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Work Related Stress and its Impact on Pregnancy Outcomes – A Systematic Review

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Abstract

Introduction: Work related stress during pregnancy is an increasing public health concern and may negatively affect maternal and fetal health. This review examined the association between occupational stress and pregnancy outcomes among employed pregnant women.

Methods: A systematic search of PubMed/MEDLINE, Scopus, Web of Science, CINAHL, Google Scholar, and Cochrane Library was conducted. Studies involving employed pregnant women exposed to workplace stress and reporting maternal or neonatal outcomes were included. Findings were synthesized narratively.

Results: Evidence showed that high job strain, long working hours, shift work, physically demanding tasks and poor workplace support were associated with increased risks of gestational hypertension, preeclampsia, miscarriage, preterm birth, low birth weight and small for gestational age infants. Supportive work environments and flexible work arrangements were linked to better outcomes.

Discussion: Work related stress is a significant but modifiable risk factor for adverse pregnancy outcomes. Improving workplace conditions and support may enhance maternal and neonatal health. Further longitudinal research is needed to strengthen the evidence base and guide effective interventions.

Keyword: Work related stress, occupational stress, pregnancy outcomes, preterm birth, low birth weight, maternal health.

Introduction

Stress is a commonly used but often vague concept. The allostatic model was developed to

address these ambiguities and to distinguish the effects of acute and chronic stress responses. Early understandings of stress focused on homeostasis the body's ability to regulate itself and maintain

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internal stability^[1]. Cohen et al. define stress as a condition in which environmental demands strain or exceed an individual's adaptive capacity, leading to psychological and biological changes that may increase the risk of disease. Work related stress has become a major occupational health challenge worldwide, affecting workers across diverse industries and employment settings. According to the World Health Organization (WHO), approximately 15% of working age adults live with a mental disorder, while depression and anxiety lead to the loss of an estimated 12 billion working days annually, costing the global economy nearly US\$1 trillion in lost productivity each year. Poor working environments characterized by excessive workloads, long working hours, low job control, job insecurity, discrimination and inadequate organizational support are recognized as significant contributors to psychological distress and adverse health outcomes^[2].

The International Labour Organization (ILO) has identified psychosocial hazards and workrelated stress as one of the most significant occupational health challenges of the modern workforce. Recent global estimates indicate that psychosocial workplace risks, including high job strain, long working hours, workplace bullying and job insecurity, contribute to more than 840,000 deaths annually worldwide and account for approximately 45 million disability-adjusted life years (DALYs) lost each year. These risks are also associated with substantial economic losses equivalent to 1.37% of global gross domestic product (GDP) annually. Furthermore, around 35% of workers globally work more than 48 hours per week, while nearly 23% report experiencing workplace violence or harassment during their working lives, highlighting the widespread nature of occupational stress exposures^[3].

Pregnancy represents a pivotal period in a woman's life, marked by profound physical, emotional and psychological changes. During this time, maternal health and well being are closely intertwined with fetal growth and development. In recent decades, an increasing number of women have

remained in employment throughout pregnancy, managing work responsibilities alongside the demands of gestation^[3, 4]. While employment may provide financial stability, personal fulfillment and social engagement, adverse working conditions and elevated stress levels can pose risks to both maternal and fetal health. Consequently, occupational stress during pregnancy has emerged as a key concern in maternal health and occupational health research^[5].

Work related stress arises when job demands exceed an individual's capacity to cope effectively. Pregnant women may encounter stressors such as excessive workloads, extended working hours, shift work, job insecurity, insufficient workplace support, discrimination or physically strenuous tasks^[6]. Many also experience added strain when balancing professional duties with family and household responsibilities. These stressors can disrupt hormonal and physiological processes, leading to elevated stress hormones such as cortisol, which may adversely affect placental function, uteroplacental blood flow and normal fetal development^[5, 6].

Poor obstetric outcomes, such as low birth weight and pregnancy related complications, represent significant public health concerns, contributing to more than 40% of neonatal deaths and a considerable share of neurodevelopmental disabilities in the United States. Increasing evidence from clinical research indicates that stress plays a critical role in shaping adverse obstetric outcomes^[7]. Research from North America, Europe and Australia has consistently demonstrated associations between occupational stress during pregnancy and adverse outcomes such as miscarriage, preterm birth, low birth weight, gestational hypertension and preeclampsia. However, evidence from the Middle East, Africa and many low and middle income countries remains limited. Although women's participation in the workforce has increased substantially across these regions, occupational health policies and workplace accommodations for pregnant employees vary considerably. As a result, the true burden of work related stress during pregnancy and its impact on maternal and neonatal

outcomes may be underreported in many settings. The lack of region specific evidence limits the ability of healthcare professionals and policymakers to develop contextually appropriate interventions^[8].

An expanding body of research has examined the association between occupational stress and unfavorable pregnancy outcomes. Evidence suggests that stressful work environments may be linked to an increased risk of preterm birth, low birth weight, miscarriage, gestational hypertension, preeclampsia and infants being small for gestational age. Beyond psychological stress, physically demanding work conditions including prolonged standing, heavy lifting, extended working hours and shift schedules have also been associated with adverse maternal and neonatal outcomes^[9].

Despite the growing body of literature, several important gaps remain. First, considerable heterogeneity exists in the measurement and definition of work related stress, making comparisons across studies difficult. Second, many studies rely on self reported stress measures and cross sectional designs, limiting the ability to establish causal relationships. Third, important occupational exposures such as shift work, long working hours, psychosocial demands, workplace discrimination and lack of organizational support are often examined separately rather than collectively. Additionally, few studies have evaluated the effectiveness of workplace interventions aimed at reducing stress among pregnant employees. Evidence from developing countries is particularly scarce, despite differences in employment conditions, social support systems, and access to maternity protection^[10].

This systematic review addresses these gaps by synthesizing available evidence on the relationship between work related stress and pregnancy outcomes among employed pregnant women. By identifying the most common occupational stressors and their associated maternal and neonatal consequences, the review provides a comprehensive understanding of the current evidence base and highlights areas requiring further investigation^[11].

Accordingly, this systematic review seeks to critically appraise and synthesize current research on the effects of occupational stress on pregnancy outcomes. Its objectives are to identify key workplace stressors affecting pregnant women, assess their associations with maternal and neonatal health outcomes and explore potential mechanisms and preventive strategies^[12]. Improved understanding of these relationships can inform workplace policies, occupational health practices and maternal care interventions aimed at creating safer and more supportive working environments for pregnant women^[13].

This review was informed by a conceptual framework that draws on multiple theoretical perspectives, including the life course developmental approach, social ecological systems theory, stress theory, a multiple determinants of health model and a perinatal health framework. Together, these perspectives suggest that environmental stressors such as major life events, everyday challenges and neighborhood or community influences initiate a cascading process that affects an individual's cognitive appraisal, biological functioning, and overall capacity to adapt^[14].

The findings of this review also have important implications for nursing education and practice. Nurses play a critical role in antenatal care, health promotion and occupational health assessment. Enhanced knowledge of workplace stressors and their potential effects on pregnancy outcomes will enable nurses to identify at risk women, provide appropriate counseling, advocate for workplace accommodations and support stress reduction strategies during pregnancy. Integrating evidence on occupational stress and pregnancy into nursing curricula can strengthen nurses' competencies in maternal health assessment, risk identification, patient education and interdisciplinary collaboration. Ultimately, improved nursing awareness and education may contribute to better maternal and neonatal outcomes through early recognition and management of work related stress during pregnancy^[15].

Despite growing evidence linking occupational stress to adverse pregnancy outcomes, inconsistencies in findings and variations in stress assessment highlight the need for a comprehensive review. Therefore, this systematic review aims to synthesize existing evidence on the effects of work related stress on pregnancy outcomes among employed pregnant women. Specifically, it seeks to identify common workplace stressors, examine their association with maternal and neonatal outcomes, assess the impact of physically demanding work conditions, explore underlying biological and psychosocial mechanisms and identify research gaps to inform future studies, workplace policies and maternal healthcare practices. The findings may also support nursing education by enhancing nurses' ability to identify, counsel and manage pregnant women exposed to occupational stress.

Objective of The Study

General Objective

The primary aim of this systematic review is to critically examine and synthesize existing evidence on the effects of work related stress on pregnancy outcomes among employed pregnant women.

Specific Objectives

1. To identify the most common forms and sources of occupational stress experienced by pregnant women in the workplace.
2. To examine the contribution of work related stress to maternal health complications, including gestational hypertension, preeclampsia and miscarriage.
3. To evaluate the association between occupational stress and adverse neonatal outcomes, such as preterm birth, low birth weight and small for gestational age infants.
4. To assess the effects of physically demanding work conditions such as long working hours, shift work, prolonged standing and heavy lifting on pregnancy outcomes.
5. To explore the biological, psychological and social mechanisms through which workplace

stress may influence the health of both the mother and the fetus.

6. To identify gaps in the existing literature and propose recommendations for future research, workplace policies and maternal healthcare interventions aimed at minimizing stress among pregnant employees.

Method of Literature Search

A comprehensive and systematic search of the literature was undertaken to identify studies examining the relationship between work related stress and pregnancy outcomes among employed pregnant women. The primary aim of this process was to gather high quality, relevant evidence from a range of reputable academic and scientific sources.

Databases Searched

Studies published from 2010 to 2025 were included in the review. The search was conducted across multiple electronic databases to ensure broad coverage of the available literature:

- PubMed/MEDLINE
- Scopus
- Web of Science
- CINAHL (Cumulative Index to Nursing and Allied Health Literature)
- Google Scholar
- Cochrane Library

These databases were selected due to their extensive collections of peer-reviewed literature in medicine, nursing, occupational health and public health.

Search Strategy

A structured search strategy was applied using a combination of keywords, Medical Subject Headings (MeSH) and Boolean operators (AND, OR). Core search terms included:

- Work-related stress
- Occupational stress

- Job stress
- Workplace stress
- Pregnancy outcomes
- Maternal outcomes
- Fetal outcomes
- Preterm birth
- Low birth weight
- Preeclampsia
- Miscarriage
- Pregnant workers

These terms were combined in various ways to optimize sensitivity and relevance of the search. An example of a search combination is shown below:

("work-related stress" OR "occupational stress" OR "job stress")

AND

("pregnancy outcomes" OR "maternal outcomes" OR "fetal outcomes")

Search strategies were adapted slightly for each database to align with specific indexing systems and search functionalities.

Table 1. PICO Model

Category	Description
Population (P)	Pregnant women who are employed or exposed to workplace environments during pregnancy
Intervention (I)	Exposure to work related stress, including psychological stress, long working hours, shift work, heavy workload, prolonged standing, job strain and physically demanding work conditions
Comparison (C)	Pregnant women with low levels of occupational stress or those working under supportive and less demanding work conditions
Outcome (O)	Pregnancy outcomes such as preterm birth, low birth weight, miscarriage, gestational hypertension, preeclampsia, small for gestational age infants and other maternal or neonatal complications

The PICO model outlines the focus of the study on the relationship between occupational stress and pregnancy outcomes. The population consists of pregnant women who are employed or exposed to workplace environments during pregnancy. The intervention includes various forms of work-related stress, such as psychological stress, long working hours, shift work, heavy workloads, prolonged standing, job strain and physically demanding tasks. The comparison group comprises pregnant women experiencing low levels of occupational stress or working in supportive and less demanding environments. The outcomes examined include adverse maternal and neonatal health effects, such as preterm birth, low birth weight, miscarriage, gestational hypertension, preeclampsia, small for

gestational age infants, and other pregnancy-related complications. Overall, the PICO framework is designed to assess how occupational stress during pregnancy influences maternal and fetal health outcomes.

Inclusion Criteria

Studies were considered eligible if they-

- Addressed occupational or work-related stress during pregnancy.
- Assessed maternal, fetal or neonatal outcomes linked to workplace stress.
- Included employed pregnant women as the study population.

- Were published in peer reviewed journals.
- Were written in English.
- Used observational or analytical study designs, including cohort, case-control, cross-sectional studies or systematic reviews.

Exclusion Criteria

Studies were excluded if they-

- Did not specifically focus on workplace or occupational stress.
- Included only non pregnant participants.
- Were editorials, commentaries, conference abstracts or duplicate publications.

- Lacked sufficient methodological detail or outcome data.
- Were not available in full text format.

Study Selection Process

All records identified through the database search were initially screened based on their titles and abstracts to assess relevance. Full text articles were then retrieved and evaluated against the predefined inclusion and exclusion criteria. Duplicate records were removed during the screening process. Only studies meeting all eligibility requirements were included in the final review[Figure 1].

