This is because there is a relationship between the perceived ease of use and the adoption of technology. This is alignment with the research conducted in various settings in sub-Sahara Africa [50] and in Nigeria [52]. Generally speaking, the acceptability of digital health tools among healthcare personnel is high when the technologies are easy to use and can be easily integrated into the workflows that are already in place [53].

Most participants 214 (69.3%) reported having access to the digital health tools available, and 203 (65.7%) indicating that they comprehend the benefits of utilizing these tools. This scoping review study examined the implementation of digital health interventions aimed at strengthening health systems in sub-Saharan Africa over 10 years, revealing that a considerable proportion of participants reported access to digital health tools and comprehension of their benefits [12].

A significant number of participants, 88 (28.5%), reported a lack of consistent electricity, while 71 (23.0%) expressed disagreement regarding the quality of the network at their facility. In Nigeria, the inconsistent supply of electricity and inadequate internet services impede the effective use and adoption of digital health tools [54], [35]. The inadequate internet coverage is exacerbated by the unreliable electricity supply. Research evidence indicates that inadequate

electricity supply significantly hinders the adoption of digital health technology in the ECOWAS region. Frequent power outages are a prevailing issue in numerous areas across Nigeria, Burkina Faso, Niger, Liberia, and Mali [17], [55].

The subscale assessing critical success revealed that 244 individuals (79.0%) indicated that utilizing digital health tools enhances their control over their work, while 223 individuals (72.2%) reported that these tools improve the quality of their work. One of the main obstacles to the implementation of digital health technology in Sub-Saharan Africa, especially Nigeria, is inadequate electrical supplies [56], [50], [57].

In the information sharing subscale, 102 (33.0%) indicated that digital health tools/systems enhance information sharing within the health facility, while 154 (49.8) expressed that the digital health tools/systems enhance information sharing with other health facilities. [58], [50] consolidated information regarding the advancement of digital health technology to enhance primary healthcare during the COVID-19 pandemic. It discussed several digital health tools and their functions in improving decision-making and information exchange within and among healthcare facilities. In addition, the role of digital health tools in facilitating access to care for marginalized communities by improving information sharing within healthcare facilities was highlighted [59].

Majority, 192 (62.1%) concurred that an excessive focus on protecting patients' privacy impacts the utilization of digital health tools/systems. This research [50] examined diverse digital health tools utilized in primary care settings throughout Africa, emphasizing issues including inadequate network access and technological proficiency. It posits that although privacy concerns are significant, they may occasionally obstruct the proper use of digital health solutions if not harmonized with usability and accessibility. The implications of the development of digital health technologies during the COVID-19 pandemic are discussed along with the impact those technologies had on primary health care [58]. It highlights the importance of quality assurance and standards for digital health tools, pointing out that an excessive focus on privacy can make the acceptance and effective utilization of these technologies more difficult. An examination of the difficulties associated with protecting the privacy of patients while also providing effective health care coordination and delivery was presented by [60] This demonstrates that firm privacy rules can sometimes make it difficult to use digital health tools in a seamless manner, which can have an impact on the delivery of healthcare as a whole.

The technical infrastructure subscale indicated that 216 (69.9%) and 244 (79.0%) participants agreed that the IT budget of the health facility is sufficient to sustain and support the digital health tools/system; and that the health facility's existing infrastructure is enough to support the digital health tools/system, respectively. The study [57] examined the challenges and opportunities associated with digital health technologies in Africa, highlighting the necessity for integrated national infrastructures to facilitate sustainable outcomes; while [51] examined the potential of digital health solutions to improve primary healthcare delivery and attain universal health coverage, emphasizing the significance of digital literacy and appropriately allocated funding in LMICs, including Nigeria.

### Available Digital Health Tools In Public Health Emergencies In Primary Healthcare Centres Across The Three States

A variety of digital health tools used in public health emergencies within the primary healthcare sector throughout the past five years. Within this period, about 11 digital health tools have been utilized. The predominant instrument utilized during this period was ODK 77 (24.9%), followed by OpenLMIS 70 (22.7%),

then Survey CTO 56 (18.1%), E-health card 34 (11.0%), NIPDS 29 (9.4%) and SORMAS 9 (2.9%) was also represented. RI SMS experienced the lowest use, representing merely 0.6%.

Several of these tools were captured as part of the digital health tools for pandemic preparedness in Nigeria, as reported in a national case study [61].

**Socio-Demographic Factors That Influences The Adoption Of Digital Health Tools**

The analysis revealed a highly significant relationship between age and adoption across all three domains ($\chi^2 = 203.64$, $p < 0.001$). Hence, our study suggests that the age of individuals in Nigeria can have a substantial impact on their adoption of digital health solutions. It is important to note that the largest group of participants fell within the age range of 31-40 years, comprising a total of 105 individuals, which accounts for 34.0% of the sample. Individuals working in the health care industry who are younger are more likely to utilize digital health solutions. Generally speaking, this age group have a greater familiarity with technology and are more willing to incorporate new digital solutions into their day-to-day activities. Other research discovered a statistically significant correlation between the age of the participants [62], [32]. This contrasts slightly with the findings by (Blondino C. K., 2024), who reported that older age was an indicator of digital device usage. When it comes to embracing digital health solutions, older health workers may experience more hurdles than younger peers. This may be the result of a lack of familiarity with digital technology, an aversion to change, or a preference for more conventional approaches. It is possible to help bridge the gap for elder health workers by providing them with proper training and support, which will make it simpler for them to embrace and use digital health solutions in an efficient manner.

In addition, this study also highlights the significant factors that influence the adoption of digital health instruments, such as sex, marital status, education level, IT expertise, profession, and geographic location. The results suggest that the adoption of digital health tools is substantially influenced by sex ($\chi^2 = 136.92$, $p < 0.001$), with individuals in marital relationships being the primary users across all systems.

Education level also emerged as a critical factor, with individuals who have completed tertiary education exhibiting virtually complete adoption in all areas, particularly in data collection and health information management and disease surveillance and response systems ($\chi^2 = 8.37$, $p = 0.007$).

The substantial impact of sex on the adoption of digital health tools is consistent with the World Health Organization's assessment of the role of digital health technologies in enhancing women's health and fostering gender equality [63]. The WHO report emphasizes that digital tools can improve access to healthcare services, particularly for women, by enabling them to manage their health independently and providing essential health information. In addition, there was a significant relationship between gender of the healthcare workers and their willingness to use digital health tools [32, 35].

Still, marital status also emerged as a significant factor, with individuals in marital relationships being the predominant users of all three systems. This may be due to the heightened health management responsibilities that are frequently associated with family life, which necessitate the use of digital health tools for the efficient delivery of healthcare.

The level of education emerged as a significant factor, with respondents holding higher education degrees demonstrating almost complete adoption in all domains. This aligns with findings from other research indicating that advanced educational attainment correlates with increased technology adoption, attributed

to enhanced digital literacy and improved access to resources. The complete adoption rate in disease surveillance and response systems, along with data collection, analytics, and visualization and logistics and supply management among respondents with higher education, highlights the significance of educational achievement in promoting the utilization of advanced health technologies. [57] examined the impact of digital health platforms on enhancing healthcare delivery in Africa, emphasizing the significance of education and training for the effective implementation of these technologies. The scoping review methodology delineated the use of digital health interventions and their influence on health systems, highlighting the significance of higher education in promoting the uptake and successful utilization of these tools [64]. This reported study analyzed diverse digital health applications and their implementation in many nations, including Nigeria, while emphasizing the need of education and training for healthcare professionals [50].

The influence of IT expertise on the adoption of logistics and supply chain management tools is notable, particularly with the highest adoption rates (83.8%) observed among individuals possessing advanced IT skills. This finding aligns with another research indicating that technical proficiency plays a crucial role in the effective use of digital health tools [20], [35]. The success of digital health in sub-Saharan Africa will hinge on the health workforce's proficiency in digital technologies [56]. On the other hand, individuals with minimal IT expertise primarily participated in disease surveillance and response, underscoring the necessity for specialized training initiatives to address this skills gap.

