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Impact of a Mobile Application-Based Intervention on Mental Health and Stress Coping Strategies among Nurses: A Randomized Controlled Trial

Shyna Noronha

Department of Nursing, Texila American University, Georgetown, Guyana

Correspondence to be addressed: E-mail - noronhashyna@gmail.com

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Abstract *Health is wealth. Nurses serve as the backbone of the healthcare system. Yet, the demanding nature of clinical practice - including extended working hours, rotational shifts, low payrolls, emotional strain, and continuous exposure to occupational stressors - significantly affects their mental well-being and professional efficiency. This study aimed to evaluate the effectiveness of a mobile application-based intervention in enhancing mental health and reducing stress among nurses employed in tertiary care hospitals. A pre-test and post-test parallel-group design was adopted among 36 registered nurses selected through simple random sampling in Mangalore, Karnataka, India. Participants were allocated into intervention and control groups, with the intervention group receiving the wellness-focused mobile application for one month while the control group received standard information. Data were collected using validated instruments, including the WHO-5 Well-Being Index, Perceived Stress Scale (PSS-4), and Brief COPE Inventory. Statistical analysis incorporated descriptive and inferential measures such as paired t-tests, independent t-tests, and chi-square tests. Between-group comparisons at post-test showed that the intervention group had significantly lower stress scores and significantly higher coping scores than the control group, while mental health scores improved significantly within the intervention group over time but did not differ significantly from the control group at post-test, likely reflecting the modest sample size. These findings indicate that digital mental health strategies can meaningfully reduce stress and strengthen coping abilities among nurses, supporting further investigation of their potential to improve broader psychological well-being. This research study concludes that mobile application-based interventions offer an innovative, accessible, and cost-effective solution to enhancing mental health, stress management, and emotional well-being among nurses in healthcare settings.*

Keywords *Coping Strategies, Mental Health, Mindfulness, Mobile Health Application, Nurses, Occupational Stress, Psychological Well-being.*

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Introduction

Nursing is a noble and dedicated service. It is widely recognized as one of the most physically and emotionally demanding healthcare professions in a global arena. Nurses are responsible for continuous patient monitoring, emergency response, medication administration, communication with patients and families, and coordination of multidisciplinary health care. These responsibilities often expose nurses to excessive psychological pressure and emotional exhaustion. Long working hours, night shifts, staff shortages, heavy patient loads, workplace conflicts, and increasing healthcare demands contribute significantly to occupational stress among nurses.

Occupational stress is defined as the harmful emotional and physical response that occurs when workplace demands exceed an individual's ability to cope effectively. Persistent stress among nurses may lead to anxiety, burnout, depression, sleep disturbances, emotional fatigue, low job satisfaction, absenteeism, reduced productivity, and poor quality of patient care. In difficult situations, prolonged stress may also affect patient safety and organizational outcomes.

Mental well-being among nurses is essential for maintaining professional competence, emotional resilience, effective communication, and compassionate patient care. Nurses who are unable to cope effectively with stress are more likely to experience psychological distress and decreased work performance. Therefore, healthcare institutions increasingly recognize the importance of implementing evidence-based interventions to improve nurses' mental health and adaptive coping skills.

Recent advances in digital health technology have created new opportunities for mental health promotion and stress management. Mobile health applications offer flexible, accessible, and cost-effective psychological support through mindfulness exercises, guided meditation, relaxation techniques, stress monitoring, emotional regulation activities, and educational resources. Unlike traditional face-to-face interventions, mobile applications can be accessed conveniently at any time without interfering with work schedules.

Several international studies have reported favorable outcomes associated with digital mental health interventions among healthcare professionals. Mobile applications have demonstrated effectiveness in reducing stress, improving emotional well-being, enhancing mindfulness, and strengthening coping abilities. However, limited randomized controlled trials have specifically examined the effectiveness of mobile app interventions among nurses in Indian healthcare settings.

Pilot randomized controlled trials are important for evaluating intervention feasibility, user engagement, effectiveness, and implementation potential before large-scale adoption. Therefore, the present study was undertaken to examine the effectiveness of a structured mobile application intervention in improving mental health and stress coping strategies among nurses working in a tertiary care hospital.