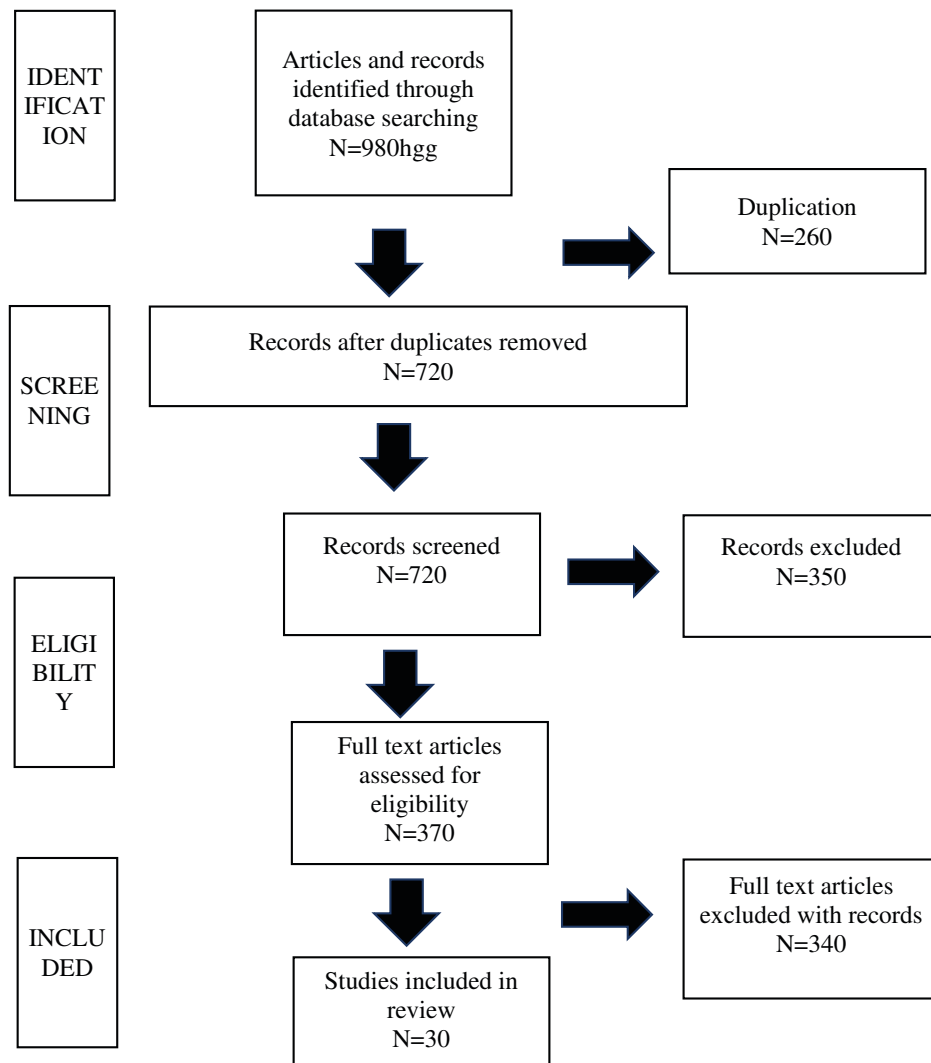


Figure 1: Flow diagram for study selection according to PRISMA

Data Extraction and Synthesis

Data from eligible studies were extracted using a standardized data extraction form. Extracted information included author details, publication year, study design, sample size, type of occupational stress assessed, pregnancy outcomes evaluated and principal findings. The results were synthesized narratively to highlight recurring themes, trends and gaps in the literature[Figure 1].

Quality Appraisal

The methodological quality of included studies was assessed using appropriate critical appraisal tools corresponding to each study design. This process helped evaluate the robustness of the evidence and identify potential sources of bias, thereby strengthening the overall reliability of the review findings. Quality appraisal of the selected studies was conducted using the Joanna Briggs Institute (JBI) Critical Appraisal Tools, with study specific checklists applied according to the research design.

Thematic Review

Work related Stress and Pregnancy Outcomes

Work related stress during pregnancy has gained increasing attention as a growing number of women remain engaged in paid employment throughout gestation. Although employment can offer financial stability, autonomy and a sense of fulfillment, unfavorable working conditions and high stress levels may adversely affect the health of both the mother and the developing fetus. Occupational stress may stem from physical workload, emotional demands, organizational pressures and inadequate social support. This thematic review synthesizes key themes identified in the literature regarding work-related stress and its influence on pregnancy outcomes^[16].

Sources and Forms of Occupational Stress During Pregnancy

The literature consistently reports that pregnant women are exposed to various workplace stressors.

Commonly cited sources include excessive workload, extended working hours, shift work, limited control over job tasks, employment insecurity, workplace discrimination and insufficient support from supervisors or colleagues. Women employed in physically demanding roles often face additional strain related to fatigue and physical exertion. Professions such as healthcare, education, manufacturing and customer service are frequently associated with elevated occupational stress during pregnancy. Moreover, many pregnant women must balance work commitments with family and domestic responsibilities, further increasing psychological pressure. Psychosocial stressors are also widely discussed. Poor communication with supervisors, interpersonal conflicts at work, lack of organizational support, and concerns about job retention during pregnancy can contribute to heightened anxiety and emotional distress. Evidence suggests that women in low income or precarious employment may experience greater stress due to financial constraints and limited labor protections^[17].

Physical and Psychological Consequences of Work Related Stress

Research demonstrates that occupational stress can negatively affect both physical and mental health during pregnancy. Stress triggers the release of hormones such as cortisol and adrenaline; sustained elevation of these hormones may disrupt placental function, impair uteroplacental blood flow and influence fetal growth and development^[18]. Several studies have linked workplace stress to psychological outcomes including anxiety, depression, sleep disturbances, fatigue and emotional exhaustion. Prolonged stress exposure may also impair immune function and promote inflammatory responses, thereby increasing vulnerability to pregnancy related complications. In addition, stress may indirectly affect pregnancy through altered health behaviors. Pregnant women experiencing high job stress may have disrupted sleep patterns, suboptimal dietary habits, or reduced utilization of antenatal care services. Some may adopt maladaptive coping behaviors, such as smoking or alcohol consumption, further elevating the risk of adverse outcomes^[18, 19].

Occupational Stress and Maternal Health Outcomes

A substantial body of evidence has examined the association between work related stress and maternal complications during pregnancy. High job strain has been linked to increased risks of gestational hypertension, preeclampsia, and miscarriage. Chronic stress can contribute to sustained activation of stress response pathways, leading to elevated blood pressure and vascular changes. Physically strenuous activities such as prolonged standing, repetitive movements and heavy lifting have been associated with maternal discomfort, musculoskeletal pain, fatigue and other pregnancy related health issues^[20]. Long working hours and shift work, particularly night shifts, are frequently implicated in adverse maternal outcomes. Disruption of circadian rhythms may affect hormonal regulation and sleep quality, compounding fatigue and stress. Some studies indicate that women working more than 40 hours per week may have a higher likelihood of pregnancy complications compared with those working fewer hours^[21].

Impact on Fetal and Neonatal Outcomes

Another prominent theme concerns the effects of occupational stress on fetal and neonatal health. Numerous studies report associations between work-related stress and outcomes such as preterm birth, low birth weight and infants born small for gestational age. Stress induced hormonal alterations may compromise placental blood flow, reducing the delivery of oxygen and nutrients to the fetus. This can hinder fetal growth and increase the risk of low birth weight. Chronic maternal stress may also promote inflammatory pathways and uterine activity, potentially triggering preterm labor. Physically demanding occupational tasks, including extended standing and heavy lifting, have been linked to fetal growth restriction and early delivery. In some cases, infants born to mothers exposed to high levels of workplace stress may require neonatal intensive care following birth. While much of the evidence supports these associations, inconsistencies

remain, likely reflecting variations in study design, occupational settings and stress measurement approaches^[22].

Role of Workplace Support and Environment

The importance of a supportive workplace environment is a recurring theme in the literature. Positive organizational practices can mitigate stress and promote healthier pregnancy outcomes. Women who receive understanding, flexibility, and support from employers, colleagues and family members tend to manage work-related challenges more effectively. Measures such as flexible schedules, workload adjustments, maternity leave allowances, and regular rest periods have been shown to reduce stress and protect maternal and fetal wellbeing. Conversely, unsupportive or hostile work environments can exacerbate emotional distress. Workplace discrimination, lack of maternity accommodations and fear of job loss may intensify stress and negatively affect mental health during pregnancy^[23].

Research Limitations and Knowledge Gaps

Despite growing scholarly interest, notable gaps persist in the evidence base. One major limitation is the lack of standardized definitions and tools for assessing occupational stress, which hinders comparison across studies. Most available studies are observational, limiting the ability to establish causal relationships. Furthermore, some studies inadequately control for confounding factors such as socioeconomic status, maternal age, lifestyle behaviors and pre existing medical conditions. Research from low and middle income countries remains limited, despite differences in working conditions, social norms and legal protections for pregnant workers. Greater attention to cultural, economic and contextual factors is needed^[24, 25].

Existing evidence indicates that work related stress during pregnancy arises from a complex interaction of physical, psychological and organizational factors. Occupational stress has

been associated with increased risks of maternal complications including gestational hypertension and miscarriage as well as adverse neonatal outcomes such as preterm birth and low birth weight. Supportive workplace policies and targeted occupational health interventions hold promise for reducing stress and improving outcomes. However, further high quality, context specific research is required to more clearly define these relationships and inform effective prevention strategies.

Results

In this systematic review, a substantial number of articles were retrieved from electronic databases and supplementary sources. Following title and abstract screening and the application of predefined inclusion criteria, a final group of studies was selected for analysis. The included studies showed considerable variation in design, study populations, occupational contexts, and methods used to assess work related stress and pregnancy outcomes. Despite this heterogeneity, the overall body of evidence suggests a consistent trend: higher exposure to workplace stress during pregnancy is associated with an increased likelihood of adverse outcomes for both mothers and their infants, although the magnitude of these associations varied across studies.

The majority of included studies employed cohort, case control, or cross sectional designs, with a smaller proportion consisting of systematic reviews. Most research originated from high and middle income countries, while evidence from low income settings was comparatively scarce. Participants represented a broad spectrum of occupations, including healthcare professionals, educators, factory and industrial workers, office employees and service sector personnel. This occupational diversity enabled a more comprehensive understanding of how different working environments influence pregnancy outcomes. Work related stress was assessed using a range of approaches. Some studies relied on self reported questionnaires, whereas others applied job strain models, evaluated workload intensity, or examined exposure to shift work. Maternal and neonatal outcomes were commonly

obtained from medical records or participant self reports and encompassed a wide range of health indicators^[25].

Work Related Stress and Maternal Outcomes

Across most studies, occupational stress was consistently linked to poorer maternal health during pregnancy. Women exposed to high job strain or unfavorable working conditions demonstrated a higher risk of developing gestational hypertension and preeclampsia compared with those in less stressful roles. Several investigations also reported an increased incidence of miscarriage, particularly during early pregnancy among women experiencing elevated levels of work related stress. Physically demanding occupations involving heavy lifting, prolonged standing and extended working hours were frequently associated with fatigue, musculoskeletal pain and other pregnancy related discomforts. Shift work especially night or rotating shifts emerged as an important contributor to maternal stress. Disrupted sleep patterns, heightened fatigue and increased physiological stress linked to such schedules were suggested as mechanisms contributing to adverse maternal health outcomes^[26].

Work Related Stress and Fetal Outcomes

The literature also indicates a notable impact of occupational stress on fetal development. Women exposed to higher levels of work-related stress were more likely to experience preterm delivery than those working in lower-stress environments. Low birth weight was another commonly reported outcome. Chronic stress has been proposed to impair placental blood flow, thereby limiting the delivery of oxygen and nutrients essential for optimal fetal growth. Similarly, infants born small for gestational age were more frequently observed among mothers exposed to high job strain or physically strenuous work. Some studies additionally reported associations with fetal growth restriction and lower Apgar scores at birth; however, these findings were not uniform across all studies, suggesting the influence of additional modifying factors^[27].

Physical Workload and Shift Work

Physically intensive work conditions were repeatedly identified as significant risk factors for adverse pregnancy outcomes. Prolonged standing, repetitive physical activity, and heavy lifting were consistently associated with increased risks of preterm birth and low birth weight. Shift work, particularly night duties, was also commonly linked to negative outcomes. Disruption of circadian rhythms, sleep deprivation and hormonal imbalance were proposed as underlying mechanisms. Nevertheless, results varied across studies, possibly reflecting differences in workload intensity, availability of rest periods and overall workplace conditions^[28].

Psychosocial Workplace Stress

Psychosocial stressors such as job insecurity, inadequate support, interpersonal conflict and workplace discrimination were strongly associated with elevated stress levels during pregnancy. Women reporting low levels of workplace support were more likely to experience anxiety, depressive symptoms and reduced overall wellbeing. In contrast, supportive working environments appeared to mitigate stress. Flexible work arrangements, understanding supervisors and positive organizational climates were associated with lower stress levels, better maternal health and more favorable pregnancy outcomes^[29].

Variability Across Studies

Although most studies identified an association between occupational stress and adverse pregnancy outcomes, the strength of this relationship varied. Some reported strong associations, while others observed weaker or non-significant findings. This variability may be attributed to differences in study design, sample size, occupational exposure assessment, types of employment examined, and the extent to which potential confounding factors such as age, socioeconomic status, lifestyle behaviors and pre existing medical conditions were controlled^[30].

Overall, the evidence synthesized in this systematic review indicates that work-related stress is associated with increased risks of adverse pregnancy outcomes. These include maternal complications such as gestational hypertension, preeclampsia and miscarriage, as well as fetal and neonatal outcomes such as preterm birth, low birth weight and small for gestational age infants. Both psychosocial stress and physically demanding work conditions contribute to these risks. Importantly, supportive and flexible workplace environments appear to play a protective role, helping to reduce stress and promote healthier pregnancies. Collectively, these findings underscore the need for workplace policies and occupational health interventions that safeguard pregnant workers and support optimal maternal and fetal health.

Discussion

This systematic review demonstrates a clear and largely consistent trend: exposure to work-related stress during pregnancy is associated with less favorable outcomes for both mothers and their infants. In practical terms, women who face high job demands, physically strenuous tasks, or unsupportive workplace environments during pregnancy are more likely to experience complications. These findings reinforce a core principle of public health research that pregnancy is a particularly vulnerable period, and occupational environments can significantly influence maternal health and fetal development. An important insight from this review is that work related stress is not a single, uniform exposure but rather a combination of multiple, overlapping stressors. These may include emotional pressures such as job insecurity or interpersonal conflict, organizational demands like extended working hours or shift schedules, and physical burdens such as prolonged standing or heavy lifting. When these stressors occur simultaneously, they may accumulate and create a greater overall strain for pregnant workers. This complexity also helps explain why the strength of associations varies across different studies.