The role of profession played a crucial part in influencing the adoption of digital health tools ($\chi^2 = 151.55$, $p < 0.001$). The subsequent research also documented the utilization of digital tools by diverse categories of healthcare practitioners [20], [35], [62]. Our study indicated that the significance of profession was crucial, as record officers predominantly utilized logistics and supply chain management (87.5%), whereas disease surveillance and response systems were chiefly utilized by CHEW/DSNO professionals (78.0%). Healthcare professionals exhibited a notable inclination towards data collection and health information management, with a percentage of 43.1%. The observed patterns illustrate the unique requirements and duties linked to various professional positions within the healthcare system.

The geographical location significantly impacted adoption rates, as rural primary health centers excelled in the implementation of disease surveillance and response systems, achieving a remarkable 100.0% rate. ($\chi^2 = 212.79$; $p < 0.001$). The results slightly contrast the existing research suggesting that metropolitan regions typically possess superior infrastructure and resources to facilitate the implementation of advanced digital health technologies [65].

When examining these findings alongside other research, it becomes clear that the integration of digital health tools is complex, shaped by a variety of demographic, educational, professional, and geographical influences.

This research highlights the intricate relationships among multiple elements influencing the uptake of digital health technologies in Nigeria. It is essential to tackle these factors with specific interventions, including the enhancement of digital literacy, the improvement of IT training, and the assurance of equitable access across various regions, to fully realize the advantages of digital health technologies.

A significant relationship was observed between perceived usefulness and the adoption of digital health tools ($\chi^2 = 39.57$, $p < 0.001$). The findings we analyzed suggest that healthcare professionals in Nigeria agree that

the perceived usefulness of technology plays a crucial role in influencing the adoption of digital health tools.

Moreover, the relationship between perceived usefulness and the adoption of digital health tools indicates that users are more inclined to utilize these tools when they recognize their benefits. It highlights the significance of creating digital health solutions that prioritize user needs and provide tangible benefits to users. This relationship underscores the importance of ongoing user feedback and engagement in the development process to guarantee that these tools stay pertinent and efficient.

The results indicate a significant relationship between perceived usefulness and the adoption of digital health tools. This is consistent with earlier studies carried out in Northern Nigeria [20], and sub-Saharan Africa, highlighting the significance of perceived usefulness in the adoption of digital health interventions. For example, [35] discovered that the perceived usefulness significantly impacted the adoption of digital health tools in Nigeria, and by [66], in Ghana.

In a similar vein, a scoping review conducted by [64] emphasized the significant impact of perceived usefulness on the adoption of digital health interventions throughout sub-Saharan Africa. The results highlight the importance of creating digital health tools that prioritize the needs and preferences of users.

By ensuring that these tools are viewed as advantageous, healthcare providers can greatly increase their adoption rates, ultimately resulting in better healthcare outcomes. Moreover, ongoing user feedback and engagement in the development process are crucial for ensuring the tools remain relevant and effective.

As well, our findings indicate that the perception of usefulness plays a crucial role in the adoption of digital health tools. This aligns with the findings of [67] in their research on Bangladesh. This insight can inform future studies and development initiatives, guaranteeing that digital health solutions are both accessible and effective. Yet, the results indicating that perceived ease of use did not have a significant correlation with the adoption of digital health were corroborated by more research [68].

Also, awareness emerged as a significant factor ($\chi^2 = 102.29$, $p < 0.001$). The results indicate that awareness played a crucial role in the readiness to embrace digital health tools. This is consistent with earlier studies carried out in Northern Nigeria, highlighting the significance of awareness in the uptake of digital health interventions. [69] reported that the awareness of digital health technologies among healthcare workers in Nigeria had a significant impact on their readiness to embrace these tools during the COVID-19 pandemic. In addition, a scoping review conducted by [70] emphasized the essential importance of awareness in the utilization of digital health throughout Nigeria. The results highlight the importance of enhancing awareness campaigns and educational initiatives to encourage the use of digital health tools. By making sure that healthcare providers and the general public are thoroughly educated about the advantages and capabilities of these tools, we can greatly increase their adoption rates, which will ultimately result in better healthcare outcomes. This insight can inform future investigations and development initiatives, guaranteeing that digital health solutions are both accessible and effective.

In a similar vein, the perception of relative advantage strongly influenced adoption ($\chi^2 = 123.55$, $p < 0.001$). [20] demonstrated that the adoption of e-health technology in Nigerian hospitals was significantly affected by the perceived relative advantage of these tools. A scoping review by [70] emphasized the significant role of relative advantage in the utilization of digital health in Nigeria. The findings highlight the necessity for the design of digital health tools to consider user needs and

preferences. Ensuring that these tools present distinct advantages over traditional methods can significantly enhance their adoption rates among healthcare providers, thereby leading to improved healthcare outcomes.

Moreover, the significance of data security was evident, and hence, considered an important factor ($\chi^2 = 48.26$, $p < 0.001$). Data security was identified as a critical factor influencing the adoption of digital health tools in Northern Nigeria. This is consistent with prior studies in the region, highlighting the significance of data security in the implementation of digital health interventions. [71] reported that concerns regarding data security significantly influenced the adoption of digital health technologies in Nigeria. [70] emphasized the importance of data security in the utilization of digital health in Nigeria. The findings underscore the necessity of integrating robust data security measures into digital health tools. Ensuring the security of these tools can significantly enhance their adoption rates among healthcare providers, ultimately resulting in improved healthcare outcomes.

Our study analyzed the relationships among users' perceptions, IT knowledge, and educational attainment concerning the implementation of digital health tools in three areas: data collection and health information management, logistics and supply chain management, and disease surveillance and response systems.

User perception of the usefulness of digital health tools is significantly associated with their utilization for data collection and health information management (Estimate: 0.183, p-value: <0.001). This finding indicates that users who perceive digital health tools as beneficial are more inclined to adopt and effectively utilize them for health data management. In logistics and supply chain management, user perception of usefulness did not demonstrate a significant effect (Estimate: -0.002, p-value: 0.96), suggesting that alternative factors may be more influential in this field.

And IT knowledge exhibited a positive correlation with the adoption of digital health tools. IT knowledge exhibited a moderate positive correlation with the utilization of Disease Surveillance & Response Systems tools (Estimate: 0.082, p-value: 0.15); however, this correlation did not reach statistical significance. IT knowledge demonstrated a significant positive correlation with the utilization of Logistics and Supply Chain Management tools (Estimate: 0.712, p-value: <0.001). This pattern underscores the significance of IT proficiency in the efficient management of logistics and supply chain processes in the healthcare sector.

The anticipated pattern of associations was not observed in the Education domain, suggesting that education levels did not significantly influence the adoption and implementation of digital health tools in the examined areas. This indicates that although education is important, it may not be the foremost factor influencing the adoption of digital health tools, in contrast to other elements like user perception and IT proficiency.

This study highlights the significant impact of user perception of usefulness and IT knowledge on the adoption and implementation of digital health tools. The findings indicate that enhancing the adoption of digital health tools, especially in data collection, health information management, and logistics, requires efforts to improve user perceptions of the tools' usefulness and to enhance IT literacy among users. Our research examined the relationships between independent variables—perceived usefulness, IT knowledge, and education—and their effects on ease of use and critical success in the context of digital health tools. The model demonstrates that disease surveillance, data collection, and logistics and supply chain management are each significantly correlated with ease of use, with estimates of 0.41, 0.70, and 0.70, respectively. The adoption of digital health tools in these areas notably improves the perceived usability of these tools.

The significant relationship between ease of use and the previously mentioned areas highlights the necessity of user-friendly design and functionality in the adoption of digital health tools. The ease of use of these tools increases the likelihood of user adoption and integration into routine workflows, thereby enhancing their effectiveness in disease surveillance, data collection, and logistics and supply chain management.

In addition, ease of use demonstrated a direct and significant positive correlation with critical success, with an estimate of 0.72. This finding underscores that the user-friendly characteristics of digital health tools serve as both a facilitator of adoption and a critical determinant of their overall success. Ensuring that these tools are intuitive and accessible enhances user satisfaction and engagement, resulting in improved healthcare outcomes.