Review of Literature

Occupational stress among nurses has been extensively documented in healthcare literature. Shivaprasad reported that nurses commonly experience stress because of workload imbalance, role ambiguity, and interpersonal conflicts in healthcare settings [1]. Sharma and colleagues observed that occupational stress adversely affects nurses' psychological and physical well-being, contributing to emotional exhaustion and reduced work performance [2]. Similarly, Adriaenssens et al. identified burnout and emotional fatigue as major psychological consequences among emergency nurses exposed to prolonged stress [3].

The role of digital technologies in mental health management has received increasing attention over the last decade. Proudfoot

emphasized the growing importance of mobile phones and digital applications in mental health promotion and treatment [4].

A randomized controlled trial conducted by Watanabe et al. evaluated a smartphone-based stress management intervention among nurses during the COVID-19 pandemic in Vietnam and Thailand [5]. The study demonstrated significant improvement in depressive symptoms and emotional well-being among nurses who received the intervention.

Linardon et al. performed a meta-analysis of app-supported mental health interventions and found that mobile applications showed modest but significant improvement in stress management outcomes and psychological functioning [6]. Firth et al. also reported that smartphone-based interventions effectively reduced depressive symptoms and promoted emotional health among users [7].

Indian studies have similarly highlighted the burden of occupational stress among nurses. Pai Vernekar and Shah reported high levels of work-related stress among nurses employed in tertiary healthcare institutions [8]. Sailaxmi and Lalitha found that structured stress management programs significantly improved stress perception among psychiatric nurses [9].

Jordan et al. observed that perceived stress and inadequate coping mechanisms negatively affected nurses' overall health and professional functioning [10]. Bhatia et al. identified high occupational stress levels among nurses working in tertiary hospitals because of excessive workload and organizational demands [11].

The importance of digital mental health interventions in India has also been emphasized in recent literature. Kumar et al. discussed the growing relevance of e-mental health initiatives in India while highlighting implementation challenges such as digital literacy and accessibility [12].

Tamminga et al., demonstrated that occupational stress prevention interventions could effectively improve psychological well-being among healthcare professionals [13]. Hersch et al. reported significant stress reduction among nurses participating in a web-based stress management intervention [14]. Babapour et al. reported that occupational stress negatively affected nurses' quality of life and caring behaviors [15].

Methodological guidance for pilot randomized controlled trials in healthcare has been described by Eldridge and Kerry Cottrell also emphasized the importance of evidence-based stress assessment and intervention strategies in mental health nursing [16].

Although global evidence supporting digital mental health interventions is growing, limited experimental research has been conducted among nurses in Indian clinical settings. Therefore, the present study aimed to address this research gap.

Need for the Study

Nurses are continuously exposed to stressful work environments that may negatively affect psychological well-being, emotional resilience, and professional performance. Persistent occupational stress contributes to burnout, absenteeism, poor patient outcomes, and decreased job satisfaction. Although healthcare organizations increasingly recognize the importance of mental health support, accessible and scalable stress management interventions remain limited.

Mobile health technologies provide flexible opportunities for delivering psychological support without interrupting clinical responsibilities. However, evidence regarding the effectiveness of mobile app-based mental health interventions among nurses in India remains inadequate. Therefore, this pilot randomized controlled trial was conducted to evaluate whether a structured mobile application could improve mental health and coping abilities among nurses.

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Theoretical Framework

The study was based on Cognitive Behavioral Theory (CBT) and Mindfulness-Based Stress Reduction (MBSR).

Cognitive Behavioral Theory

Cognitive Behavioral Theory explains how thoughts, emotions, and behaviors influence psychological functioning. The intervention incorporated behavioral activation strategies, coping exercises, emotional regulation techniques, and positive reinforcement activities designed to improve mental well-being.

Mindfulness-Based Stress Reduction

Mindfulness-Based Stress Reduction focuses on enhancing present-moment awareness and emotional regulation through mindfulness practices. The mobile application included guided meditation, breathing exercises, relaxation techniques, stretching activities, and mindfulness reminders to reduce stress and improve coping.