From a biological perspective, the relationship between stress and adverse pregnancy outcomes is well founded. Chronic stress activates the body's stress response system, leading to sustained release of hormones such as cortisol. During pregnancy, these hormonal changes may disrupt placental function, reduce uteroplacental blood flow, and impair fetal growth and development. Such mechanisms offer a plausible explanation for commonly observed outcomes in the literature, including preterm birth, low birth weight, and restricted fetal growth. The review also identifies a consistent association between occupational stress and maternal complications such as elevated blood pressure, gestational hypertension, and preeclampsia. Prolonged activation of the stress response can overstimulate the nervous system, contributing to vascular strain and increased blood pressure. Additionally, stress often affects everyday health behaviors such as sleep quality, nutrition, and adherence to antenatal care which can further compound risks during pregnancy. With respect to fetal outcomes, preterm birth emerged as one of the most frequently reported consequences linked to workplace stress. Stress related hormonal changes and inflammatory processes may precipitate early labor in some women. Similarly, low birth weight and small for gestational age infants were more commonly reported among mothers exposed to high levels of stress or physically demanding work. These findings highlight the combined importance of both psychological and physical working conditions in shaping fetal growth.

The role of the workplace environment itself was another prominent theme. Evidence consistently suggests that supportive working conditions can substantially mitigate stress and improve outcomes. Flexibility, understanding from supervisors, and practical accommodations were associated with lower stress levels and better maternal and neonatal health. In contrast, environments characterized by discrimination, inadequate maternity support, or fear of job loss tended to intensify stress and worsen outcomes. This indicates that improving pregnancy outcomes is not solely about reducing workload but also about fostering a respectful and supportive

organizational culture. At the same time, the review acknowledges variability across studies. While many reported strong associations between occupational stress and pregnancy complications, others found weaker or inconclusive links. Such discrepancies are likely related to differences in study design, stress assessment methods, occupational contexts and population characteristics. Confounding factors such as socioeconomic status, maternal age, lifestyle behaviors and pre existing health conditions also influence outcomes and may account for some inconsistencies. A lack of standardized measures for work-related stress remains a significant challenge in this field.

Another limitation highlighted is the geographic concentration of evidence. Most studies have been conducted in high and middle income countries, resulting in limited data from low-income settings where work conditions may be more physically demanding and labor protections less robust. Consequently, the global burden and patterns of occupational stress during pregnancy may not yet be fully captured. Despite these limitations, the overall conclusion is clear: reducing work related stress during pregnancy is both important and beneficial. Interventions such as flexible scheduling, reduced physical workload, strong maternity protections and supportive management practices have the potential to improve outcomes for both mothers and infants. This review confirms that work related stress is a significant factor influencing pregnancy outcomes. Addressing occupational stress is therefore not only a matter of employee wellbeing but also a critical component of maternal and child health protection. Future research should prioritize standardized stress measurements, longitudinal study designs and more inclusive populations to generate stronger, more generalizable evidence to inform policy and workplace practices.

Limitation and Future Direction

This systematic review suggests an association between work related stress and adverse pregnancy outcomes; however, its conclusions are limited by substantial heterogeneity in study designs,

populations, occupational exposures, and stress measurement methods. The predominance of observational studies restricts causal inference, inconsistent adjustment for confounding variables may bias estimates, evidence from low income settings is limited and publication bias cannot be excluded.

Future research should employ standardized stress assessment tools, prospective longitudinal designs, rigorous confounder control and greater inclusion of low and middle-income countries, alongside intervention and mechanistic studies. Overall, higher quality and globally representative evidence is needed to strengthen causal understanding and inform effective workplace and maternal health policies.

Conclusion

This systematic review provides compelling evidence that work related stress is a meaningful determinant of pregnancy outcomes. Pregnant women exposed to elevated workplace stress whether through emotional demands, physical strain, or organizational pressures demonstrate a higher risk of maternal and neonatal complications, including gestational hypertension, preeclampsia, miscarriage, preterm birth, low birth weight and small for gestational age infants. Importantly, occupational stress is rarely the result of a single exposure; rather, it reflects the cumulative effect of multiple stressors such as excessive workload, long or irregular hours, shift work, job insecurity, strained workplace relationships, and inadequate organizational support. Although effect sizes vary across studies, the overall body of evidence consistently associates higher workplace stress with poorer pregnancy outcomes.

Encouragingly, the review also highlights the protective role of supportive work environments. Flexible schedules, reduced physical and psychological demands and strong employer support are associated with improved maternal wellbeing and more favorable birth outcomes, underscoring the potential impact of targeted workplace policies and occupational health interventions. While

methodological variability across studies warrants cautious interpretation, the central message is clear work related stress represents a significant yet modifiable risk factor for adverse pregnancy outcomes. Addressing it through supportive workplace practices and evidence based policies offers a practical and effective pathway to improving maternal and neonatal health.

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Digital Health in Nursing: Opportunities, Challenges and the Road Ahead

An Integrative Review

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Abstract

Digital Transformation is bringing challenges to health systems in healthcare in all over the world where nurses makes a majority of the workforce in health systems and play an essential role in the sweep out process. Gradually but definitely technologies like electronic health records, artificial intelligence for the clinical decision making, telemedicine, remote sensors and robotic assistance plays a significant role and a game changing process in which patient care is given and evaluated. In spite of pandemic makes the digitalisation has driven forward the health sector little is known about its effects on nursing research today. This integrative review was undertaken to synthesis the various evidence on digital transformation in nursing examining the opportunities its presents the challenges its poses and its impact on nursing roles and the directions its signal for future practices.

Authors performed an integrative review to fill this gap also it brings attention to study the data on digital information on nursing which mainly focuses on opportunities, challenges, impact the roles and practice and future innovative directions. Researches from January 2014 to December 2023 were searched intensely through various databases such as CINAHL, PubMed, Scopus and Web of Science. The review is mainly focused on problem identification, literature search, quality assessment, data analysis and thematic synthesis.

From 78 studies, five main themes emerged: The expanding role digital technologies in nursing, which brings new opportunities at both practice and system levels ongoing structural and ethical barriers evolving the nursing key roles and

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identity and future priorities for direction for education, policy and practice. Evidence also states the digital tools improve care coordination, patient safety, clinical decision making and work force improvement. Though there are few nurses who are digitally illiterate, similarly another challenge is unequal access part for workflow interruptions. Ethical consideration is also another challenges such as data privacy, algorithm bias accountability and others.

Moreover, the review also understands adjustments in variation of nursing practice where advanced roles and informatics develop alongside concerns about maintaining the personal human side of the care. Overall, digital transformation is a complex and evolving force in nursing that promises significant innovation and growth but requires careful attention to ethical, educational and systemic issues. Successful integration depends on equitable technology access and establishing strong governance that preserves both clinical quality and the core human values of nursing.

Key Words: Digital Transformation, Telehealth Nursing, Healthcare technology, Artificial Intelligence

Introduction

Health care has grown significantly over the past ten years which has had a positive impact on technologies like wearable technologies, telehealth platforms, robotics, AI Assisted decision support and electronic health records(EHR's) which are now plays a vital role in modern clinical practice ⁽¹⁾. The COVID 19 pandemic accelerated the adoption of digital triage systems, virtual care and remote monitoring further altering this transition ⁽²⁾. The Global policy environment increasingly recognises digital transformation as a strategic improvement in health systems and advancing universal health coverage. The world Health Organisation's (WHO) global strategy on digital health 2020-2025 endorsed by 73rd world health assembly frames digital health as central to achieving health coverage committing member state accelerate the development and adoption of accessible affordable and person centred digital health solutions while strengthening the workforce, governance and competencies and cross border interoperability ⁽⁵⁹⁾. Notably the strategies call for digital health competencies to be embedded in the education and training curricula for health professionals a mandate of direct relevance to the nursing ⁽⁵⁹⁾. In spite this momentum global progress remains uneven and the data from the world bank states that approximately 4.6 billion people are unable to access the health care systems without the knowledge eon digital health showing a great difference between high income and lowincome resource settings. This disparity reinforces the argument that digital transformation in nursing

cannot be examined in isolation from the broader global equity agenda that WHO and the World Bank have placed at the center of digital health policy ⁽⁵⁹⁾.

Digital transformation in nursing extends beyond embracing the technology and entails a thorough integration of digital technologies into practice, education and administration fundamentally improves the patient outcomes professional responsibilities and care procedures. In addition to redefine the nursing care abilities and professional limits it includes the clinical information systems data driven population health management with AI supported decision making and simulation based education ^(2,3). This transformation, however, presents a dual-edged reality for the nursing profession. On the positive side, digital technologies offer substantial benefits can significantly improve patient safety through reduced medication and documentation errors, enhanced care coordination across multidisciplinary teams, greater efficiency in clinical workflows, expanded access to care through telehealth in underserved and remote settings, and richer opportunities for nursing education through simulation and virtual training ^(4,5). Conversely, this shift introduces significant challenges. Increased documentation burden and alert fatigue have been linked to nurse burnout and reduced time for direct patient care, while disparities in digital literacy among nursing staff particularly across age groups and resource settings which can create uneven adoption and risk of error ^(6,7). Concerns around data privacy, algorithmic bias in AI-supported decision-making, and the erosion of the relational, human centred core of nursing care add further ethical complexity ^(8,9).

Despite the enormous growth of literature in the digital information the benefits are limited since the evidence is still dispersed among the technologies, specialities and location limiting its practical applicability ^(7,8).

As a result, this review will aim to examine the current stage of digital technologies used in nursing practice and to explore the opportunities with the key challenges and barriers and impact on roles and workforce priorities for nursing.

Methods

Methodological Framework

This integrative review was in line with the five stages framework developed by Whitmore and Knafl which includes (1) identification of problem and formulating the aim and research questions (2) a Comprehensive literature search using multiple electronic data base (3) data evaluation involving assessment of methodological quality and relevance of various studies (4) data analysis through thematic synthesis to generate overarching themes (5) presentation of findings with critical interpretation and integration of evidence ^(10,11). The frame work was mainly chosen because of its ability to incorporate diverse research methodologies and its sustainability for examining complex and multidimensional phenomena that extend beyond a single theoretical perspective. The integrative reviews are particularly well suited to nursing sciences because there are various domains such as biomedical, psychosocial and organisational domains that cannot be adequately captured through methodically narrow review resources. Unlike Systematic reviews which are typically restricted to experimental or quasi experimental designs the integrative review accommodates the full diversity of nursing evidence like quantitative, qualitative, mixed method and

theoretical reflecting nursing identity both a clinical science and human relational practice ^(10,11).

Search Strategy

A comprehensive literature search was undertaken across four major electronic databases PubMed, CINAHL, Scopus, Web of Science. The databases were selected to ensure comprehensive coverage of biomedical nursing and interdisciplinary literature. The literature search was conducted in 2026 and included studies from January 2014 to December 2023. This ten-year period was chosen to find out the contemporary advancements in digital health technologies and evolving health care practices while reducing the inclusion of obsoleted technologies and outdated evidence.

Search strategies were developed using Medical Subject Headings (MeSH), CINAHL Subject Headings and relevant free text key words to ensure an extensive retrieval of studies. Boolean operators (AND, OR) were employed to combine the main concepts related to digital transformation and nursing practice. The search strategies incorporated terms such as: (digital transformation, OR digital health OR health Informatics OR nursing Informatics) AND (nursing practice OR nursing care, OR nursing role OR nurses) AND (electronic health records OR artificial intelligence OR telehealth OR telemedicine OR wearable technology OR clinical decision support OR robotics. Data base specific modification including truncation and wildcard symbols were applied in accordance with the indexing systems and search requirements of each database. Furthermore, the reference list of each eligible articles and relevant review studies were manually screened to identify the additional studies that may not have been captured through the electronic database process.

Table 1. Boolean operators and search syntax across electronic databases

Operator / Feature	PubMed	CINAHL	Scopus	Web of Science
AND	AND	AND	AND	AND
OR	OR	OR	OR	OR

Continue....

NOT (exclusion)	NOT	NOT	AND NOT	NOT
Truncation	* (asterisk)	* (asterisk)	* (asterisk)	* (asterisk)
Field tags	[tiab], [mh]	TI:, AB:, MH""	TITLE-ABS-KEY()	TS=, TI=
Controlled vocabulary	MeSH (auto-explode)	CINAHL Headings (manual explode)	Not applicable	Not applicable
Phrase searching	"quotation marks"	"quotation marks"	"quotation marks"	"quotation marks"

Inclusion and Exclusion Criteria

Studies were considered if they are in the conclusion: (a) focused substantively on digital technologies in the context of nursing practice, nursing roles, or nursing education; (b) were published in peer-reviewed journals between January 2014 and December 2023; (c) were written in the English language; and (d) employed primary or secondary research methods, including empirical quantitative, qualitative, or mixed-methods designs, systematic reviews, integrative reviews, or conceptual/theoretical frameworks with empirical grounding. Excluded were: conference abstracts, editorial commentaries, opinion letters, and case reports providing insufficient methodological detail; studies focused exclusively on medical (physician) rather than nursing practice without disaggregated nursing data; and publications addressing digital technologies in veterinary, dental, or non-clinical nursing contexts.