This study illustrates the significant impact of perceived usefulness, IT knowledge, and education on the usability and success of digital health tools. The identified associations in our model indicate that emphasizing user-centric design and ongoing education can markedly improve the adoption and effectiveness of these tools in healthcare environments.

Our study examines the relationship between infrastructure and the implementation of digital health tools, yielding significant insights. The adoption of disease surveillance and response systems was positively correlated with infrastructure ($\beta = 0.12$, $p = 0.025$), indicating that improvements in infrastructure may enhance the effectiveness of these systems. This finding demonstrates that strong infrastructure is vital for the effective deployment of disease surveillance tools, which are necessary for monitoring and addressing public health threats.

In addition, infrastructure demonstrated a significant positive correlation with data collection and health information management ($\beta = 0.33$, $p < 0.001$) and a robust positive correlation with the adoption of logistics and supply chain management tools ($\beta = 0.55$, $p < 0.001$).

Our results indicate that robust infrastructure is essential for the effective implementation of digital health tools in diverse areas, facilitating the efficient collection, management, and utilization of health data. In the context of this discussion, infrastructure refers to the availability of a supply of electricity, as well as the reliability and consistency of access to the internet and connectivity, the amount of broadband that is available, and the accessibility to computers. This is consistent with the findings obtained by [72] in the course of their inquiry of the state of electronic health in developing countries, including Nigeria.

The ease of use was identified as a significant factor influencing the implementation of digital health tools. The findings of our study indicate a positive association between ease of use and disease surveillance and response systems ($\beta = 0.35$, $p < 0.001$), data collection and health information management ($\beta = 0.59$, $p < 0.001$), as well as logistics and supply chain management ($\beta = 0.60$, $p < 0.001$). This indicates that user-friendly digital health tools enhance adoption rates, resulting in improved healthcare management and outcomes.

Similarly, ease of use significantly influenced critical success factors ($\beta = 0.78$, $p < 0.001$), highlighting its role in the overall success of digital health implementations. Prioritizing user-centric design and ensuring navigability of digital health tools can lead to increased adoption rates and enhanced efficiency within health systems.

Again, this study highlights the critical importance of infrastructure and perceived ease of use in the adoption and implementation of digital health tools. The associations identified in this research indicate that enhancing infrastructure and creating user-friendly tools are critical for the effective implementation of digital health solutions in healthcare environments.

## Conclusion

The use and sustainable adoption of digital health solutions in low- and middle-income countries (LMICs) like Nigeria require a comprehensive strategy that includes infrastructure, stakeholder involvement, policy development, financial viability, and user-centered design. By concentrating on these domains, policymakers and practitioners can leverage digital health technologies to improve healthcare outcomes and attain greater equity in health services.

Our research has pinpointed multiple key areas essential for the effective expansion of digital health efforts in Nigeria. These encompass guaranteeing that programs have intrinsic attributes that deliver quantifiable benefits to address unmet needs and engaging end-users from the outset. The technical profile of the digital health tool should prioritize simplicity, interoperability, and adaptability. All stakeholders must be engaged, trained and motivated in order to effectively deploy and implement new projects.

Sustainable finance is essential for facilitating long-term growth, including adequate private sector investment. The policy framework governing digital healthcare efforts must be consistent with overarching healthcare policies. It is crucial to consider the extrinsic environment, which encompasses the provision of the necessary infrastructure to facilitate the implementation of digital initiatives on a large scale.

In the context of scaling and integrating digital health, collaborative endeavors to establish a less-siloed strategy may offer the necessary leadership to facilitate the deployment of new solutions in Nigeria. These practices may also influence the formulation and implementation of health programs in the years to come.

Our analysis revealed a number of contextual elements and interconnected pathways that likely mitigated the effects of digital health technologies in the context of primary health care. When assessing the role of digital solutions in primary health care settings, it is imperative to consider the technical functionality of the technology and the behavioural responses of the end-users. In addition, the larger health system's requirements and the digital ecosystem's readiness, which includes the capacity at the primary health care level to implement digital solutions, must be considered. Conceptual and/or methodological frameworks are necessary to enhance comprehension of the myriads of individual, organizational, technological, and system-level factors that influence the performance of digital health solutions, as well as to better understand, classify, and examine the associative mechanisms of digital health and PHC (or UHC-related) outcomes.

The deployment, utilization, and expansion of mobile health systems in Northern Nigeria are impeded by a greater number of obstacles and impediments. In addition to the impediments that obstruct progress, there are also enabling components that could be utilized to facilitate the design, implementation, and expansion of digital health tools. It is clear that the northern region of Nigeria may require contextualized strategies that are tailored to the unique challenges the region is currently experiencing.

A variety of factors, both facilitating and impeding, affect the digital health systems in Nigeria. Common barriers and enablers were identified by a variety of primary health care workers. In order to encourage use and sustainable adoption, all stakeholders must take an active role in overcoming the obstacles. In spite of the extant obstacles, this investigation indicates that digital health systems in Nigeria and sub-Saharan Africa are approaching a favourable future. This research revealed strategies and opportunities for the sustainable adoption and integration of digital health tools into the Nigerian health care systems.

In order to effectively and efficiently integrate digital health into public services in sub-Saharan Africa, particularly Nigeria, primary health care should improve its response capacity, increase the utilization of information and communication technologies, and address challenges through scientific evidence.

There should be a transition from donor-driven pilot initiatives to programs that are cost-effective, sustainable, robust, and managed by the Nigerian government. This is due to the substantial potential of digital health technologies to fortify Nigerian health systems in order to achieve UHC and the SDGs for health. To prevent the wastage of finite health resources, the duplication of efforts, and the wastage of time on unsuccessful interventions, this plan will employ a demand-driven, people-centered approach, as opposed to a supply-driven approach. It was determined that government ownership and leadership are essential for the long-term viability of digital health initiatives in Nigeria and their successful expansion.

Nevertheless, proof of concept alone is insufficient to propel digital technologies into widespread adoption for large-scale use. In order to successfully implement digital health tools, it is essential to establish a balance between a user who is receptive to the intervention, a high-quality digital instrument, and an appropriate framework at the policy and implementation levels. In order to accomplish this blend, the proposed tools must be user-friendly and possess an advantage over conventional service delivery methods. Furthermore, there should be no necessity for advanced training, or high-cost resource investment during their utilization.

## Conflict of Interest

None declared.


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# Socio-demographic Factors Influencing the Adoption of Digital Health Tools for Public Health Emergencies in Northern Nigeria

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***Abstract***

*This study assessed the determinants influencing the adoption of digital health tools for public health emergencies in primary healthcare centres in Nigeria. The research was conducted in registered primary healthcare centres located in Abuja-Federal Capital Territory, Niger, and Nasarawa in Northcentral Nigeria. A multistage sampling technique was employed, utilizing pretested semi-structured questionnaire for data collection. The findings revealed the recent implementation of 11 digital health tools. The tools were classified into categories: Disease Surveillance and Response Systems, Data Collection, Analytics, Visualization and Use, and Logistics and Supply Chain Management. Key factors affecting the adoption of these tools included Age ($\chi^2 = 203.64$, $p < 0.001$), Sex ($\chi^2 = 136.92$, $p < 0.001$), Marital Status ($\chi^2 = 44.64$, $p < 0.001$), Level of Education ($\chi^2 = 8.37$, $p = 0.007$), Rate of IT Knowledge ($\chi^2 = 228.22$, $p < 0.001$), Profession ($\chi^2 = 151.55$, $p < 0.001$), and PHC ($\chi^2 = 212.79$, $p < 0.001$). The findings indicate that multiple demographic and professional factors significantly influence the adoption of digital health tools. The research identified key factors that affect the effective implementation and adoption of these technologies. Identified key enablers comprise robust infrastructure, stakeholder engagement, policy development, financial sustainability, and user-centred design. By addressing these barriers and leveraging identified enablers, Nigeria can improve its preparedness and response to public health emergencies, thereby enhancing healthcare outcomes and greater equity in health services. This study offered insights and recommendations for policymakers and practitioners focused on advancing sustainable digital health initiatives Nigeria.*

***Keywords:*** *Digital Health, Nigeria, Primary Healthcare Centres, Public Health Emergencies.*

## Introduction

It is essential to prioritize the integration of digital health into community and primary healthcare initiatives in order to improve and monitor access to outstanding and equitable health services [1]. The primary healthcare infrastructure in Nigeria is unstable, which poses a substantial challenge to the Nigerian healthcare system, according to the 2019 report released by the Federal Government of Nigeria [2]. The inadequacies in the robustness and resilience of health systems were exposed by the COVID-19 pandemic, according to [3]. They were certain that multi-dimensional initiatives to strengthen health systems will be essential for achieving the necessary preparedness and agility to address future public health crises.