Aim of the Study

To evaluate the effectiveness of a mobile application intervention on mental health and stress coping strategies among nurses.

Objectives of the Study

1. To assess baseline mental health, stress levels, and coping strategies among nurses.
2. To implement a structured mobile application-based stress management intervention.
3. To compare post-intervention stress levels and coping strategies between intervention and control groups.
4. To determine the effectiveness of the intervention in improving mental health outcomes.

Hypotheses:

H1: Nurses receiving the mobile application intervention will demonstrate significantly improved mental health, lower stress levels, and better coping strategies compared with nurses in the control group.

H2: The intervention group will show significant improvement in psychological well-being and coping abilities following the intervention.

Materials and Methods

Research Design

A randomized controlled trial with a parallel-group pre-test and post-test design was adopted for the study.

Setting of the Study

The study was conducted at Fr. Muller's Charitable Hospital, Thumbay, Mangalore, India.

Population and Sample

The target population consisted of registered nurses working in various hospital departments, including medical wards, surgical wards, intensive care units, emergency units, operating theaters, pediatric wards, obstetric and gynecological units, and psychiatric departments.

A total of 36 nurses who met the eligibility criteria participated in the study. Participants were randomly assigned to:

1. Intervention group (n = 18)
2. Control group (n = 18)

Inclusion Criteria

- Registered nurses employed in the hospital.
- Nurses willing to provide informed consent.
- Nurses able to operate smartphone applications.
- Nurses with at least six months of work experience.

Exclusion Criteria

- Nurses diagnosed with severe psychiatric disorders.
- Nurses unable to use smartphones.

- Nurses are currently participating in another mental health program.
- Nurses on prolonged leave during the study period.

Randomization

- Participants were recruited through a digital link shared by the investigator and distributed directly via FMCI nursing leadership. This link allowed interested individuals to be assessed for eligibility.
- To ensure an unbiased distribution, simple randomization was performed with 1:1 allocation ratio. The randomization sequence was fully automated and generated by the application developer using computer-generated random numbers.
- Upon the successful completion of the informed consent process and pre-test in the digital link, the system automatically assigned the participating nurses to either the intervention or control group. To maintain study integrity and minimize contamination between groups, participants in the intervention group received restricted, authenticated access using participant number and password to the mobile application.

Description of the Intervention

Participants in the intervention group received access to the SHANTHI mobile application for a duration of six weeks, with instructions to engage with the content daily for approximately 10 to 30 minutes. To ensure strict intervention fidelity, user engagement was tracked via an administrative backend dashboard that logged individual session completions and precise total daily usage duration. Automatic reminders to use the app were sent out daily along with motivational quotes to encourage users to engage with the app (Figure 1 to 3).

Category	Metric	Value
EXPORT INFORMATION		
	Export Date	12/3/2025, 1:18:57 PM
	Export Filter	All Participants
PARTICIPANT OVERVIEW		
	Active Participants	41
	Intervention Group	23
	Control Group	18
	Demographics Completed	35
APP USAGE STATISTICS		
	Total App Sessions	212
	Average Session Duration (min)	8
	Total Session Time (hours)	29.3
PRETEST ASSESSMENT		
	Total Pretest Responses	41
	Registered Nurses	41
	Consented Participants	41
	WHO-5 Average Score (%)	80.5%
	PSS-4 Average Score	9.6
POSTTEST ASSESSMENT		
	Total Posttest Responses	36
	Posttest Completion Rate (%)	88%
	WHO-5 Average Score (%)	82.9%
	PSS-4 Average Score	9.3
	Responses with Feedback	9
DEMOGRAPHICS SUMMARY		
	Total Demographics Surveys	35