Data Evaluation

The methodological quality of included studies was assessed using design-appropriate appraisal tools. Quantitative studies were evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for analytical cross-sectional studies or randomized controlled trials, as applicable (12). Qualitative studies were assessed using the Critical Appraisal Skills Program (CASP) Qualitative Checklist (13). Mixed-methods studies and systematic

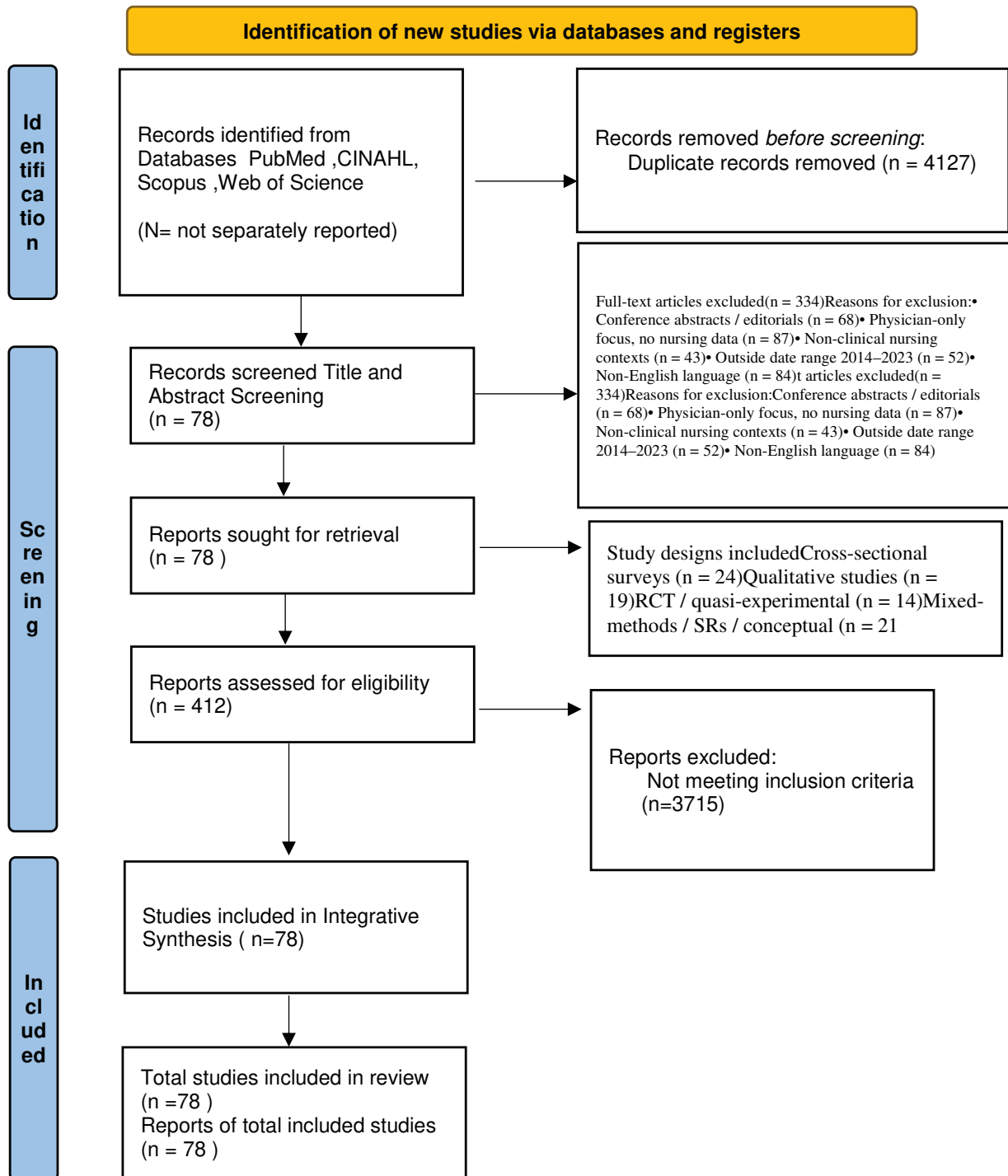
reviews were appraised using the JBI Mixed Methods Appraisal Tool and AMSTAR-2, respectively (14, 15). Quality appraisal was conducted by two independent reviewers, with disagreements resolved through discussion and, where necessary, arbitration by a third reviewer. Studies were not excluded solely on the basis of quality ratings, but quality assessments informed the weight attributed to individual studies during synthesis.

Data Synthesis

A thematic synthesis approach was employed, consistent with recommendations for integrative reviews addressing heterogeneous evidence bases⁽¹⁶⁾. In the initial phase, data relevant to the review aims were extracted from included studies using a standardized extraction template capturing: study design, setting, country, sample characteristics, digital technology examined, key findings, and quality rating. In the analytical phase, descriptive codes mainly assigned inductively to units of meaning within the extracted data. Descriptive codes were subsequently grouped into descriptive themes, which were further refined into higher-order analytical themes that interpreted and extended beyond the findings of individual primary studies^(16, 17). A certain process was iterative and reflexive, with themes reviewed and refined until saturation was reached. The five themes presented in the results section represent the final analytical synthesis

Prisma 2020 Flow Diagram

Digital Transformation in Nursing Practice : Integrative Review



Results

Characteristics of Included Studies

The search strategy yielded 4127 records after the removal of duplicates. Following title and abstract screening, 412 text articles were assessed for eligibility. After applying the predefined inclusion and exclusion criteria, 78 studies were included in the final synthesis. The selected studies represented 26 countries with the largest contribution originated from the United States ($n = 22$) the United Kingdom ($n = 11$) Australia ($n = 9$) and Canada ($n = 7$). The included literature comprises a range of methodological approaches including the cross sectional surveys ($n = 24$), qualitative studies ($n = 19$) Randomised or quasi experimental trails ($n = 14$), Mixed Method studies ($n = 11$), Systemic reviews ($n = 7$) and conceptual or theoretical paper ($n = 3$). Most studies were conducted in hospital based clinical setting ($n = 47$) while others are focused on primary and community health care settings ($n = 18$) and nursing education environments ($n = 13$).

The Landscape of Digital Technologies in Clinical Practice

The range of digital technologies identified across the included studies highlight the wide spread of rapidly expanding integration of informatics within nursing practice. Electronic Health records (EHRs) emerged as the most frequently examined technology appearing in 61 of the 78 included studies either as the primary area of the investigation or as a part of the broader digital infrastructure supporting health care delivery^(18,19). The metamorphosis from paper based to digital documentation systems has been universal across high income country settings, with EHR platforms such as Epic, Cerner, and All scripts now standard in acute care environments in North America and Western Europe⁽²⁰⁾. However, considerable heterogeneity in EHR design, functionality, and interoperability was documented, with implications for nursing workflow that will be elaborated in subsequent themes.

Clinical decision support systems (CDSS) emerged as a discrete but closely related technology

domain, particularly as embedded features within EHR platforms^(21, 22). AI-powered CDSS capabilities which includes predictive analytics for deterioration, sepsis early warning systems, and medication safety alert were documented with increasing frequency in post 2019 literature, reflecting the maturation of machine learning applications in clinical settings⁽²³⁾. Telehealth and remote patient monitoring technologies occupied a prominent position in the post-2020 literature, consistent with pandemic-driven adoption. Studies documented deployment of synchronous video consultation platforms, asynchronous store-and-forward systems, and continuous remote monitoring via wearable biosensors across a range of chronic disease management and post-acute care contexts^(24, 25).

Robotics and automation technologies, although less frequently represented than EHR's and telehealth were identified in 14 studies. These applications include medication dispensing robots, automated logistic system for transport and supply chain management and in a smaller subset of studies, socially assisted robots used in aged care and rehabilitation settings^(26, 27). Nursing simulation technologies includes high fidelity mannequins, Virtual reality environments and Augmented Reality Platforms featured prominently within the nursing education literature with evidence indicating a marked increase in the adoption across nursing schools globally since 2017⁽⁸⁾. Mobile health (m health) applications which including patient self-management tools, clinical reference databases, and nursing communication platforms constituted a final discrete technology cluster, with evidence of both institutional deployment and informal personal adoption by nursing staff⁽²⁹⁾.

Opportunities Afforded by Digital Transformation

A robust and consistent evidence base supports the capacity of digital technologies to generate meaningful improvements across multiple dimensions of nursing practice, patient care, and professional development. Enhanced Patient Safety. Evidence from multiple study designs converges on

the potential of digital tools to reduce preventable harm. Computerized physician/nurse order entry (CPOE) with embedded CDSS was associated with significant reductions in medication error rates across several large multisite studies, with one systematic review reporting error reduction rates of 50–80% compared with paper-based systems ⁽²¹⁾. AI-driven early warning systems demonstrated statistically significant improvements in time-to-recognition of clinical deterioration in prospective studies conducted in intensive care and medical-surgical settings, with implications for sepsis mortality and unplanned ICU admissions ^(23,30). Barcode medication administration systems, universally acknowledged as a basic safety standard in contemporary acute care, were associated with administration error reductions of 41–96% across a meta-analysis of 10 studies ⁽³¹⁾.

Care Coordination and Communication. Digital communication platforms and integrated EHRs were consistently documented as facilitators of interdisciplinary care coordination. Structured handover tools embedded in EHRs reduced information loss at care transitions, and nurses in qualitative studies described improved sense of situational awareness and confidence when working with comprehensive, real-time patient data ^(32, 33). Telehealth platforms enabled nurses to maintain continuity of care for geographically dispersed or mobility-limited patients, with evidence of particularly notable impact in rural and remote settings where in-person follow-up would otherwise be precluded ⁽³⁴⁾.

Workforce Efficiency. Time-motion studies documented in four quantitative investigations indicated reductions in time devoted to documentation tasks following optimised EHR implementation, with corresponding increases in direct patient care time—findings that align with theoretical predictions regarding administrative efficiency gains from digitisation ^(35, 36). Medication dispensing robotics reduced pharmacy errors and nursing time spent in medication preparation in two controlled studies conducted in acute hospital settings ⁽²⁶⁾. Mobile clinical reference tools were

associated with reduced time to locate drug or clinical protocol information and improved nurse confidence in clinical decision-making ⁽²⁹⁾.

Professional Development and Education. Digital simulation technologies offered documented benefits for nursing education, including the ability to create standardised, reproducible clinical scenarios with immediate feedback mechanisms impossible to replicate in real clinical environments ⁽²⁸⁾. VR-based clinical simulation demonstrated non-inferior or superior outcomes relative to traditional clinical placement on a range of assessed competencies in randomised controlled trials, suggesting potential for addressing nursing clinical placement capacity constraints in the context of workforce shortages ⁽³⁷⁾. mHealth applications facilitated point-of-care access to evidence-based guidelines and drug references, functioning as continuous professional development tools for practicing nurses ⁽²⁹⁾.

Constraints and Challenges in Digital Transformation

The evidence base is notably candid regarding the multidimensional challenges that constrain and complicate digital transformation in nursing practice. These challenges span individual, organizational, and systemic levels. Digital Literacy and Competency Deficits for that a persistent finding across qualitative and cross-sectional studies is the heterogeneity in nursing staff's digital literacy and technology competencies, with significant variations documented by age cohort, educational background, clinical specialty, and healthcare setting ^(38,39). Older nurses and those who are practicing in limited resource settings consistently reported lower digital self-efficacy and higher technology anxiety, contributing to suboptimal technology utilisation and workaround behaviours that partially or wholly negate the safety benefits ⁽⁴⁰⁾. Looking on the various studies identified gaps in digital competency education cross undergraduate nursing curriculum exploring that the profession is not systematically enriching the next generation nurses with the informatics foundation necessary for the contemporary practice ⁽⁴¹⁾.

Implementation and usability challenges: The implementation of digital technologies mainly EHR's was mainly linked with the nursing workflow disruption in the transition period. Increased documentation burden on the phenomenon described as "documentation overload" or "note bloat" was reported in a substantial proportion of the included studies ^(19, 35). Nurses in multiple qualitative investigations described experiences of technology-related moral distress, arising from perceptions that documentation requirements displaced time available for direct patient care which ones a tension that strikes at the relational and humanistic foundations of nursing practice ⁽⁴²⁾. Poor system usability, inadequate interoperability between platforms, and alert fatigue generated by excessive CDSS notifications were recurrently identified as system-level barriers that simultaneously undermined efficiency and eroded user trust in digital systems ^(22, 43).

Equity and Access Disparities. Digital transformation does not proceed uniformly across healthcare systems, and the evidence reveals concerning equity implications. Studies conducted in low and middle-income country (LMIC) settings documented profound infrastructural barriers to digital adoption, including unreliable electricity supply, limited internet connectivity, and absence of device availability of barriers that risk deepening global healthcare inequities if digital transformation proceeds without deliberate equity-centred governance ⁽⁴⁴⁾. Within high-income settings, disparities in digital health literacy among patient populations particularly older adults, those with low socioeconomic status, and linguistic minorities were documented as barriers to equitable telehealth access, with nurses frequently positioned as intermediaries responsible for bridging these gaps without adequate preparation or resources ⁽⁴⁵⁾.

Ethical and Privacy Concerns. The ethical dimensions of digital health technologies received increasing attention in post-2018 literature. Concern regarding data privacy and cyber security highlighted across the literature mainly in the

context of increasing exposure of the health care systems to ransomwares and large-scale data breaches⁽⁴⁶⁾. The findings also revealed that ambiguity surrounding nurse's role in obtaining the informed consent for digital capture and in communicating potential privacy risks to the patients suggesting persistent gaps in preparedness and role delineation ⁽⁴⁷⁾. Adding this recent evidence underscore a range of ethical challenges associated with integration of Artificial intelligence (AI) in health care including the algorithmic bias in clinical decision support system limited transparency in AI generated outputs and unresolved questions in accountability in AI related clinical errors. Nursing scholars have additionally caution that inadequate ethical governance and regulatory oversight of AI Implementation may exacerbate the existing health disparities and contribute to inequitable patient outcomes ^(8,48).

Organisational and leadership barriers. Institutional culture, leadership support and resource allocation were identified as the major determinants of successful digital transformation at the organisational level. Studies focusing on survey and interview methodologies mainly found the nurse perceived lack of managerial support, inadequate training profession and limited involvement of frontline nurses in system design and implementation decision were associated with lower technology adoption, higher resistance and poorer patient outcomes ^(49,50). The absence of nurse information in technology governance and procurement processes was identified as a structural deficiency in multiple health system analyses, with arguments advanced that nursing perspectives are indispensable to the design of clinically effective and human centred digital health systems ^(6, 51).

Impact on Nursing roles and Professional Identity

Changes in scope of practice

substantiation implies that digital tools have expanded nursing roles, majorly in telehealth and advanced practice settings. Nurse practitioners and community nurses using remote monitoring

for chronic disease management were able to care for more patients while maintaining outcomes comparable to traditional face-to-face care (34,52). Yet, this also introduced uncertainty around the extent in which clinical judgment remains fully independent when supported by AI systems (53).