The healthcare sector is becoming more reliant on information. At present, the provision of healthcare necessitates the implementation of information-intensive business processes. In order to improve population health through evidence-based decision-making, healthcare administrators are increasingly relying on real-time information exchange that is derived from high-quality, easily accessible data.

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The implementation of digital health technologies can facilitate, sustain, and accelerate progress in universal health coverage (UHC) [4]. The alignment of catalytic mechanisms to facilitate the dissemination and gradual adoption of digital health technologies, with the integration of information and communication technologies (ICTs) and enhanced organizational capacity, supported by appropriate systems, structures, and resources, has proven essential for fostering rational and effective decision-making. This is in addition to the implementation of efficient people-centered management practices that aim to improve information flow [5]. Health systems must consistently adapt and modify themselves to align with local circumstances, ensuring a coordinated response to the requirements and expectations of the population, despite the fact that the implementation of health services should vary by context.

It is imperative to capitalize on the impetus of evolving health concerns, requirements, and expectations in order to expedite the adoption of innovative technology. Investing in and promoting synergy, alleviating restrictive obstacles, enhancing interoperability, and developing user-friendly platforms to expedite coordination, communication, and decision-making are all ways to achieve this.

Data is essential for informing policy, strategic, and evidence-based decision-making, monitoring provider performance and implementing regulatory measures, and creating evidence-informed tools for the high-quality and consistent delivery of services [6].

Technology improves efficiencies in clinical and public health. It significantly enhances disease prevention, surveillance, case identification, investigation, and follow-up without causing significant disruptions to the standard workflow [7]. And this can be accomplished without the introduction of any additional significant challenges.

The utilization of digital health tools is becoming increasingly important in the administration of public health emergencies, particularly in primary healthcare centers in low- and middle-income countries (LMICs) like Nigeria.

Digital health tools encompass a variety of technologies that are designed to enhance the delivery and management of health services. These tools are indispensable for optimizing the timeliness, precision, and efficiency of health data collection, disease surveillance, and response initiatives. In the event of public health emergencies, such as infectious disease outbreaks, these tools are indispensable for facilitating the rapid and efficient response by healthcare professionals. The rapid detection, notification, and response to public health risks/emergencies are essential components of surveillance, which is a core competency in International Health Regulation (IHR). Consequently, a surveillance system that is both sensitive and adaptable is required, as well as an early warning function, to monitor epidemics and detect changes in epidemiological data in a timely manner to enable effective action [8].

A disease surveillance system must be adaptable enough to accommodate the changing requirements of public health systems. This includes the automation of data collection and real-time task processing, the integration of robust data analytics and connected visualizations, and the linking of surveillance systems between siloed systems to facilitate communication and actionable information sharing with public health partners across organizational boundaries. Nevertheless, digital technologies offer the potential to improve the delivery of a diverse array of health services, increase the responsiveness of health systems to the needs of individuals and communities, and improve the accessibility of health services [6].

In Nigeria, primary healthcare centers (PHCs) are the primary point of contact for individuals seeking health care, thereby playing a critical role in the early detection and

management of public health emergencies. There are numerous challenges associated with the implementation of digital health tools in these contexts. It is essential to examine the factors that influence the adoption of these tools in order to develop strategies that will effectively overcome obstacles and encourage their sustainable adoption. PHCs serve as the frontline in the healthcare delivery system in Nigeria, providing essential services to vast populations, particularly in rural and underserved areas. In these settings, the timely adoption of digital health tools can greatly improve disease surveillance, data collection, health information management, and logistics. However, several determinants influence the implementation and sustainable adoption of these tools, and understanding these factors is crucial for developing effective strategies to address barriers and leverage enablers.

Primary healthcare professionals expressed their apprehensions regarding the lack of sufficient involvement in the planning process, the absence of a contextual and comprehensive national policy and plans for e-health, and the downsizing of implementation at the local level, which is also contingent upon the active participation of all stakeholders in the planning and implementation process [9]. Hence, the determinants that influence the use and sustainable adoption of digital health tools for public health emergencies in PHCs in Nigeria were the focus of our study.

This research underscores the significance of a variety of demographic and professional factors, such as age, sex, marital status, education level, IT knowledge, and profession, in influencing the adoption of digital health tools. This study also investigated determinants to provide a deeper understanding of the enablers and barriers that influence the adoption of digital health tools in PHCs in Northern Nigeria. The results will offer policymakers, healthcare providers, and other stakeholders, practicable strategies on how to effectively promote and sustain the adoption of digital health technologies for public health emergencies within the scope of the study.

One of the objectives of this research is aimed at assessing the implementation of the digital health tools adopted for public health emergencies; of course, towards enhancing healthcare outcomes and promote equity in health services in Nigeria and other LMICs.

Nigeria encounters recurrent natural and environmental calamities, alongside violent conflicts such as insurgency and sectarian strife. Nigeria's public health concerns are escalating due to fast population growth, increased mobility, infrastructure degradation, and outbreaks of infections, especially in Northern Nigeria. The governments of Liberia, Guinea, and Sierra Leone demonstrated a delayed response in implementing necessary emergency measures and maintaining a consistent communication strategy during the Ebola outbreaks in West Africa, which hindered the effective containment of the outbreak [10]. Nigeria's public health system has experienced a significant rise in cases and fatalities since January 2024 [11], as a result of cholera outbreaks that have been reported in more than 35 states. During any emergency situation, data is gathered that possesses the potential to guide actions and enhance the quality, efficiency, or impact of the response [12]. This may encompass activities such as identifying and prioritizing gaps and needs, mobilizing existing resources and efforts, coordinating response initiatives to prevent redundant efforts, advocating for the allocation of resources, or monitoring interventions [12]. Surveillance data, like survey data, are predominantly quantitative and collected using standardized tools and forms. This can be accomplished through the use of active methods, such as soliciting information from communities. Alternatively, employing passive methodologies, such as meticulously documenting every case presented at the health center [13].

Digital health is a dynamic domain within the health sector that has the potential to aid in achieving health objectives by providing timely, accurate, and comprehensive health information to inform decision-making and service provision. In light of the imperative to integrate emerging domains such as artificial intelligence, big data, and genomics, as well as the application of advanced computing sciences, the phrase "digital health" is becoming increasingly prevalent [14].

Health 4.0, which is derived from the principles of Industry 4.0, is a transformation in the healthcare industry's business model. It is designed to improve interactions among healthcare clients (patients), infrastructure, and various stakeholders, as stated by [15]. It emphasizes the importance of innovative technologies in the provision of cost-effective, value-added, and improved healthcare services, as well as in the delivery of healthcare. These technologies were defined as resources management applications, patient-centered applications, tools for healthcare professionals, systems for epidemic and pandemic preparedness, and advanced healthcare systems management applications [16].

Every country faces a significant social and economic challenge regarding healthcare. Currently, healthcare administrators, clinicians, researchers, and other practitioners in the field are under increasing pressure due to escalating public and private expectations [17]. The escalating costs of healthcare have significant effects on the quality of life of individuals. Concurrently, the persistent increase in population has a substantial impact on the demand for healthcare, necessitating the development of novel and more complex scientific interventions [18]. Although, the advancements in ICTs have significantly contributed to the development and enhancement of healthcare solutions in recent times, the deployment of digital health in Africa has several challenges, including poor coordination of pilot projects, deteriorating healthcare systems, lack of awareness and comprehension, inadequate infrastructure, and non-interoperability issues [19], [20], [21].