Figure 1. Research Dashboard Summary

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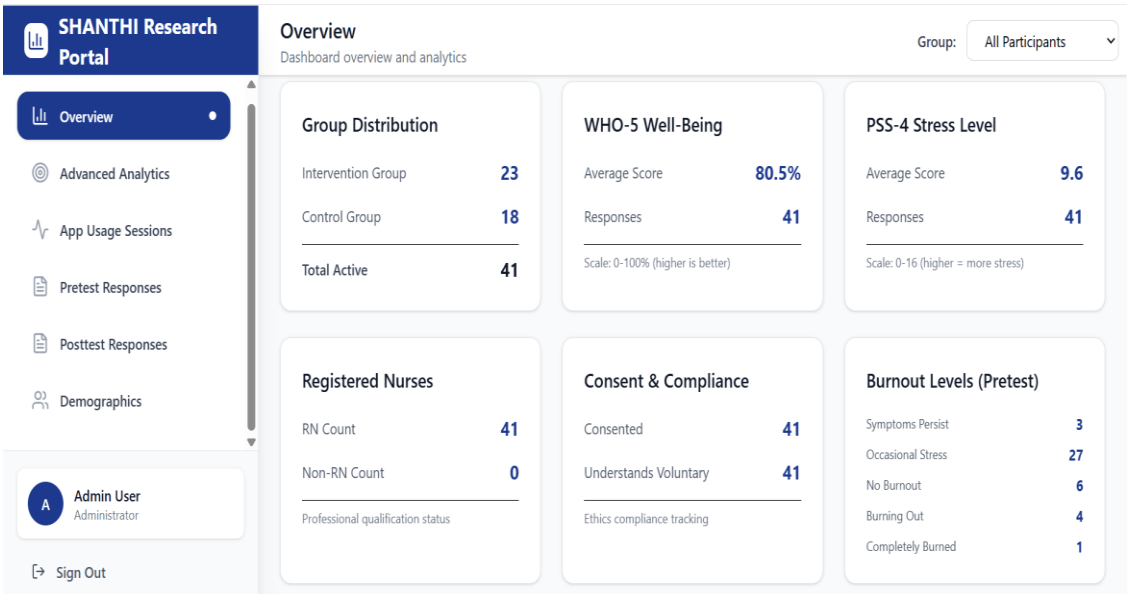

Figure 2. Administrative Backend Dashboard

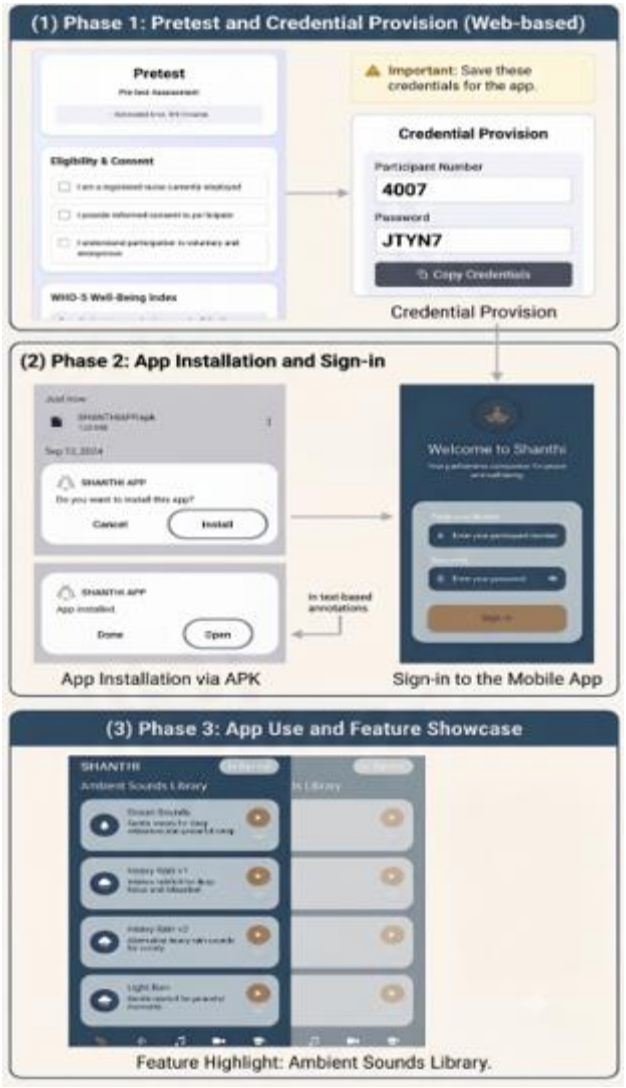

Figure 3. User Flow of SHANTHI App

The app included:

- Guided meditation sessions
- Mindfulness exercises
- Breathing technique guides
- Educational courses on stress management and other self-care
- Motivational reminders and app achievements

Participants were encouraged to use the application daily for approximately 10-30 minutes.