Impact on Nurses Value and Relationships

Many nurses expressed that increased a strong measure of trust on screens, documentation systems, and performance metrics may reduce time spent in direct patient interaction. This was observed as affecting empathy, communication, and the therapeutic relationship which is major to nursing practice (42,54).

Workforce Implications

Though the most important view is digital technologies is reshaping rather than replacing the nursing work. Regular tasks may decline while cognitive, interpretive and patient centred responsibilities are likely to increase (27,56). The overall results will depend on organisational readiness, investment in training and equitable implementation of digital systems.

Future Direction and Emerging Priorities

The synthesis identifies various convergent future directions that reflect both the path of technological advancement and the emerging needs of nursing profession.

Artificial Intelligence and Predictive Analysis

Emerging evidence from early implementation studies indicates substantial potential in areas such as predictive monitoring of patient deterioration, individual care planning and automated clinical documentation and population level health surveillance (23,30). However, realising this benefits requires targeted investment in nursing specific AI literacy, strengthened ethical governance framework and precisely designed clinical validation studies that evaluate outcomes directly relevant to nursing practice (8).

Digital Competency Standards and Education Reform

The literature demonstrates growing consensus that standardised digital competency framework tailored to nursing are critical for preparing the workforce for Increasingly digitalised healthcare environments (38,41). Professional bodies such as American college of nursing (AACN) and the Technology Informatics Guiding Education Reform (TIGER) initiative have proposed structured integration of informatics competencies within the nursing curricula. Early evaluations of these initiative suggest improvements in graduate readiness for digital practice environments and enhanced informatics capability among newly qualified nurses (57).

Interoperability and Data Standards

The fragmentation of digital health infrastructure characterised by propriety systems limited interoperability and inconsistent data standards represents a fundamental barrier to realising the full potential of digital transformation. Adoption of Health standards such as HL7 FHIR(Fast Health Care Interoperability Resources) and SNOMED CT for nursing documentation is increasingly documented as essential for enabling data driven care coordination and population level nursing research (58).

Person Centred Digital Design

The literature frequently emphasise the need for human and person-centred design principles in the development of digital technologies. Involving frontline nurses throughout co design activities from need assessment and repetitive prototyping and post implementation evaluation has been linked to improve the technology acceptance, enhanced usability and better patient outcomes in studies of participatory implementation process (49,59).

Global Equity in Digital Research:

Ensuring equitable digital transformation across varied healthcare contexts is a recurrent priority.

Authors call for targeted international investment in digital infrastructure, adaptable implementation frameworks tailored to local contexts and mechanism for south-south knowledge exchange to avoid reproducing colonial dynamics in global health informatics ⁽⁴⁴⁾.

Discussion

The findings of this integrative review are broadly consistent with previous studies that have documented the growing integration of digital technologies into nursing practice and healthcare delivery. Similar to earlier reviews, this review identified electronic health records (EHRs), telehealth, simulation technologies, and artificial intelligence as increasingly important tools that support clinical decision-making, communication, documentation, and patient care (1,2). Consistent with prior evidence, digital technologies were associated with improvements in patient safety, quality of care, and workflow efficiency, reinforcing their value as components of modern nursing practice ^(21,31).

However, this review extends previous findings by demonstrating the widespread and interconnected use of diverse digital technologies across clinical, educational, and administrative nursing settings. Unlike earlier reviews that often focused on a single technology, the present review provides a comprehensive overview of digital transformation within nursing over a decade of rapid technological advancement.

A key difference from previous literature is the stronger emphasis on implementation-related factors. While earlier studies acknowledged barriers to technology adoption, the current review highlights digital literacy, organizational readiness, leadership support, workflow integration, and workplace culture as critical determinants of successful implementation. These findings suggest that the benefits of digital technologies are not solely dependent on the technologies themselves but also on the context in which they are introduced and used.

This review also contributes a nursing-specific perspective by emphasizing nurses' active

role in technology adoption, optimization, and evaluation. Collectively, the findings indicate that although digital technologies offer substantial opportunities to improve nursing practice and patient outcomes, their effectiveness depends on addressing persistent implementation challenges. Future research should focus on strengthening digital competencies, organizational support, and evidence-based implementation strategies to maximize the benefits of digital transformation in nursing.

Implication for Nursing Education:

The fact that so many nurses both those already in practice and those fresh out of undergraduate programs still struggle with basic informatic skills should be consider an alarm in nursing education. The evidence supports that systematic integration of nursing informatics content including digital literacy, EHR competency, AI ethics and telehealth skulls across undergraduate and postgraduate curricula ^(41,57). Integration should extend over and above discrete informatics modules to fix in the digital competency development within clinical skills, professional practice and evidence-based practice units reflecting the cross-cutting relevance of digital tools in contemporary nursing practice.

On the simulation side technologies like VR and AR genuinely excite and for good reason. The idea that student could develop clinical competence through immersive digital environments without the logistical headaches of traditional placement is compelling. Some studies even suggest these tools perform comparably to real placement experience which is no small finding. These results come from controlled studies with their own limitations as a partial replacement for hands on experience ⁽³⁷⁾.

Implications for Policy

Policy-level action is required across several dimensions to enable equitable and effective digital transformation in nursing. Health system policy should prioritise nursing representation in national digital health strategy development, ensuring that the workforce most affected by—and most

responsible for executing—digital transformation exercises meaningful influence over its direction. Regulatory frameworks governing AI clinical decision support should include explicit provisions for clinical validation in nursing-relevant contexts and for algorithmic transparency sufficient to enable informed clinical judgement (8, 48).

International policy must grapple with the equity dimensions of digital transformation. The evidence documents significant disparities in digital health infrastructure and adoption between and within countries, with the risk that digital transformation accelerates rather than mitigates global health inequity ⁽⁴⁴⁾. Multilateral investment in digital health infrastructure in LMIC settings, combined with the development of context-appropriate rather than high-income-country-derived implementation models, is an ethical imperative that nursing organisations are well positioned to advocate.

Limitations

Several limitations of this review must be acknowledged. First, restriction to English-language publications may have introduced language bias, excluding relevant evidence from non-English-speaking research communities, including those in contexts particularly affected by digital health equity challenges. Second, the heterogeneity of included studies such as spanning diverse designs, settings, technologies, and outcome measures and constrains the specificity of conclusions that can be drawn regarding particular technologies or clinical contexts. Thematic synthesis, while appropriate to this heterogeneity, does not permit the statistical precision of meta-analytic approaches. Third, publication bias is a recognized limitation of evidence synthesis: studies documenting successful or positive outcomes of digital technologies may be more likely to achieve publication than those documenting failure or harm, potentially producing an optimistically skewed evidence base. Fourth the rapid development of technology findings on specific platforms or tool may have limited validity or storage space mainly in the domains such as AI and Machine learning where the landscape is evolving on a timescale measured in

months. Finally quality heterogeneity across studies such as varying from various methodologically systemic review and RCT to cross sectional surveys with significant limitations needs close monitoring on findings from weaker studies although quality assessment informed rather than determined the weight attribute to individual source.

Conclusion

Digital transformation has become an integral component of contemporary nursing practice, education, and healthcare delivery. This integrative review, guided by the Whitemore and Knafl framework, demonstrates that digital technologies can enhance patient safety, improve care coordination, expand nursing roles, and support innovative educational approaches. However, the findings also highlight persistent challenges related to digital literacy, organizational readiness, leadership support, and equitable access to technology.

A key finding of this review is that successful digital transformation depends less on the technology itself and more on the socio-technical environment in which it is implemented. Technology adoption is most effective when supported by workforce preparation, strong governance, evidence-based implementation strategies, and organizational commitment.

To maximize the benefits of digital transformation, healthcare organizations should prioritize digital competency development, nurse involvement in technology design and implementation, and policies that promote ethical, equitable, and patient-centered care. As the largest group of healthcare professionals and the primary providers at the point of care, nurses are uniquely positioned to shape a digital future that enhances healthcare outcomes while preserving the humanistic values central to nursing practice.

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Graduate Attributes Acquisition in Nursing and Allied Health Professions Education at the Higher Institute of Health Specialties, Oman: A Multi-Cohort Cross-Sectional Study (2018-2025)

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Abstract

Background: Graduate attributes are essential outcomes in higher education, representing key competencies required for workforce readiness. In nursing and allied health professions education, these attributes are critical for preparing graduates to deliver safe, effective, and patient-centered care. This study aims to assess postgraduate students' perceptions of graduate attributes acquisition at the Higher Institute of Health Specialties in Oman.

Methods: A retrospective cross-sectional study was conducted using institutional survey data collected between 2018 and 2025. A total of 435 postgraduate diploma graduates from nine different specialties were surveyed. Data was collected using a validated structured questionnaire with high internal consistency (Cronbach's $\alpha = 0.989$). Descriptive statistics, one-way ANOVA were employed for data analysis.

Results: Students reported high levels of agreement across all studied graduate attributes, with mean scores ranging from 3.39 to 3.49. Among graduate attribute domains, "Cultural Sensitivity" attained the highest mean score (3.44 ± 0.446), followed in descending order by "Communication" (3.42 ± 0.564), "Legal & Ethical Practice" (3.41 ± 0.566), "Lifelong Learning" (3.41 ± 0.582), "Innovative Leadership" (3.41 ± 0.564), "Knowledgeable & Safe Practice" (3.40 ± 0.511), "Critical Thinker" (3.40 ± 0.560), and "Research-Related Competencies" (3.39 ± 0.564); the lowest was still above the midpoint. No

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statistically significant differences were observed across academic programs ($p = 0.424$) or cohorts ($p = 0.202$). Differences across domains were statistically significant ($p = 0.020$), but the effect size was minimal.

Conclusion: The study results indicate that nursing and allied health professions from different postgraduate diploma programs at the studied institution effectively support the consistent development of graduate attributes. However, targeted improvements in “Research-Related Competencies” are recommended. These results have implications for curriculum development, teaching strategies, and quality assurance.

Keywords: Allied Health Professions, Graduate Attributes, Nursing Education, Quality Assurance, Retrospective Study

Introduction

In developing countries, higher education systems face increasing market pressures to demonstrate their value, contributing to the conceptualization and adoption of “Graduate Attribute”(GA)indicators and frameworks.¹ GAs refer to the qualities, skills, and understandings that students are expected to develop during their academic studies.^{1,2} These include communication, teamwork, critical thinking, clinical reasoning, professionalism, ethics, and digital literacy, skills considered essential for employability, adaptability, and professional growth in contemporary workplaces.³ Consequently, Higher Education Institutions (HEIs) carry the responsibility of developing these capabilities,⁴ and GAs already guide curriculum design, teaching practices, assessment, and institutional direction (albeit often in an unsystematic way).^{4,5}

Despite their obvious and axiomatic importance, uncertainty remains regarding how well staff and students understand or engage with GAs.¹ Concerns have been raised that current higher education systems are not sufficiently preparing graduates for rapidly changing professional contexts, resulting in a skills gap between what students learn (rooted in legacy curriculums), and what the labor market demands.⁴ At the same time, universities face growing influence from business and government sectors, raising debates about whether higher education should prioritize employability above traditional broader educational purposes.⁶ In any case, the challenge for HEIs seeking to deliver value to students and society lies in strengthening student capability and adaptability, while ensuring that education maintains both academic depth and

pertinent long-term socioeconomic value, rather than becoming purely market-driven.⁶

The rising emphasis on GAs is linked to the recognition of continuous professional development and lifelong learning, commensurate with changing technological and professional expectations and labor market demands. Traditionally, undergraduate education fed into specialist professional careers, but nowadays graduates and employers face different and more dynamic needs and pressures, which naturally affect graduate employability, and the development of outcome-based quality measures.⁴

In Oman, the need to adapt to the contemporary HEI landscape is reflected in the work of the Oman Authority for Academic Accreditation and Quality Assurance of Education, which oversees institutional and program accreditation through external audits, self-study evaluations, and public reporting to support transparency and quality enhancement.⁴ This Authority requires that HEIs clearly define, implement, and evaluate GAs as part of program learning outcomes, with evidence of their achievement forming a key component of accreditation and institutional review processes, as conceptually displayed in Figure 1. This alignment ensures that GAs are not only institutionally relevant, but also nationally standardized and benchmarked against international expectations for professional practice.

Despite the growing emphasis on GAs in health professional education, there is a limited understanding of how students perceive their development of these essential skills over time. Preliminary observations at the Higher Institute of Health Specialties (HIHS) suggest variability in students’ awareness and engagement with GAs, raising concerns about their

preparedness for evolving healthcare environments. This gap highlights the need to examine students' perceptions of GA acquisition at the HIHS and to identify key academic and institutional factors influencing these perceptions across multiple cohorts from 2018 to 2025 to inform curriculum design, teaching strategies, and learning environment improvements.

The present study focuses exclusively on postgraduate students, because they are the primary beneficiaries and direct recipients of the education process with regard to Gas (i.e., undergraduates are still in the process of acquiring these attributes at a preliminary level). While the perspective of faculty members, institutional leaders, government agencies, employers, and other stakeholders are also important for a comprehensive evaluation of GAs, their inclusion was beyond the scope of this retrospective study, which is primarily geared toward exploring the immediate outcomes of the current GA framework (i.e., "graduate" attributes among "graduates" themselves). Therefore, this study assesses postgraduate students' perceptions of GA acquisition at the HIHS, and examines differences across cohorts, academic programs, and attribute domains.

Material and Methods

Study Design

This study adopted a retrospective cross-sectional design utilizing existing institutional survey data collected and maintained by the Quality Section of the HIHS(HIHS-QS).

Study Population

Inclusion and Exclusion Criteria

The study included postgraduate students enrolled at HIHS between 2018 and 2025 who voluntarily completed the GA survey. These cohorts were chosen because they reflect individuals who have firsthand experience with the curriculum, instructional strategies, evaluation techniques, and learning environment of the Institute, offering well-informed perspectives on the acquisition of GAs. All

participants provided informed consent for the use of their data for institutional research and quality improvement purposes.