It is evident that Africa is currently grappling with fragmented digital health deployment endeavours. But this perceived missing link is yet to be fully explored through necessary empirical research in Nigeria to date. Despite their potential benefits, the uptake and sustainable integration of digital health tools in Nigerian primary healthcare centres remain fraught with challenges. Therefore, this study was designed to examine the factors that influences adoption of digital health tool in primary healthcare centres in Nigeria. It is this gap in research that this study intends to fill to extend the frontiers of knowledge in digital healthcare management.

Furthermore, there is insufficient information regarding the factors that influence the sustainable adoption of digital health tools in primary healthcare settings, particularly in Northern Nigeria, where they are intended to be used by healthcare professionals. Consequently, the objective of this research is to investigate the variables that affect the sustainable adoption and utilization of digital health instruments in PHCs in Nigeria. This research focused on a comprehensive range of factors, including demographic characteristics (such as age, sex, and marital status), educational levels, IT knowledge, and professional backgrounds of the healthcare workers. In addition, it examines the technical and infrastructural elements that facilitate or hinder the integration of digital health solutions.

The problem is further compounded by the diverse and complex healthcare landscape in Nigeria, where disparities in infrastructure, resource allocation, and policy implementation pose significant challenges. In the face of these obstacles, there is an urgent need for targeted research to identify and address the specific determinants that impact the adoption of digital health tools in Nigerian PHCs.

By providing a contextual analysis of these factors, this study aims to inform policymakers, healthcare providers, and other stakeholders on the critical areas that require attention to enhance the effective use adoption of digital health technologies.

The ultimate goal is to improve the readiness and capacity of primary healthcare centres in Nigeria to manage public health emergencies, thereby contributing to better health outcomes and increased resilience in the healthcare system.

## Methodology

### Study Design

This study utilized a cross-sectional facility-based design.

### Study Area

This study was undertaken in three states of the Northern region: Nasarawa, Niger, and FCT-Abuja.

### Study Population

The study population included doctors/nurses, disease surveillance and notification officers (DSNOs), local government area monitoring and evaluation officers (M&EOs), record officers, community health extension workers (CHEWs), and community health workers (CHWs) from the State Primary Healthcare Development Agency of the respective states.

### Inclusion Criteria

Recruitment for the study was limited to healthcare professionals within the jurisdiction of the SPHCDA (State, LGA and HF levels) who are 18 years and above and have given their consent to participate.

### Exclusion Criteria

Non-healthcare professionals and healthcare workers who have not given their consent were excluded from the study.

### Sample Size Determination

The sample size for the quantitative sample was calculated using the standard formula for estimating a single population proportion:

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}}\right)^2 P(1-P)}{d^2}$$

$Z_{1-\frac{\alpha}{2}}$= Standard normal variate (at 5% type 1 error ($\hat{P}$<0.05) is 1.96)

P = Expected proportion in population based on previous studies implementing digital health=27.3% [22]

d = Absolute error or precision=0.05

$$n = \frac{(1.96)^2 0.273 \times (0.727)}{0.05^2} = 305$$

$$n = 113\ per\ group$$

Non-response rate: Individuals may decline to participate while they have been selected through random methods.

By accounting for a 10% non-response rate:

*Final sample size*=Effective sample size/1-NR anticipated

$$n = \frac{305}{0.9} = 339$$

### Sampling Technique

The multi-stage sampling technique was carried out in this investigation. The first stage entailed the purposive selection of one geopolitical zone (Northcentral) from the six geopolitical zones in Nigeria, with a focus on the level of security hazards, particularly armed insurgency. From the seven (7) states in the Northcentral geopolitical zone, three (3) were selected through a simple random sampling process by balloting: Abuja, Niger, and Nasarawa.

In the third stage, balloting is employed to identify two (2) LGAs per senatorial district in each of the selected states that have the highest number of accessible PHCs and have implemented digital health tools for public health emergencies. The fourth stage involved purposive sampling method to identify accessible primary healthcare centers where digital health tools have been implemented within the chosen local government areas. The

study's recruitment focused exclusively on healthcare professionals working under the State Primary Health Care Development Agency's jurisdiction, who are 18 years or older and have provided their consent to participate.

### Data Collection Methods

Research assistants were recruited from each state and received training on the data collection instrument after the questionnaire was translated into ODK (Open Data Kit), a user-friendly application for data collection designed for the Android operating system. The pre-tested semi-structured questionnaire was administered among healthcare professionals who actively engaged in the implementation of digital health tools.

### Validation of Questionnaire

The reliability of the instrument was assessed by using a subset of the sample size, specifically 10%, and the questionnaire was distributed to a population comparable to the sample population in a different State. Necessary modifications were done following the pre-test.

The validation of the digital health survey instrument was conducted through the application of Cronbach's alpha. The Cronbach alpha value range of the e-value scale indicated a satisfactory validation estimate of 0.93. Furthermore, the Cronbach alpha value remained within a similar range when an item was deleted.

### Data Management and Analysis

To increase accuracy, data was entered, refined, and encoded. Our evaluation assessed their comprehensiveness and reliability. Next, the questionnaire was carefully inspected for errors, coded, and entered into SPSS version 25.0. Descriptive and inferential statistics were used. For bivariate analysis, Chi-square was used. Structural equation Modeling (SEM), a multivariate technique, was used to estimate and test complex correlations between dependent and independent variables and show how they interact.

For this investigation, a p-value of less than 0.05 indicated 95% confidence.

### Ethical Considerations

Ethical clearance was secured from the National Health Research Ethics Committee of Nigeria (NHREC), with the approval number NHREC/01/01/2007-28/06/2024. The study participants provided informed verbal and written consent prior to completing the questionnaire, following an explanation of the study's objectives and significance. The collected data was maintained in a confidential manner. The questionnaire was composed in English, the language comprehended by the participants in the study area. All data collected for this study underwent coding, and no names or identities would be utilized in any publications or reports.

## Results

The characteristics of the participants recruited for this study from the selected PHCs in the three states are presented in Table 1. The majority of participants, 105 (34.0%), were between the ages of 31 and 40. And the majority of health practitioners, 195 (63.1%), were male. Furthermore, a substantial proportion of the participants were married, with 243 (78.6%), and 305 (98.7%) having completed at least tertiary education, respectively. In addition, 109 individuals (35.3%) exhibited a minimum level of IT knowledge. The plurality of PHCs, 168 (54.4%), were situated in rural areas and utilized at least one digital health tool.

**Table 1.** Descriptive Statistics of the Respondents' Characteristics

| Variable | Frequency | Percentage |
|---|---|---|
| Age | | |
| 21-30 | 57 | 18.4 |

| | | |
|---|---|---|
| 31 – 40 | 105 | 34.0 |
| 41 – 50 | 101 | 32.7 |
| 51 Above | 46 | 14.9 |
| Sex | | |
| Male | 195 | 63.1 |
| Female | 114 | 36.9 |
| Marital Status | | |
| Single | 63 | 20.4 |
| Married | 243 | 78.6 |
| Separated/Divorced | 3 | 1.0 |
| Level of Education | | |
| Primary/secondary | 4 | 1.3 |
| Tertiary | 305 | 98.7 |
| Rate of IT Knowledge | | |
| Fairly | 109 | 35.3 |
| Minimum | 120 | 38.8 |
| Maximum | 77 | 24.9 |
| None | 3 | 1.0 |
| Profession | | |
| Doctor/Nurse | 90 | 29.1 |
| CHEW/DSNO | 82 | 26.5 |
| Record officers | 137 | 44.3 |
| PHC location | | |
| Rural | 168 | 54.4 |
| Semi-Urban | 88 | 28.5 |
| Urban | 53 | 17.2 |
| Digital Health Tools | | |
| SORMAS | 9 | 2.9 |
| ODK | 77 | 24.9 |
| DHIS2 | 21 | 6.8 |
| eIDSR | 2 | 0.6 |
| EMID | 1 | 0.3 |
| LoMIS | 8 | 2.6 |
| RI SMS | 2 | 0.6 |
| NIPDS | 29 | 9.4 |
| E-HEALTH CARD | 34 | 11.0 |
| Survey CTO | 56 | 18.1 |
| OpenLMIS | 70 | 22.7 |

## Descriptive Statistics of Digital Health Tools

The questionnaire was utilized to assess participants' perceptions regarding the usefulness, ease of use, relative advantages, awareness, risks, data security, infrastructure, critical success factors, staff experience, information sharing, and the technical

infrastructure related to the adoption of digital health tools.