The control group received general wellness education without access to the mobile application.

Data Collection Tools:

The investigator used the following for data collection:

- Socio-demographic questionnaire
- WHO-5 Well-Being Index
- Perceived Stress Scale (PSS-4)
- Brief COPE Inventory
- App usage records

Validity and Reliability

Standardized instruments with established validity and reliability were used in the study. The WHO-5 Well-Being Index, PSS-4, and Brief COPE Inventory have demonstrated satisfactory psychometric properties in previous studies.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee before data collection. Written informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the study. Participation was voluntary, and participants had the right to withdraw at any stage.

Statistical Analysis

Data were analyzed using descriptive and inferential statistical methods. Frequency, percentage, mean, and standard deviation were used for descriptive analysis. Chi-square tests were applied to assess baseline homogeneity between groups. Paired t-tests and independent t-tests were used to evaluate intervention effectiveness. Statistical significance was considered at $p < 0.05$.

Results

Demographic Characteristics:

The intervention and control groups were comparable with respect to age, gender, marital status, educational qualification, years of experience, salary, working department, shift pattern, and residence. Chi-square analysis demonstrated no statistically significant differences between groups at baseline, indicating homogeneity.

Comparison of Mean Post-test Mental Health, Stress and Coping Strategies Levels between Intervention and Control Groups

Table 1. Comparison of Mean Post-test Level of Mental Health, Stress and Coping Strategies between Experimental and Control Group

N=18

Variables	Point of testing	Group	Mean	SD	SEM	MD	df	't' Value	'p'Value
Mental Health	Posttest	Exp	17.611	3.416	0.805	1.333	34	1.190	0.242*
		Con	16.278	3.304	0.778				
Stress	Posttest	Exp	5.833	2.618	0.617	-5.111	34	5.684	0.001***
		Con	10.944	2.775	0.654				
	Posttest	Exp	45.222	7.125	1.679	17.833	34	8.797	0.001***

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Coping Strategies		Con	27.389	4.816	1.135				

**** Very highly significant, ** Highly significant, * Not significant, Exp-Experimental group, Con-Control group*

Mental Health Outcomes

The comparison of mental health scores between the intervention and control groups before and after the intervention is presented in Table 1.

Table 2. Comparison of Mental Health Scores Between Groups

Group	Pre-test Mean ± SD	Post-test Mean ± SD	t-value	p-value
Intervention Group	15.167 ± 5.171	17.611 ± 3.415	2.518	0.022**
Control Group	15.833 ± 3.823	16.278 ± 3.304	-1.458	0.163

**** Very highly significant, ** Highly significant, * Not significant*

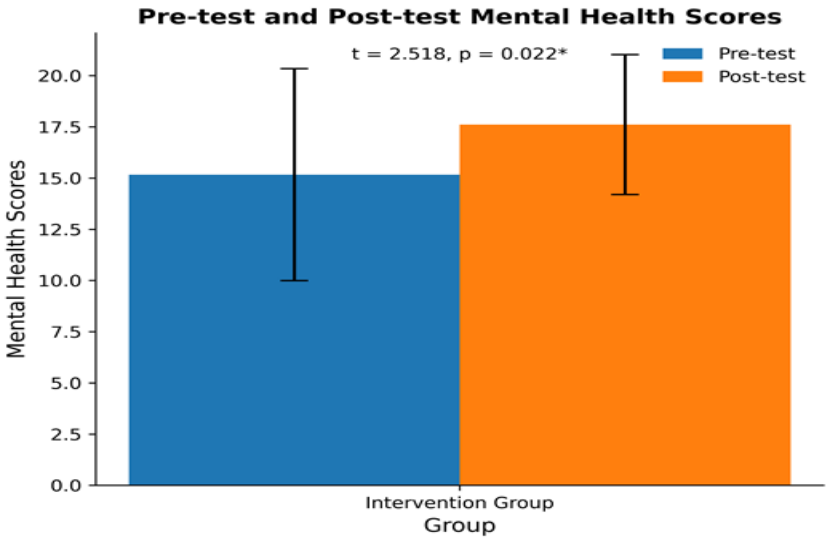

Figure 4. Comparison of Mental Health Scores within Intervention Group between Pre-test and Post-test