Exclusion criteria included survey responses that were incomplete or missing key variables related to GA perceptions, students who withdrew from their programs before survey completion, and records identified as duplicates or containing unverifiable data. Additionally, data from the academic year 2019-2020 were excluded due to the significant disruption caused by the COVID-19 pandemic, which resulted in reduced student participation.

Sampling Strategy and Population Response Rate

All postgraduate students at the HIHS were invited to participate via a general email (containing study information and a survey link, as described below), distributed to all students' official HIHS email accounts. A census sampling strategy was employed, whereby all postgraduate students who completed the institutional GA survey between 2018-2025 and met the eligibility criteria were included in this study. Since this study was retrospective analysis of the existing institutional survey data, no additional participant recruitment was conducted. During the study period 643 postgraduate students were eligible to participate, and 435 completed this survey, yielding a notably high overall response rate of 67.6%.

Data Collection

Instrument

The study utilized a preexisting, structured, four-point, Likert-type quantitative questionnaire, which was designed by the HIHS-QS specifically to evaluate students' perceptions of their own development across a comprehensive range of GA domains. The instrument assesses the achievement of GAs among all students (irrespective of the program of study). The current retrospective study utilized these existing anonymous data; therefore, no additional data collection was undertaken by the research team.

The instrument's domains include: "Communication", "Critical Thinker", "Cultural Sensitivity", "Innovative Leadership", "Knowledgeable & Safe Practice", "Legal & Ethical Practice", "Lifelong Learning", and "Research-Related Competencies". The instrument has been routinely administered within the institution as part of its quality assurance processes over many years (since 2018), and it is aligned with recognized GA frameworks in higher education, ensuring contextual relevance and applicability.

Instrument Validity and Reliability

Although the present study employed a retrospective cross sectional design using existing institutional survey data, the GAs questionnaire had been developed, validated, and routinely implemented by the HIHS-QS as part of its institutional quality assurance process prior to commencement of this study. The validity and reliability of the instrument were carefully considered by the HIHS. Content validity was established through a systematic review by subject matter experts, including faculty members and curriculum specialists, to ensure that all relevant GAs were adequately represented. Face validity was confirmed by academic staff and program coordinators, who assessed the clarity, comprehensibility, and appropriateness of the survey items in capturing students' perceptions. The internal consistency of the instrument was evaluated using Cronbach's α , demonstrating excellent reliability ($\alpha = 0.989$), indicating a high degree of consistency among the survey items.

Procedure

As part of the HIHS Quality Assurance process, the GA survey is administered electronically by the HIHS-QS. Survey links generated by the HIHS-QS are distributed via the official HIHS-QS email server to all postgraduate students' official emails upon completion of their program. Participation in the annual survey is voluntary, and responses are collected anonymously, to ensure confidentiality.

The HIHS-QS securely store and maintain the anonymized survey data for institutional quality assurance and program evaluation purpose throughout the study period.

Data Analysis

To ensure confidentiality and data protection, all records were anonymized, and unique study identification numbers were assigned to each participant. No personally identifiable information was retained in the analytical dataset. Data management procedures included systematic data cleaning, such as screening for missing values, identifying and removing duplicate entries, verifying data accuracy, and standardizing variable coding across cohorts to ensure comparability over time. The dataset was securely stored in password-protected institutional systems, with restricted access limited to authorized members of the research team.

Statistical analysis was conducted using both descriptive and inferential approaches. Descriptive statistics were used to summarize participant characteristics and responses across GA domains, including means, standard deviations (SDs), frequencies, and percentages. Comparative analyses were performed using one-way analysis of variance (ANOVA) to examine differences in GA scores across cohorts and academic programs. Trend analysis was undertaken to explore patterns and changes in students' perceptions over time. In addition, repeated measures ANOVA was conducted to assess within-subject differences across the various GA domains. All statistical analyses were performed using SPSS Statistics (version 28), and a p-value of ≤ 0.05 was considered statistically significant.

Ethics

Ethical approval was obtained from the HIHS ethical committee for this retrospective study of anonymous, aggregate data. The HIHS-QS is responsible to administer the standardized GA

survey to postgraduate students at the completion of their academic programs. The collected data are automatically anonymized (i.e., the researchers and HIHS personnel are blinded to the identity of individual participants), and are securely stored in the institutional quality assurance database, maintained according to the institutional policies. Access to this data is restricted to authorized personal and is used for institutional quality monitoring, program evaluation, and approved research purposes.

Results

Overview

A total of 435 postgraduate students participated in the study (Figure 2). Participants

represented nine postgraduate diploma programs offered in HIHS and cohorts graduating between 2018 and 2025. The study sample was predominantly female and of Omani nationality. The largest proportion of participants was enrolled in the Health Services Management Program (18.2%, $n=79$), followed by the Adult Critical Care Nursing Program (16.8%, $n=73$), while the Critical Care Neonatal and Pediatric Nursing Program contributed the smallest proportion of participants (6.2%, $n=27$). The remaining participants were distributed across Community Health Nursing, Midwifery, Emergency Nursing, Mental Health Nursing, Infection Prevention and Control, and Nephrology Nursing programs (Figure 2), providing representation from all major postgraduate diploma programs at HIHS.

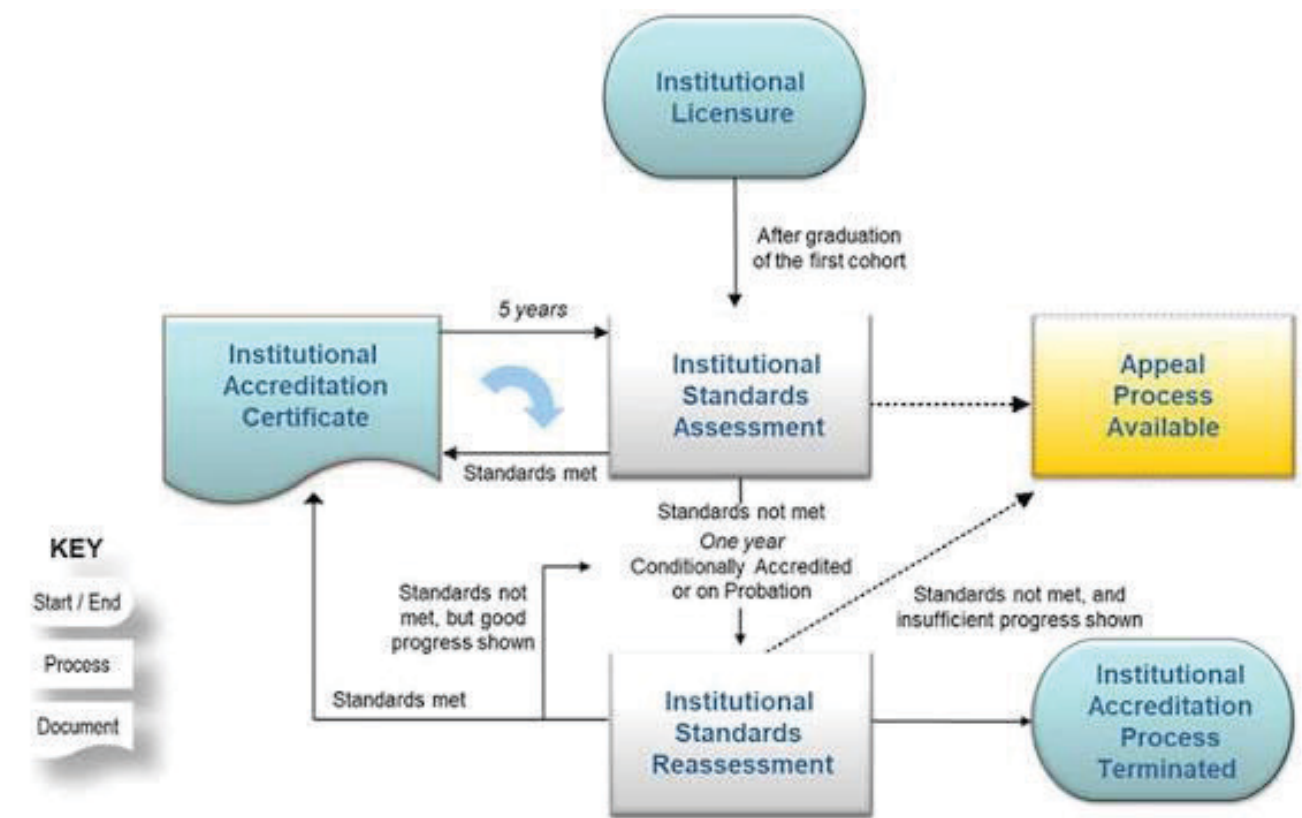


Figure 1: Conceptual illustration of the Oman Authority for Academic Accreditation and Quality Assurance of Education framework.^{23''}

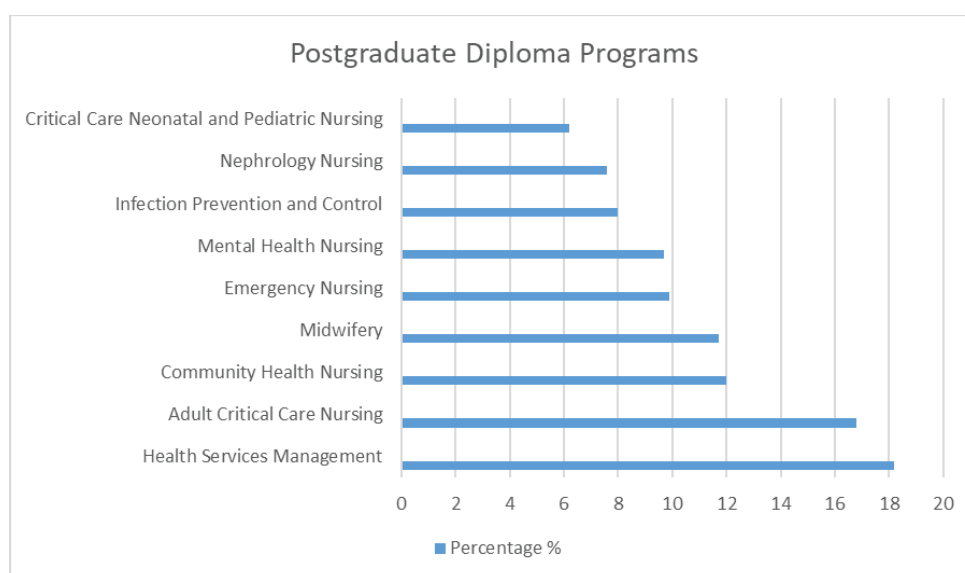


Figure 2: Distribution of participants by postgraduate diploma programs at the Higher Institute of Health Specialties (N = 435).

Overall, students reported high levels of perceived acquisition of GAs. Mean scores across all GA domains ranged from 3.39 to 3.44 on a four-point Likert scale, indicating that participants generally selected either “agree” or “strongly agree” when rating their attainment of the expected GAs. This pattern demonstrates a consistently positive perception of GA development among postgraduate students regardless of program or cohort.

GA Scores by Postgraduate Program

Table 1 presents the distribution of participants and mean GA scores according to postgraduate diploma program. Mean total GA scores ranged from 62.21 ± 11.25 in the Community Health Nursing Program to 66.41 ± 9.29 in the Health Services Management Program. Students enrolled in the Emergency Nursing Program also reported relatively high scores (66.35 ± 12.23), followed by those in the Midwifery Program (65.42 ± 8.95) and Nephrology Nursing Program (65.64 ± 10.04).

Table 1. Distribution and mean “Graduate Attribute” scores by postgraduate program.

Program	Frequency n (%)	Mean $\pm$ SD
Health Service & Management	79 (18.2)	66.41 ± 9.29
Adult Critical Care Nursing	73(16.8)	65.00 ± 9.94
Critical Care Neonatal and Pediatric Nursing	27 (6.2)	62.48 ± 10.23
Emergency Nursing	43 (9.9)	66.35 ± 12.23
Mental Health Nursing	42 (9.7)	65.00 ± 9.73
Infection Prevention and Control	35 (8.0)	65.11 ± 9.29
Nephrology Nursing	33 (7.6)	65.64 ± 10.04
Community Health Nursing	52 (12.0)	62.21 ± 11.25
Midwifery	50 (11.5)	65.42 ± 8.95
p-value		0.424

*Note.*One-way ANOVA was used to compare mean scores across programs. A p-value ≤ 0.05 was considered statistically significant. Effect size was calculated as $\eta^2 = 0.008$ (very small effect).

Although numerical differences in mean scores were observed between programs, these variations were relatively small and accompanied by overlapping SDs, indicating comparable levels of perceived GA acquisition across disciplines. One-way ANOVA confirmed that these differences were not statistically significant ($p = 0.424$, $\eta^2 = 0.008$). This indicates that perceptions of GAs acquisition were consistent across different fields of study.

The relatively consistent mean scores across programs indicate that the GAs are being developed uniformly across the various academic disciplines offered by the institution.

GA Scores Across Student Cohorts

Table 2 summarizes students' perceptions of GA acquisition across six graduating cohorts spanning the period from 2018–2019 to 2024–2025. Mean scores ranged from 63.71 ± 9.51 among the 2024–2025 cohort to 67.15 ± 9.13 among the 2022–2023 cohort. The largest cohort included students graduating during 2023–2024 ($n = 132$), followed by the 2024–2025 cohort ($n = 99$). Earlier cohorts were represented by smaller sample sizes, particularly the 2020–2021 cohort ($n = 19$).

Table 2. Descriptive statistics and one-way ANOVA results for students' perceptions of "Graduate Attribute" acquisition across cohorts (2018-2025).

Cohort	N	Mean	SD	95% CI (Lower-Upper)
2018-2019	43	65.49	8.88	62.76-68.22
2020-2021	19	65.05	9.22	60.61-69.49
2021-2022	64	66.02	11.42	63.16-68.87
2022-2023	78	67.15	9.13	65.09-69.21
2023-2024	132	63.98	10.73	62.14-65.83
2024-2025	99	63.71	9.51	61.81-65.60
Total	435	64.98	10.09	64.03-65.93

Note. One-way ANOVA revealed no statistically significant differences between cohorts ($F(5, 429) = 1.461$, $p = 0.202$, $\eta^2 = 0.017$). This indicates a very small effect size, suggesting that students' perceptions of graduate attribute acquisition remained stable across the study period.