In the subscale evaluating the perceived usefulness of the digital health tool, around 150 respondents (48.5%) agreed that these tools improve their task completion capabilities, while 202 respondents (65.4%) recognized that digital health tools streamline their work processes or simplify their tasks. Regarding ease of use, the subscale indicated that 79 (25.6%) participants experienced general frustration with digital health tools/systems, whereas 228 (73.8%) stated that they found these tools/systems easy to use. The majority of participants indicated access to the available digital health tools, with 214 (69.3%), and 203 (65.7%) expressing an understanding of the benefits associated with their use. A considerable portion of participants, 88 (28.5%), indicated an inconsistency in electricity supply, whereas 71 (23.0%) voiced their discontent with the quality of the network at their facility. The subscale evaluating critical success showed that 244 individuals (79.0%) reported that the use of digital health tools enhances their control over their work, while 223 individuals (72.2%) indicated that these tools improve the quality of their work. In the information sharing subscale, 102 (33.0%) reported that digital health tools/systems improve information sharing within the health facility, whereas 154 (49.8%) indicated that these tools/systems facilitate information sharing with other health facilities. A significant portion, 192 (62.1%), agreed that an overemphasis on safeguarding patients' privacy affects the use of digital health tools and systems. The technical infrastructure subscale revealed that 216 (69.9%) and 244 (79.0%) participants concurred that the IT budget of the health facility is adequate to maintain and support the digital health tools/system; and that the current infrastructure of the health facility is sufficient to support the digital health tools/system, respectively.

## Available Digital Health Tools for Public Health Emergencies in Primary Healthcare Settings Across the Three States

We assessed the diverse digital health tools that have been implemented in the PHCs for public health emergencies over the past five years. Overall, approximately 11 digital health instruments have been implemented during this period. The primary tool employed during this timeframe was ODK 77 (24.9%), followed by OpenLMIS 70 (22.7%), survey CTO 56 (18.1%), E-health card 34 (11.0%), NIPDS 29 (9.4%), SORMAS 9 (2.9%). However, RI SMS was the least utilized instrument, with a usage rate of only 0.6%.

## Categories of Assessed Digital Health Tools

**Table 2.** The Three Groups of the Assessed Digital Health Tools

| | Frequency | Percentage |
|---|---|---|
| Digital Health Tools | | |
| Logistics & Supply Chain Management | 80 | 25.9 |
| Disease Surveillance & Response Systems | 41 | 13.3 |
| Data Collection, Analytics, Visualization & Use | 188 | 60.8 |

**Disease Surveillance & Response Systems:** SORMAS, eIDSR, NIPDS

**Data Collection, Analytics, Visualization & Use:** ODK, DHIS2, SurveyCTO, E-health Card, EMID

**Logistics & Supply Chain Management:** LoMIS, RI SMS, OpenLMIS

A national case study conducted by the Federal Ministry of Health in 2022 reported that a number of these tools were collected as part

of the digital health tools for pandemic preparedness in Nigeria.

## Socio-demographic Factors that Influences the Adoption of Digital Health Tools

**Table 3.** Assessing the Relationship between Responses from the Digital Health Survey and Digital Health Tools

| Variable | Logistics & Supply Chain Management n (%) | Disease Surveillance & Response Systems n (%) | Data Collection & Health Information Management n (%) | Chi-square | p-value |
|---|---|---|---|---|---|
| Age | | | | | |
| 21-30 | 0 (0.0) | 9 (22.0) | 48 (25.5) | 203.64 | <0.001 |
| 31 – 40 | 10 (12.5) | 32 (78.0) | 63 (33.5) | | |
| 41 – 50 | 24 (30.0) | 0 (0.0) | 77 (41.0) | | |
| 51 Above | 46 (57.5) | 0 (0.0) | 0 (0.0) | | |
| Sex | | | | | |
| Male | 10 (12.5) | 41 (100.0) | 144 (76.6) | 136.92 | <0.001 |
| Female | 70 (87.5) | 0 (0.0) | 44 (23.4) | | |
| Marital Status | | | | | |
| Single | 0 (0.0) | 9 (22.0) | 54 (27.7) | 44.64 | <0.001 |
| Married | 77 (96.3) | 32 (78.0) | 134 (71.3) | | |
| Separated/Divorced | 3 (3.8) | 0 (0.0) | 0 (0.0) | | |
| Level Education | | | | | |
| Primary/secondary | 4 (5.0) | 0 (0.0) | 0 (0.0) | 8.37 | 0.007 |
| Tertiary | 76 (95.0) | 41 (100.0) | 188 (100.0) | | |
| Rate of IT Knowledge | | | | | |
| None | 3 (3.8) | 0 (0.0) | 0 (0.0) | 228.22 | <0.001 |
| Fairly | 0 (0.0) | 11 (26.8) | 98 (52.1) | | |
| Minimum | 10 (12.5) | 30 (73.2) | 80 (42.6) | | |
| Maximum | 67 (83.8) | 0 (0.0) | 10 (5.3) | | |
| Profession | | | | | |
| Doctor/Nurse | 0 (0.0) | 9 (22.0) | 81 (43.1) | 151.55 | <0.001 |
| CHEW/DSNO | 10 (12.5) | 32 (78.0) | 40 (21.3) | | |
| Record officers | 70 (87.5) | 0 (0.0) | 67 (35.6) | | |
| PHC | | | | | |
| Rural | 10 (12.5) | 41 (100.0) | 117 (62.2) | 212.79 | <0.001 |
| Semi-Urban | 17 (21.3) | 0 (0.0) | 71 (37.8) | | |
| Urban | 53 (66.3) | 0 (0.0) | 0 (0.0) | | |

Table 3 presents an analysis of the socio-demographic factors that influence the adoption of digital health tools. The factors are categorized into three domains: Logistics & Supply Chain Management, Disease Surveillance & Response Systems, and Data Collection, analytics, visualization & use.

The analysis demonstrated a highly significant relationship between age and adoption in all three domains ($\chi^2 = 203.64$, $p <$

0.001). The majority of individuals in the Logistics & Supply Chain Management field were 51 years of age or older, with 57.5% of the workforce. Conversely, the younger age groups, specifically those between 21 and 30, were underrepresented. In contrast, respondents aged 31-40 exhibited a predominant adoption rate of 78.0% for the Disease Surveillance & Response Systems. The instruments for Data Collection & Health Information Management were primarily used by respondents in the 41-50 age range, which comprised 41.0% of users. Males constituted the majority of users in Data Collection & Health Information Management (76.6%), and they were entirely dominant in the Disease Surveillance & Response Systems (100.0%).