The intervention group demonstrated statistically significant improvement in mental health scores following the six-week intervention period (t(17) = 2.518, p = 0.22) (See Figure 4). However, the between-group comparison of post-test mental health scores was not statistically significant (t(34) = 1.190, p = 0.242), indicating that this within-group improvement did not translate into a significant advantage over the control group. (See Table 2).

Stress Outcomes

Table 3. Comparison of Stress Outcomes Between Groups

Group	Pre-test Mean ± SD	Post-test Mean ± SD	t-value	p-value
Intervention Group	10.333 ± 1.847	5.833 ± 2.618	8.667	0.001***
Control Group	10.556 ± 1.653	10.944 ± 2.776	-0.642	0.529*

**** Very highly significant, ** Highly significant, * Not significant*

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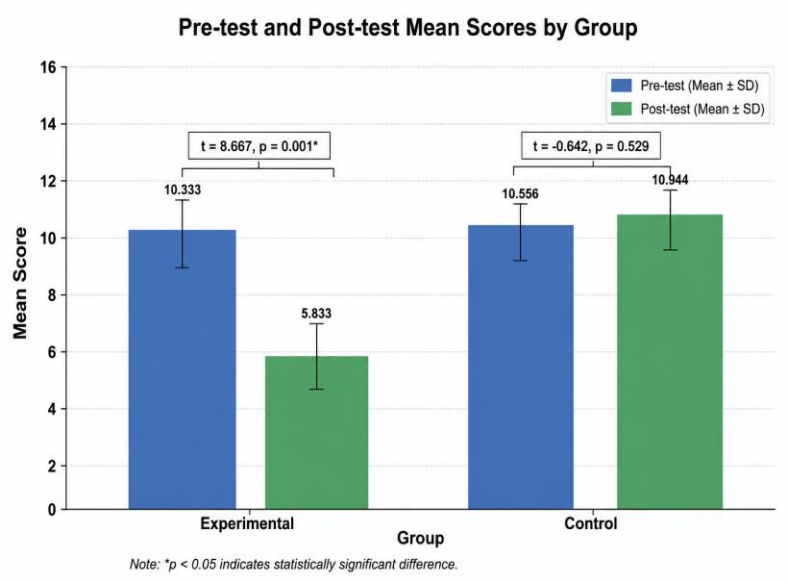

Figure 5. Comparison of Stress Scores between Groups after the Intervention

The intervention group demonstrated a significant reduction in perceived stress scores from pre-test to post-test ($t(17) = 8.667$, $p = 0.001$), whereas no significant change occurred in the control group ($t(17) = -0.642$, $p = 0.529$). (See Figure 5) The intervention group also had significantly lower stress scores than the control group at post-test ($t(34) = 5.684$, $p = 0.001$) (See Table 3).

Coping Strategy Outcomes

Table 4. Comparison of Coping Strategies Between Groups

Group	Pre-test Mean ± SD	Post-test Mean ± SD	t-value	p-value
Intervention Group	28.444 ± 5.628	45.222 ± 7.125	7.892	0.001***
Control Group	28.278 ± 3.893	27.389 ± 4.816	1.16	0.262*