The 95% confidence intervals for the cohorts' mean scores demonstrated substantial overlap, further supporting the similarity of students' perceptions across graduation years. One-way ANOVA showed that differences in mean GA scores between cohorts were not statistically significant, $F(5, 429) = 1.461$, ($p = 0.202$, $\eta^2 = 0.017$). These findings indicate that students' perceptions of GA acquisition remained stable over time despite minor fluctuations in average scores between successive cohorts.

Students' Perceptions Across GA Domains

Descriptive statistics for each GA domain are presented in Table 3. Mean domain scores were consistently high, ranging from 3.39 ± 0.564 to 3.44 ± 0.446 , demonstrating positive perceptions across all eight GA domains.

Table 3. Descriptive statistics of students' perceptions across "Graduate Attribute" domains (N = 435)

Domain	Mean $\pm$ SD
"Knowledgeable & Safe Practice"	3.40 ± 0.511
"Critical Thinker"	3.40 ± 0.560

Continue....

"Research-Related Competencies"	3.39 ± 0.564
"Communication"	3.42 ± 0.564
"Legal & Ethical Practice"	3.41 ± 0.566
"Lifelong Learning"	3.41 ± 0.582
"Innovative Leadership"	3.41 ± 0.564
"Cultural Sensitivity"	3.44 ± 0.446

Among the domains, "Cultural Sensitivity" attained the highest mean score (3.44 ± 0.446), suggesting that students perceived themselves to be particularly competent in demonstrating respect for cultural diversity and providing culturally responsive healthcare. The relatively lower SD also indicates greater consistency in responses among participants for this domain.

The "Communication" domain achieved the second-highest mean score (3.42 ± 0.564), followed by "Legal & Ethical Practice", "Lifelong Learning", and "Innovative Leadership", each with a mean score of 3.41. The "Knowledgeable & Safe Practice" and "Critical Thinker" domains each recorded a mean score of 3.40, reflecting similarly positive perceptions of competency. The "Research-Related Competencies" domain recorded the lowest mean score (3.39 ± 0.564); however, this value remained well above the midpoint of the response scale, indicating that students generally agreed that they had developed "Research-Related Competencies", despite this domain receiving comparatively lower ratings than the others.

To examine differences among the eight GA domains, a repeated-measures ANOVA was performed. The analysis identified a statistically significant difference in mean scores across domains ($p = 0.020$, partial $\eta^2 = 0.012$). However, the observed effect size was very small, indicating that although statistical differences existed, the magnitude of these differences was negligible and of limited practical importance.

Summary

Across all analyses, students consistently reported positive perceptions regarding the acquisition of the HIHS GAs. No statistically significant differences were observed according to postgraduate program or graduating cohort, indicating that GA development was perceived similarly across academic disciplines and over successive years. Although small statistical differences were observed among individual GA domains, these differences were minimal, with all domains receiving mean scores above 3.3 on a four-point scale. Overall, the findings demonstrate a high level of perceived GA attainment among postgraduate students at HIHS.

Discussion

In this study, students' perceptions of GAs acquisition at the HIHS were examined, highlighting the effectiveness and consistency of competency development across cohorts, programs, and domains. The results of the study indicate consistently high levels of perceived GAs attainment throughout cohorts and programs, suggesting that HIHS has a stable and integrated educational framework.

Overall Perception of GAs Acquisition

The results indicate that students reported high levels of agreement across all GAs items, with mean scores ranging from 3.39 to 3.49. From this result, HIHS postgraduate programs effectively support the development of key professional competencies required for professional practice. Furthermore, the reliability of the findings is strengthened by the high internal consistency of the instrument (Cronbach's α coefficient = 0.989).

The consistently high ratings across all items suggest that students are not only learning about GAs in the curriculum but also experiencing them in meaningful ways. Recent studies highlight competency-based education, interprofessional learning, and outcome-driven curricula that remain pivotal to health professions education globally,^{7,8} and are strongly associated with improved graduate readiness for practice.⁹⁻¹¹ Similar emphasis has

been noted in the Omani context, where GAs are specifically incorporated into national frameworks and institutional policies to direct curriculum development and student growth. Additionally, an examination of Oman's quality audit reports reveals that HEIs are under growing pressure to show quantifiable attainment and match learning outcomes with GAs.⁴

However, the consistently high scores may also indicate that the instrument may lack sensitivity in distinguishing higher skill levels while students perceive strong competency attainment. Furthermore, there is a risk of social desirability bias among longstanding postgraduate students rating their HEI.

Domain-Level Insights

The results indicate slight differences in scoring across all domains, but they provide important insights. The "Cultural Sensitivity" domain recorded the highest mean score (mean = 3.44), suggesting that students view themselves as highly respectful, tolerant, and responsive to various cultural contexts. This is especially significant in the Omani healthcare environment, where providing culturally competent care is crucial. The strong results in this area might be indicative of the incorporation of ethical, social, and cultural elements within the curriculum, along with experiences with diverse patient groups.

In contrast, the "Research-Related Competencies" domain recorded the lowest mean score (mean = 3.39), although still in a high range. This suggests that although students feel reasonably confident in the application of research and evidence-based practice, this area may not be as strongly emphasized or experienced as other skills.^{12,13} Similar findings have been reported in health professional education, where students typically demonstrate lower confidence in research-related skills compared to clinical competencies,⁸ particularly when research exposure is limited within clinical training environments.^{11,14} In the same vein, research on graduate employability and attributes in Oman has also shown that educational institutions tend to

prioritize generic and technical (e.g., clinical) skills, with limited integration of research competencies and industry engagement.¹⁵ This disparity highlights the necessity of better incorporating evidence-based practice and research training into postgraduate curricula. Given the central role of evidence-based practice in health care, even small gaps in perceived research competency can impact graduates' ability to critically evaluate scientific evidence and contribute to improved practice.

The repeated measures ANOVA confirmed statistically significant differences across all domains; however, the effect size was very small (partial $\eta^2 = 0.008$), suggesting that these differences are not practically significant. This implies that GAs have been developed with no significant gaps, but with space for specific improvement, especially in "Research-Related Competencies".

Consistency Across Cohorts

A vital finding of this study is that there are no statistically significant differences across cohorts ($p = 0.202$). Students' opinions of GAs acquisition were similar between 2018 to 2025, despite slight variations in mean scores. This is consistent with research from Oman and the larger Gulf Cooperation Council, where standardized educational outcomes across student cohorts are facilitated by accreditation requirements and structured competency frameworks. According to Al Saadi (2023), national quality assurance bodies in Oman play a crucial role in maintaining consistency by mandating that institutions show that program outcomes and GAs are aligned.⁴

This notable consistency indicates that HIHS's curriculum delivery, teaching quality, and assessment methods have remained stable over time. Additionally, it shows that the Institute's initiatives for quality control and standardization are successful in preserving consistent learning experiences across various student cohorts. While this consistency reflects stability in curriculum delivery, it may also indicate a lack of sensitivity in capturing developmental progression across the training stages.

This consistency also aligns with the findings from institutions with structured curricula and strong quality assurance systems, where standardized learning environments contribute to stable student perceptions across cohorts.^{14,16}

Comparison Across Programs

The analysis revealed no statistically significant differences in GAs across the various programs offered at HIHS ($p = 0.424$). The mean scores ranged from 62.21 to 66.41, but these variations were not significant. This finding suggests that GAs are uniformly embedded across all programs at HIHS, regardless of specialization. This consistency reflects effective institutional alignment of the program learning outcomes with the general GAs, which is considered a fundamental principle of curriculum design and quality assurance in higher education.^{17,18} Regional studies have shown similar patterns, with GAs becoming more uniform across programs to satisfy workforce demands and accreditation requirements. However, research from Oman also indicates that to improve the applicability of these qualities in practical contexts, greater cooperation between academic institutions and business stakeholders is required (which in this context entails enhanced public-private collaboration).¹⁵

Strengths in Key Competency Areas

High scores in domains such as “Communication”, Legal and Ethical Practice, “Innovative Leadership”, and “Lifelong Learning” indicate that students feel well-prepared in important areas required for healthcare practice. These competencies are essential in multidisciplinary healthcare environments and are frequently strengthened through clinical training, teamwork, and reflective practice. Research on health professions students in Oman has also shown positive perceptions toward collaborative practice and interprofessional learning, highlighting the significance of these skills in healthcare education.¹⁹ The strong results in the “Knowledgeable & Safe Practice” domain demonstrate how well HIHS programs prepare students for competent and safe clinical practice, which is the fundamental requirement in postgraduate health education.

Implications for Curriculum and Teaching

The results highlight several significant implications for curriculum development and teaching practices. The consistently high scores across all studied domains imply that current methods of instruction, such as interactive learning techniques and clinical exposure, are effective and should be continued.

However, the relatively lower scores in the “Research-Related Competencies” domain suggest that organized opportunities such as student-led projects, research mentorship, and evidence-based assignments are needed to improve research integration. Stronger focus on high order competencies (e.g., research application and innovation) may further improve the results, but low variations across domains indicate that GAs are well aligned. Faculty development initiatives may help teachers to incorporate these skills more efficiently into their teaching and assessment practices.²⁰

Quality assurance reviews in Oman stress the significance of incorporating stakeholders in curriculum development and methodically evaluating GAs.⁴ Furthermore, current worldwide developments emphasize how innovation and technology-enhanced learning support competency development.²⁰ Enhancing research competencies is particularly important in the Omani context, where strengthening evidence-based practice is a key priority in national healthcare strategies.²¹

Implications for Quality Assurance

From a quality assurance perspective, the results offer compelling proof of institutional efficacy in delivering GAs consistently across cohorts and programs. The consistency of the results over time demonstrates the strengths of the academic framework and the policies at HIHS. As part of accreditation procedures, regulatory bodies in Oman mandate that institutions precisely define, evaluate, and continuously enhance GAs, highlighting the significance of continuous assessment and benchmarking via coherent indicators.⁴

The use of student perception data offers a valuable understanding of the lived educational experience and enhances traditional performance-based indicators. To support ongoing quality improvement in higher education, it is generally advised to incorporate such data into routine program review and accreditation procedures.¹⁹

Strengthening research competencies through structured mentorship and inquiry-based learning has been widely recommended to enhance evidence-based practice skills among health professions students.^{9,11}

These findings are particularly relevant to nursing education, where the development of competencies such as clinical reasoning, "Communication", and evidence-based practice is essential for safe patient care.

Strengths and Limitations

The retrospective cross-sectional design offers several strengths, including time and cost efficiency, the ability to assess multiple variables simultaneously, and suitability for estimating prevalence and identifying associations across groups, thereby enhancing the generalizability of results.

However, the cross-sectional design limits the ability to track individual progression over time, and the observed high scores may reflect a ceiling effect. Additionally, the reliance on self-reported measures may introduce bias, as previous research suggests that perception-based instruments may overestimate competency and lack sensitivity in detecting nuanced differences in skill acquisition.^{14,22} Furthermore, postgraduate students (and alumni) may exhibit social desirability bias and be favorably disposed to their alma mater, causing them to express excessively positive perceptions (although this in itself reflects student satisfaction and is indicative of HEI quality).

Conclusion

Main Outcomes

This study offers insightful information about how postgraduate students at the HIHS perceive

GAs acquisition. The results show consistently high levels of perceived competency in every domain, suggesting that HIHS programs successfully aid in the development of essential professional attributes required for healthcare practice. The HIHS's curriculum implementation and quality assurance procedures are strong, consistent, and standardized, as evidenced by the lack of notable differences between cohorts and programs.

Significantly, the findings confirm that HIHS is effective in developing critical skills, such as "Communication", "Legal & Ethical Practice", "Cultural Sensitivity", and "Lifelong Learning", all of which are attributes that are essential for graduates' successful performance in intricate and multidisciplinary healthcare settings. These results are consistent with regional and worldwide trends in health professions training that prioritize competency-based education and outcome-driven curricula.^{7,8}

The comparatively lower scores in the research domain, however, point to a specific area that needs improvement. Enhancing research-related skills such as critical appraisal, data interpretation, and evidence-based decision-making will be crucial in preparing graduates to support innovation and ongoing healthcare system improvement. Addressing this gap through organized research training, mentorship, and incorporation of evidence-based practice within curricula is recommended.⁸

From a wider angle, this study adds to the increasing amount of data on GA development within the Gulfregion, especially in Oman, where higher education institutions are under increasing pressure to show quantifiable results aligned with national quality assurance frameworks.⁴ The results highlight the significance of continuous assessment, stakeholder involvement, and benchmarking programs to ensure that GAs remain relevant and adaptable to changing health care requirements.

Further Research and Practice

Future research should incorporate objective, larger samples, comparative studies across Gulf

countries, male and female differences, performance-based measures to complement self-reported data, as well as longitudinal designs to evaluate the development of GAs over time. A more comprehensive understanding of the effectiveness of GA development could also be achieved by exploring employer perspectives and assessing workplace readiness.³Future studies could try using the same instrument with students at other HEIs in Oman and elsewhere, particularly seeking to compare the GA experiences of students in private and public institutions.

In conclusion, although HIHS demonstrates strong performance in developing well-rounded healthcare professionals, continued efforts by researchers and practitioners to strengthen research competencies and align educational practices with evolving healthcare demands are essential, to ensure workforce readiness for the future, and to attain the fundamental services and socioeconomic benefits for students and society for which education itself is instituted.²⁰

Statements and Declarations

Ethical Considerations

Ethical approval was obtained from the Higher Institute Research and Newsletter Committee on 15 February 2026 (Ref: MOH/HIHS/2026), and all procedures followed were in accordance with the ethical standards.