Furthermore, the adoption of digital health instruments was significantly influenced by sex ($\chi^2 = 136.92$, $p < 0.001$). The primary consumers of all three systems were individuals in marital relationships, particularly in Logistics & Supply Chain Management (96.3%) and Data Collection & Health Information Management (71.3%) ($\chi^2 = 44.64$, $p < 0.001$). Adoption was significantly influenced by the level of education ($\chi^2 = 8.37$, $p = 0.007$). In all areas, individuals with tertiary education exhibited virtually complete adoption. They achieved 100% adoption in both Disease Surveillance & Response Systems and Data Collection & Health Information Management, as well as 95.0% adoption in Logistics & Supply Chain Management. The respondents with the highest level of IT expertise were the primary adopters of Logistics & Supply Chain Management, with 83.8% of the sample. Conversely, those with the least knowledge were predominantly engaged in Disease surveillance and response, which was statistically significant ($\chi^2 = 228.22$, $p < 0.001$). The adoption of digital health instruments was significantly influenced by the role of profession ($\chi^2 = 151.55$, $p < 0.001$). Record officers primarily employed Logistics & Supply Chain Management (87.5%), while CHEW/MRO/DSNO professionals primarily adopted Disease Surveillance & Response Systems (78.0%). Healthcare personnel exhibited a higher propensity to employ Data Collection & Health Information Management (43.1%). Data Collection & Health Information Management was significantly adopted in semi-urban regions (37.8%), while rural primary health centers were the primary implementers of Disease Surveillance & Response Systems (100.0%). The adoption of Logistics & Supply Chain Management was significantly represented in urban centers, with a percentage of 66.3% and $p < 0.001$.

**Table 4.** Association between Users' Perceptions, Literacy, and Experiences in Implementing and Adopting the Digital Health Tools

| **Independent variables** | **Dependent variables**<br>**Digital health tools in used** | **Estimate** | **p-value** |
|---|---|---|---|
| Perceived Usefulness | Disease Surveillance & Response Systems | -.116 | 0.04 |
| IT Knowledge | Disease Surveillance & Response Systems | .082 | 0.15 |
| Education | Disease Surveillance & Response Systems | .017 | 0.77 |
| Perceived Usefulness | Data Collection & Health Information Management | .183 | <0.001 |
| IT Knowledge | Data Collection & Health Information Management | -.205 | <0.001 |
| Education | Data Collection & Health Information Management | .155 | 0.004 |
| Perceived Usefulness | Logistics & Supply Chain Management | -.002 | 0.96 |
| IT Knowledge | Logistics & Supply Chain Management | .712 | <0.001 |
| Education | Logistics & Supply Chain Management | -.317 | <0.001 |

### Association between Users' Perceptions, Literacy, and Experiences in Implementing and Adopting the Digital Health Tools

The associations between the implementation of digital health tools and users' perceptions, IT knowledge, and education levels are illustrated in Table 9 and Figure 2 below. The use of tools for data collection and health information management was significantly associated with user perception of the usefulness of digital health tools (Estimate: 0.183, p-value: <0.001). However, there was no significant effect in the area of Logistics and Supply Chain Management (Estimate: -0.002, p-value: 0.96). In addition, IT Knowledge exhibits a positive correlation (Estimate: 0.082, p-value: 0.15) with Disease Surveillance & Response Systems tools and a stronger correlation (Estimate: 0.712, p-value: <0.001) with Logistics & Supply Chain Management tools. However, this pattern does not hold for Education.

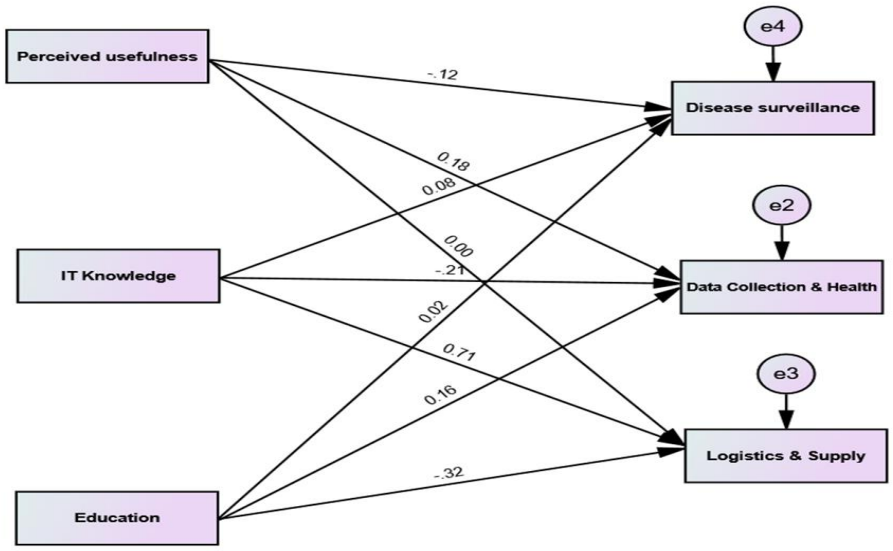


**Figure 1:** Pathway Analysis to Access actual Users' Perceptions, Literacy, and Experiences in Implementing and Adopting the Digital Health Tools.

## Discussion

The demographic characteristics of the individuals selected for this study from various primary health facilities across three states in Northern Nigeria are notably significant.

The majority of participants, 105 (34.0%), were between the ages of 31 and 40. This finding is consistent with the research conducted by [23]. The age group of 31-40 is particularly significant because it frequently represents a techno-savvy and professionally active segment of the population, which is essential for the sustainable adoption of digital health tools. Most of the health practitioners, 195 (63.1%), were male.

This finding is typical in other developing countries [24], [25], but it is not the case in developed countries, where people of both sexes have rights that are nearly equivalent to one another [26], [27].

The World Health Organization reports that 70% of the worldwide health workforce comprises females, a phenomenon referred to as the feminization of healthcare occupations. In Nigeria, women represent the predominant demographic among medical doctors and nursing and midwifery personnel, according to data from 2018 indicating that 65% of physicians and 87% of nursing staff were female [28]. Nonetheless, Trained healthcare workers on the frontlines in Northern Nigeria are predominantly male because of insufficient educational attainment among girls. The gender imbalance among healthcare professionals in Northern Nigeria is a critical concern. The

region encounters obstacles, including less educational achievement among girls, which constrains their prospects of becoming skilled healthcare professionals. Consequently, the majority of skilled healthcare professionals are male [29].

Conversely, a significant number of unskilled healthcare workers, including community health volunteers, are primarily female. This circumstance is shaped by cultural norms and the restricted presence of female healthcare practitioners [29].

Initiatives to rectify this discrepancy encompass enhancing educational possibilities for girls and fostering community involvement to endorse the acceptance of healthcare services provided by male frontline health workers [30].

In addition, a substantial proportion of participants were married, with 243 (78.6%) and 305 (98.7%) having completed at least tertiary educations. This indicates a well-educated and potentially stable demographic, which may positively influence the sustained use of these tools. The adoption and sustainable use of digital health instruments in primary healthcare centers in Nigeria can be influenced by a variety of factors, including the marital status of healthcare workers. Healthcare professionals who are married frequently balance their professional obligations with their family obligations. This dual role can have an impact on their capacity to engage with and implement new technologies, particularly if these tools necessitate additional training or time investment [31].

Furthermore, the tension associated with the adoption of new technologies may be mitigated by the fact that married individuals may have more robust support systems at home. This assistance may be provided by spouses or extended family members who assist in the management of domestic responsibilities.

Marriage can offer a sense of motivation and stability. Healthcare professionals may be more inclined to adopt digital health tools that can enhance their work efficiency and patient care when they feel supported at home [31]. It is interesting to note that the adoption of digital health instruments is contingent upon the availability of training and ongoing professional development. Healthcare professionals who are married may encounter difficulties in attending training sessions as a result of family obligations, which may impact their proficiency with these tools.

The success of the adoption of digital health tools is also contingent upon the policies and support supplied by healthcare institutions. Married healthcare professionals can more effectively engage with digital health initiatives and balance their responsibilities by utilizing flexible work schedules, on-site childcare, and other supportive measures.

In general, the key to sustainable adoption is the establishment of an environment that accommodates the diverse needs and circumstances of healthcare workers, despite the fact that marital status can present both challenges and advantages.

In addition, 109 respondents (35.3%) exhibited a minimum level of IT knowledge. There is a similarity between this and a study that was carried out in one of the Northern States of Nigeria [24]. A number of factors have an impact on the minimum level of information technology proficiency of primary health workers in Northern Nigeria: The majority of primary health care institutions in Northern Nigeria are confronted with considerable resource limitations, such as insufficient financing for information technology infrastructure and training [32]. This makes it more difficult to provide health staff with the appropriate information technology skills and tools. It is common for there to be a dearth of all-encompassing training programs that are centered on information technology skills for those who work in the health care industry. It's possible that the training programs that are currently available don't effectively address the utilization of digital tools and technology that

are necessary for the delivery of modern healthcare [32].