**** Very highly significant, ** Highly significant, * Not significant*

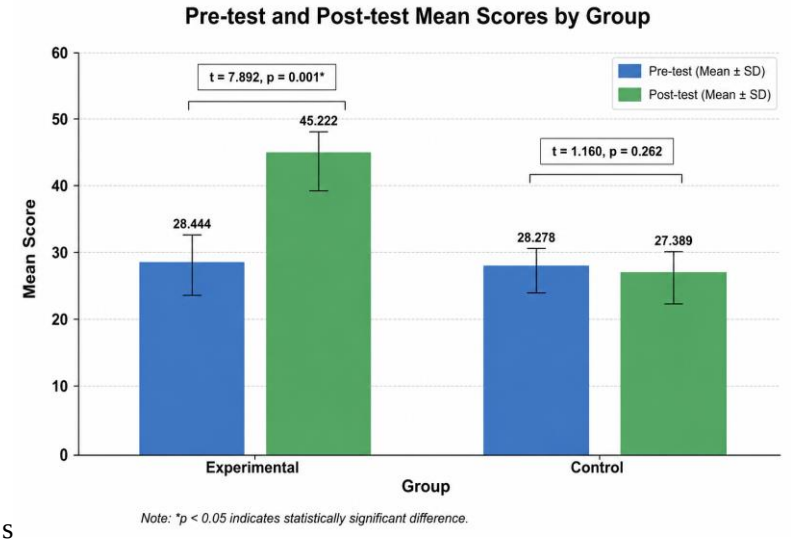

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Figure 6. Comparison of Coping Strategies

Coping strategy scores improved significantly in the intervention group from pre-test to post-test ($t(17) = 7.892$, $p = 0.001$), while the control group showed no significant change ($t(17) = 1.160$, $p = 0.262$) (See figure 6). The intervention group also scored significantly higher on coping than the control group at post-test ($t(34) = 8.797$, $p = 0.001$) (See Table 4). Nurses who used the mobile application demonstrated greater use of adaptive coping mechanisms and improved emotional regulation abilities.

Association Between Demographic Variables and Study Variables

Significant associations were identified between mental health scores and gender ($p = 0.022$), as well as frequency of night shifts ($p = 0.041$). Coping strategy outcomes were significantly associated with educational qualification ($p = 0.027$) and working hours ($p = 0.019$). No significant association was observed between stress scores and demographic variables.

Discussion

The present study evaluated the effectiveness of a structured mobile application intervention in improving mental health and stress coping strategies among nurses working in a tertiary healthcare institution. The findings demonstrated significant improvement in psychological well-being, substantial reduction in perceived stress, and enhancement of coping abilities among participants who received the intervention.

The observed reduction in stress scores among nurses in the intervention group supports previous findings reported in international literature. Watanabe et al. demonstrated that smartphone-based stress management interventions significantly improved depressive symptoms and emotional well-being among nurses during the COVID-19 pandemic [6]. Similarly, Linardon et al. concluded that app-supported mental health interventions effectively improved stress management and psychological functioning [7].

Part of the improvement in coping and stress scores observed in the present study is consistent with cognitive-behavioral mechanisms of change. The Cochrane review by Tamminga et al. categorises individual-level occupational stress interventions into those that work by modifying an individual's thoughts, feelings, and behaviour around a stressor, and those that work by directing attention away from the stress experience through relaxation or other disengagement strategies [13]. This review inspires the CBT-based and mindfulness-based components built into the SHANTHI application. Consistent with this cognitive-behavioural pathway, Watanabe et al.'s smartphone-based program for nurses was structured around established CBT techniques including self-case formulation, behavioral activation, and cognitive restructuring, which produces measurable reductions in depressive symptoms [6].

The SHANTHI application used these mechanisms through its educational courses on stress management and self-care, which helped nurses identify and reframe unhelpful appraisals of workplace stressors. Furthermore, the automated system of daily motivational reminders and app achievements functioned as behavioral activation tools, which encourages consistent interaction and reinforces adaptive behavioral responses through repeated practice. These aspects provide a plausible explanation for why coping showed the largest and most robust between-group effect in this study ($t = 8.797$).

Simultaneously, the improvement in coping abilities may be attributed to the guided meditation sessions, mindfulness exercises, and breathing technique guides incorporated into the SHANTHI application. These components correspond directly to the "attention-away" category of stress intervention described by Tamminga et al., which aims to alleviate the

emotional experience of stress directly rather than changing the cognitive evaluations that give rise to it [13]. Within the app interface, these structured exercises work by cultivating present-moment awareness and a more accepting, non-reactive stance toward stressful thoughts, while the breathing guides provide an immediate physiological anchor to down-regulate acute autonomic arousal during high-pressure shifts. Over the six-week intervention, this repeated daily practice supports better emotional regulation, self-awareness, and resilience among healthcare professionals.

The SHANTHI app utilizes both the CBT coursework that alters the cognitive appraisal producing stress and the mindfulness features that modify the immediate emotional response to it to produce a combined and improved overall effectiveness of coping competencies, which stems the consistent coping improvement than the overall mental health indicators did on their own.

The flexibility and accessibility of mobile health applications make them particularly suitable for nurses who often experience irregular schedules and high workload demands. Unlike traditional face-to-face counseling programs, mobile applications provide immediate psychological support without disrupting clinical responsibilities.

Another important finding of the study was the positive user engagement observed among nurses using the mobile application. Participants reported that the intervention was easy to access, convenient to use, and helpful for stress management. These findings suggest that digital mental health interventions may achieve good acceptability among healthcare professionals when designed using user-friendly and evidence-based approaches.

The present study findings also support the growing integration of digital wellness interventions into occupational health programs. Healthcare institutions may consider implementing structured mobile mental health initiatives to improve employee well-being, reduce burnout, increase resilience, and enhance staff retention.

Between-group comparisons at post-test confirmed that the intervention group achieved significantly greater reductions in stress ($t(34) = 5.684$, $p = 0.001$) and significantly greater gains in coping ($t(34) = 8.797$, $p = 0.001$) than the control group. For mental health however, even though the intervention group improved significantly within itself over the six-week period ($t(17) = 2.518$, $p = 0.022$), this improvement did not translate into a statistically significant advantage over the control group at post-test ($t(34) = 1.190$, $p = 0.242$) (See Table 1). This may be related to the limited sample size and short duration of the intervention, both of which reduce the power to detect between-group effects even when a genuine trend toward improvement is present. Longitudinal studies with larger populations are required to evaluate long-term effectiveness on mental well-being specifically.

The study has several limitations. First, the sample size was relatively small and limited to a single healthcare institution, which may affect generalizability. Second, the intervention period lasted only six weeks. Third, self-reported questionnaires may introduce reporting bias. Future multicenter randomized controlled trials with larger samples and extended follow-up periods are recommended.

Despite these limitations, the findings contribute valuable evidence regarding the potential effectiveness of mobile mental health interventions among nurses in Indian healthcare settings.

Conclusion

The mobile application-based intervention was effective in improving psychological well-being, reducing perceived stress, and enhancing coping strategies among nurses. Nurses who participated in the intervention demonstrated significant improvement in emotional health and adaptive coping abilities following the six-week intervention period.

The findings suggest that mobile mental health applications can serve as practical, accessible, and cost-effective tools for supporting occupational mental health among healthcare professionals. Incorporating evidence-based digital wellness programs within healthcare institutions may contribute to improved employee well-being, resilience, and quality of patient care.

Further large-scale randomized controlled trials are recommended to confirm the effectiveness of mobile app interventions and support broader implementation within healthcare systems.

Nursing Implications

Clinical Implications

Mobile health interventions may be integrated into workplace wellness initiatives to support nurses experiencing occupational stress and emotional fatigue.

Educational Implications

Nursing education programs should include digital mental health literacy, mindfulness training, and stress management competencies and strategies to prepare nurses for demanding clinical environments.

Administrative Implications

Healthcare administrators may consider implementing structured digital wellness programs to improve employee satisfaction, productivity, resilience, and retention.

Research Implications

The present pilot study provides a foundation for future large-scale research exploring digital mental health interventions among healthcare professionals in different settings and populations.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Funding

No external funding was received for this study. The research was conducted independently as part of academic research work.

Conflict of Interest

The author declares no conflict of interest related to this study.

Ethical Approval

Ethical approval for the study was obtained from the Institutional Ethics Committee before commencement of data collection.

Author Contributions

The investigator contributed to conceptualization, methodology, data collection, statistical analysis, interpretation of findings, manuscript preparation, and final review of the study.

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