It is possible that the region has limited access to dependable internet and energy, both of which are essential for the efficient utilization of information technology in the healthcare industry. In addition, the development and utilization of information technology solutions are both hampered by this infrastructure gap.

Although there are national standards and policies that are aimed at enhancing primary healthcare, the implementation of these policies and standards at the local level might be inconsistent.

It is necessary to develop targeted interventions in order to address these difficulties. These interventions should include greater financing, enhanced training programs, improved infrastructure, and effective policy implementation in order to strengthen the information technology capabilities of primary health workers in Northern Nigeria.

The majority of health centers, 168 (54.4%), were situated in rural areas and utilized at least one digital health tool. It is generally accepted that a sizeable percentage of PHCs in northern Nigeria are situated in villages and other rural areas. In comparison to metropolitan inhabitants, rural populations frequently encounter more obstacles while attempting to gain access to healthcare. The purpose of this distribution is to improve access to healthcare services for rural populations.

As part of broader efforts to improve health equity and guarantee that marginalized groups access vital health services [33], the focus on rural areas is a component of those general efforts. Nevertheless, the availability of services and the quality of such services might substantially fluctuate from one region and facility to another [34].

Across all three domains, the analysis demonstrated a highly significant relationship between age and adoption ($\chi^2 = 203.64$, $p < 0.001$). Thus, our research indicates that the age of individuals in Nigeria and sub-Saharan Africa can significantly influence their adoption of digital health solutions. It is crucial to note that the age group of 31-40 years was the greatest group of participants, with a total of 105 individuals, accounting for 34.0% of the sample. The utilization of digital health solutions is more prevalent among younger individuals employed in the health care sector. They are generally more inclined to integrate new digital solutions into their daily routines and possess a greater understanding of technology. Additional research has identified a statistically significant correlation between the age of the participants [22], [35]. This is in minor contrast to the results that digital device usage was correlated with older age [31]. The adoption of digital health solutions may present more challenges for older health professionals than for their younger counterparts. This may be the consequence of a desire for more traditional methods, an aversion to change, or a lack of familiarity with digital technology.

By offering older health personnel appropriate training and assistance, it is feasible to facilitate their adoption and utilization of digital health solutions in an effective manner.

In addition, this investigation underscores the substantial variables that determine the adoption of digital health instruments, including marital status, education level, IT proficiency, occupation, and geographic location. The findings indicate that the adoption of digital health instruments is significantly influenced by sex ($\chi^2 = 136.92$, $p < 0.001$), with persons in marital relationships being the primary users of all systems. The level of education also emerged as a critical factor, with individuals who have completed tertiary education exhibiting virtually complete adoption in all areas, particularly in data collection, analytics, and visualization; logistics and supply chain management, and disease surveillance and response systems ($\chi^2 = 8.37$, $p = 0.007$).

Sex's considerable influence on the adoption of digital health tools is in accordance with the World Health Organization's evaluation of the role of digital health technologies in promoting gender equality and improving the health of women [36]. Moreover, the willingness of healthcare personnel to utilize digital health tools was significantly correlated with their gender [22],[23].

However, marital status also came to be a significant determinant, as individuals in marital relationships were the primary users of all three systems. The utilization of digital health tools for the effective administration of healthcare may be attributable to the increased health management responsibilities that are frequently associated with family life.

Education level emerged as a significant factor, with respondents who possess higher education degrees exhibiting nearly complete adoption in all domains. This is consistent with the results of other research that suggests that improved access to resources and enhanced digital literacy are associated with increased technology adoption, which is attributed to advanced educational attainment. The full adoption rate of the categorized domains of digital health tools, among individuals with higher education underscores the importance of educational achievement in facilitating the use of advanced health technologies. A study was conducted to investigate the influence of digital health platforms on the improvement of healthcare delivery in Africa, underscoring the importance of education and training in the successful implementation of these technologies [37].

The methodology for scoping reviews outlined the impact of digital health interventions on health systems and the importance of higher education in facilitating the successful adoption and implementation of these tools [38].

The necessity of healthcare professionals' education and training is underscored, as it examines the implementation of a variety of digital health applications in numerous countries, including Nigeria [39].

Respondents with advanced IT skills exhibit the greatest adoption rates (83.8%), which is indicative of the significant impact of IT expertise on the adoption of logistics and supply chain management tools. This result is consistent with research that suggests technical proficiency is essential for the effective utilization of digital health tools [9], [23]. In Sub-Saharan Africa, the success of digital health will be contingent upon the health workforce's proficiency in digital technologies [40]. In contrast, individuals with limited IT expertise were primarily involved in disease surveillance and response, which emphasizes the need for specialized training initiatives to address these skills divide.

The profession's influence on the adoption of digital health tools was significant ($\chi^2 = 151.55$, $p < 0.001$). The subsequent research revealed that a variety of healthcare practitioners [9], [23], [35] utilize digital tools. The importance of profession was underscored by our research, as record officers primarily employed logistics and supply chain management (87.5%), while CHEW/DSNO professionals mostly employed disease surveillance and response systems (78.0%). Various professional positions within the healthcare system are associated with distinct requirements and responsibilities, as evidenced by the observed patterns.

Adoption rates were significantly influenced by the geographical location, as rural primary health centres demonstrated exceptional proficiency in the implementation of disease surveillance and response systems, attaining an impressive 100.0% rate ($\chi^2 = 212.79$; $p < 0.001$). The findings slightly contradict research, which posits that metropolitan regions generally have superior infrastructure and resources to encourage the adoption of advanced digital health technologies [41]. This information can be used to guide future research and development initiatives, ensuring

that digital health solutions are both effective and accessible.

Further, the adoption of digital health tools was positively correlated with IT knowledge. Although there was a moderate positive correlation between IT knowledge and the utilization of Disease Surveillance & Response Systems tools (Estimate: 0.082, p-value: 0.15), this correlation did not attain statistical significance. A substantial positive correlation was observed between the utilization of Logistics and Supply Chain Management tools and IT knowledge (Estimate: 0.712, p-value: <0.001). This pattern highlights the importance of IT proficiency in the effective administration of logistics and supply chain processes in the healthcare sector.

In the Education domain, the anticipated pattern of associations was not observed, indicating that the adoption and implementation of digital health tools in the assessed areas were not substantially influenced by education levels.

## Conclusion

The adoption of digital health instruments is significantly influenced by socio-demographic factors, as this study emphasizes. The analysis indicates that the adoption of digital health technologies is significantly influenced by factors such as age, sex, marital status, level of education, IT knowledge, and professional background. These results underscore the necessity of targeted strategies that take into account these socio-demographic variables in order to improve the adoption of digital health tools.

The adoption of digital health tools is intricate, influenced by a diverse array of demographic, educational, professional, and geographical factors, as evidenced by the examination of these findings in conjunction with other studies.

The findings of this study underscore the complex interplay of numerous factors that influence the adoption of digital health technologies in Nigeria. It is important to address these factors through targeted interventions, such as the improvement of IT training, the enhancement of digital literacy, and the guarantee of equitable access across multiple regions, in order to fully capitalize on the benefits of digital health technologies. It is critical to consider the unique requirements and preferences of various demographic groups in order to ensure the successful implementation of these technologies. For example, IT knowledge and skills can be enhanced among healthcare professionals through customized training programs, which in turn enhances their preparedness and capacity to effectively utilize digital health tools. Moreover, inclusive policies that address the specific obstacles encountered by different demographic groups can foster a more equitable distribution of access to digital health solutions. Policymakers, healthcare providers, and stakeholders can create interventions that are more sustainable and effective by comprehending and utilizing the socio-demographic factors that influence the adoption of digital health tools. This method not only enhances healthcare outcomes but also guarantees that digital health technologies are accessible to and advantageous to all demographics, thereby fostering greater health equity and more resilient healthcare systems.

## Conflict of Interest

None declared.


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