Consent to Participate

The study used previously collected survey data for which informed consent was obtained from participants at the time of data collection.

Consent for Publication

All data were collected and analyzed in anonymized form; therefore, consent for publication was not required.

Declaration of Conflicting Interest

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Funding Statement

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Data availability

The authors confirm that the data supporting the findings of this study are available within the article (and/or) its Supporting Information Materials.

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Prevalence and Associated Factors of Internet Addiction among Adolescents in an Urban Setting in Nepal: A Cross-sectional School-based Study

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Abstract

Background: Adolescents are increasingly vulnerable to internet addiction due to early and frequent internet exposure, particularly in urban areas where internet use is higher globally and in Nepal. Growing internet accessibility in developing countries has put adolescents at risk of internet addiction. Therefore, this study aimed to assess the prevalence and associated factors of internet addiction among adolescents in an urban setting in Nepal.

Materials and Methods: A cross-sectional school-based study was employed among 348 adolescent students in grade eleven and twelve recruited from a public school of Kathmandu metropolitan city, Nepal. One-stage cluster sampling technique was used to select sections. Data were collected using a self-administered structured questionnaire. Data were analyzed using the Chi-square and logistic regression.

Results: The prevalence of internet addiction among adolescents was 56.84%. Adolescents who engaged in entertainment based online activities have higher odds including chatting (OR=1.82, 95% CI: 1.120–4.818), listening to music and watching videos or movies (OR=1.982, 95% CI:1.048–3.748) and playing online games (OR=1.82, 95% CI:1.153–2.859). Adolescents who spent three or more hours online daily have higher odds of internet addiction (OR=3.25, 95% CI:2.054–5.159) whereas internet use for educational purposes and parental control were not significantly associated with internet addiction.

Conclusions: The prevalence of internet addiction among adolescents in an urban Nepal is high. Internet addiction was higher in adolescents engaged in entertainment-based online activities, and those spending longer hours online daily. Thus the study emphasizes promoting educational and goal-oriented online activities.

Keywords: Adolescents, Internet Addiction, Nepal, Prevalence, Urban setting

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Introduction

Adolescence is a unique stage of human development and an important time for laying the foundations of good health ^[1]. During this period, there is an increased risk of emotional crises, often accompanied by mood changes and periods of anxiety and depressive behavior ^[2]. Research has indicated a link between social media use and psychological problems ^[3]. A meta-analysis showed a positive correlation between social networking sites addiction with depression, stress and anxiety ^[4]. Globally, it is estimated that one in seven (14.3%) of 10-19 year-old experience mental health conditions ^[5]. It is estimated that 4.1% of 10-14 year adolescents and 5.3% of 15-19 year adolescents experience an anxiety disorder. Depression is estimated to occur among 1.3% of adolescents aged 10-14 years, and 3.4% of 15-19 years ^[5]. In Nepal, the prevalence of mental disorder was 5.2%, stress related disorder was 2.8% and major depressive disorder was 0.6% among adolescents ^[6]. Virtual communication featured by media use is prevalent among adolescents in the information age ^[7]. Adolescents are more likely to use the internet for a wide range of activities such as information search, social networking, communicating, music playing, emailing, playing games and fulfilling their social needs ^[8].

Internet is considered to be the most widely used media in the world. It has penetrated all process of life ^[9]. An excessive and uncontrolled internet use, often referred to as internet addiction, affects many aspects of a person's daily life ^[10]. The number of internet users has grown exponentially in the world; the number of active internet users in the world far exceeds 4 billion people ^[11]. The proportion of the global population using the internet increased from 17% in 2005 to 53.6% in 2019, with more than half of the internet users living in Asia ^[12]. In Nepal, the government's efforts to promote digital technology and expand internet access have led to a significant increase in internet users ^[13]. Nepal's internet penetration rate is 55.8% and 16.5 million individuals using internet in 2025 ^[14]. A survey in Nepal reported that 51.1% of the households had access to

the internet, with 44.2% of the population using it at least once a week ^[15].

Internet usage in urban dwellers is significantly higher compared with those living in rural areas, globally as well as in Nepal ^[16]. In Nepal, broadband internet access is available in urban areas boast a higher rate at 45.7%, while rural areas lag at 21.5% ^[17]. In urban areas of Kathmandu valley, 79.3% households have access to the internet, while 43.2% households in urban areas outside Kathmandu valley and 17.4% households in rural areas have access to the internet. This shows the disparity in internet access in urban and rural areas ^[18].

The prevalence of severe problematic internet use is ranged from 0 to 47.4%, whereas the prevalence of internet overuse is ranged from 7.4% to 46.4% among students from Southeast Asia ^[19]. Children are using internet without knowing that harming, damaging, and abusing or insulting someone may amount to crime ^[20]. The widespread use of the internet has resulted in the significant concerns with regards to problematic internet behaviour and related conditions ^[21]. Among internet users, physical impairments have been found such as insomnia (26.8%), daytime sleepiness (20%), and eye strain (19%) ^[19]. Internet addiction reduces social interaction to family, friends, and community leading to mental health problems such as depression, anxiety, and other psychological problems ^[22].

The growing availability of the internet, along with widespread use of devices like smart phones and tablets, allows adolescents to access and use internet during the day and at bedtime. In developing countries, this easy access has increased the risk of internet addiction among adolescents ^[23]. The extreme use of internet showed the addictive behaviour of the internet use ^[24]. Although concerns are rising and policy debates continue about the negative impact of internet use, much remains to be learned and studied about internet addiction, particularly among adolescents. Internet addiction is increasingly recognized as significant public health concern, especially when it has negative effects on children and adolescents ^[25].

Adolescents who have grown up in the digital technology era are more vulnerable to internet addiction because of their early exposure to the internet [26]. Assessing the prevalence of internet addiction and its associated factors among adolescents can help to address the negative consequences they face during their developmental stage. However, existing research has largely focused on older adults [19, 27-28]. Kathmandu district of Nepal is the fastest-growing urban areas in South Asia [29], where the adoption of digital technologies and internet use is rapidly expanding [13]. While studies focus on more technologically advanced settings [27] rapidly urbanizing environment in a developing country like Nepal offer unique sociocultural and technological context for better understanding of internet use. Thus this study aimed to assess prevalence and associated factors of internet addiction among adolescents in an urban setting in Nepal. This study findings are expected to strengthen nursing education by enhancing digital health literacy and preparing nurses to identify, counsel and support school and community-based interventions for healthy internet use among adolescents.

Materials and Methods

Study Design and Setting

A cross sectional descriptive study design was used in the study with quantitative research method. The study site was Kathmandu metropolitan city, Kathmandu district of Bagmati province, Nepal. Kathmandu is the Federal capital of Nepal, located in a bowl-shaped valley in the central part of the country. It has the largest population and the highest population density among all cities in Nepal [30]. In Nepal's population of 29,164,578, adolescents (10-19 years) comprised 20.1% of the total population. Bagmati Province had 1,081,509 adolescents (10-19 years), representing 18.4% of its total population [31].

Study Participants and Sampling

The study population was adolescents who were enrolled in grade 11 and 12 in Kathmandu metropolitan city. One public school with the highest student population was purposively selected for the study. The sample size was calculated using the Cochran formula, assuming a 29.9% prevalence of internet addiction [32], 95% confidence interval, and 8% non-response rate, resulting in a required sample size of 348 students. The school had a total of 26 sections, each comprising approximately 50 students. Based on this, seven sections were selected as clusters using the lottery method to obtain the required sample, including five sections with 50 students each and two sections with 49 students each. The response rate was 94.54% as 19 participants submitted the incomplete questionnaire thus 329 data sets was analyzed. Participants were adolescent students currently enrolled in secondary school, who had access to at least one device with internet, able to communicate in Nepali, and willing to participate in the study. Students who did not receive parental consent were excluded from participation.

Instruments

A self-administered structured questionnaire was used as the research instrument. Questionnaire consisted of socio-demographic characteristics, pattern of internet use and standardized "internet addiction test" questionnaire.

Socio-demographic characteristics: This questionnaire consisted of 7 questions including age, sex, grade, place of residence, source of household income, family type and number of siblings.

Pattern of internet use: The pattern of internet use questionnaire was developed based on a review of the relevant literature. This questionnaire consisted of 9 questions including devices used to access internet, devices used to connect internet, preferred

place to use internet, commonly used search engines, commonly used social networking sites, purposes of using internet, mostly preferred time for internet use, time spend online daily and parental control over internet use.

Internet Addiction Test (IAT): Internet addiction test is a validated instrument to measure internet addiction, developed by Dr. Kimberly Young [33]. It consists of 20 items and rated in terms of a five-point Likert rating scale (0=doesn't Apply, 1=rarely, 2=occasionally, 3=frequently, 4=often and 5=always). Likert scale ranging from 0 to 5 (0=less extreme behaviour to 5=most extreme behaviour) that measures the severity of self-reported compulsive use of the internet. The scoring ranges from 0 to 100 where 0 to 30 score is considered as normal level of internet usage; 31 to 49 score as mild level of internet addiction; 50 to 79 score as presence of a moderate level of internet addiction; and 80 to 100 score as severe dependence upon the internet. The higher the score is, the higher is the severity of the problem [34]. Cronbach's alpha of Internet Addiction Test is 0.88. Reliability of the tool is measured by internal consistency and test-retest method which is 0.88 and 0.82 respectively [34]. The instrument was translated into Nepali and subsequently back-translated into English to ensure that the original meaning was preserved. The translated version tool was pre-tested on 10% of the study sample. The reliability of the Nepali version of the Internet Addiction Test (IAT) was assessed using Cronbach's alpha, which was found to be 0.83, indicating good internal consistency.

Data Collection

Ethical approval was taken from Institutional Research Board (IRB) of National Academy of Medical Sciences (Ref. No. 458/2082/83) on September 18, 2025. Written permission was obtained from the school (Ref. No.082/403). Data were collected from 14 December 2025 to 2 January 2026. Participants were selected based on predefined inclusion criteria. The study purpose was explained to participants before data collection. Participants under 18 years

provided guardian-signed assent forms before informed consent was obtained, while participants aged 18 years or older provided informed consent directly. Participants were also ensured for the voluntary participation and could withdraw from the study at any time. The questionnaire was distributed in classrooms during leisure periods. Participants completed a self-administered questionnaire in the Nepali language in the presence of the researcher, which took approximately 15-20 minutes to complete. Anonymity was ensured by coding questionnaires without names, and confidentiality was maintained by not disclosing participants' information. Data were collected by the researchers and stored on a password-protected laptop.

Data Analysis

Out of 348 recruited participants, data sets of 19 participants submitted the incomplete questionnaire thus 329 data sets was analyzed. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics were used to summarize socio-demographic characteristics and pattern of internet use. The data were presented as frequency, percentage, mean, minimum, maximum, and Standard Deviation (SD). Chi-square test was used to assess the association between levels of internet addiction and selected variables, with statistical significance p -value <0.05 . The strength and significance of association between dependent and independent variables was measured by Odds Ratio (OR) with 95% Confidence Interval (CI). The finding of the study was presented through tables and text.

Results

Table 1 shows that the mean age of the participants was 16.57 ± 0.92 years. Most of the participants (52.58%) were female and 50.76% were from grade eleven. Majority of participants (72.30%) stayed in rented home and 33.74% main source of household income is business. Majority of participants (63.22%) belonged to nuclear family and 92.40% participants had siblings.

Table 1. Socio-Demographic Characteristics of Adolescent Participants (n=329)

Socio-Demographic Characteristics	Frequency	Percentage
Age (in years)		
14-16	160	48.63
17-19	169	51.37
Mean±SD:16.57±0.92		
Sex		
Male	156	47.42
Female	173	52.58
School grade		
11	167	50.76
12	162	49.24
Place of residence		
Own home	91	27.70
Rented home	238	72.30
Source of household income		
Business	111	33.74
Service	114	34.65
Agriculture	81	24.62
Labour	23	6.99
Type of family		
Nuclear	208	63.22
Joint and extended	121	36.78
Number of siblings		
Single child	25	7.60
Having siblings	304	92.40

Table 2 illustrates that 97.26% participants used mobile phone followed by laptops (49.85%), TV screens (20.06%), tablets (10.94%), and computers (7.90%). Most participants connect internet through Wi-Fi (96.66%) followed by mobile data (45.89%), cable/modem (5.77%) and FTTH/optical networks (4.26%). Majority of participants used the internet at their residence/home (95.44%) followed by hostels (6.38%), cybercafés (6.38%) and schools (6.08%).

Google was commonly used search engines (89.36%) followed by YouTube (81.76%), ChatGPT (76.90%), Wikipedia (15.20%), Yahoo (5.17%) and Bing (4.86%). Participants commonly used WhatsApp (78.72%), Instagram (75.38%) face-book (67.17%) and messenger (63.53%). Most of participants used internet for chatting with friends and family (89.67%), searching study material (89.67%) and listening songs and watching videos/movies (86.32%). Night

was the mostly preferred time to use internet among 50.46% participants followed by evening (44.68%), morning (2.43%) and afternoon (2.43%). Most of the participants (60.18%) spend 3 hours or more time

online daily with 2.78 ± 0.90 hours per day mean duration of internet use. Most participants reported having parental control (88.15%), while 11.85% participants reported no parental control over their internet use.

Table 2. Internet Related Information among Adolescent Participants (n=329)

Internet Related Information	Frequency	Percentage
Devices used to access internet*		
Mobile phone	320	97.26
Laptop	164	49.85
TV screen	66	20.06
Tablet	36	10.94
Computer	26	7.90
Devices used to connect internet*		
WiFi	318	96.66
Mobile data	151	45.89
Cable/MODEM	19	5.77
FTTH/Optical network	14	4.26
Preferred place to use internet*		
Residence/Home	314	95.44
Hostels	21	6.38
Cybercafe	21	6.38
School	20	6.08
Commonly used search engines*		
Google	294	89.36
YouTube	269	81.76
Chat GPT	253	76.90
Wikipedia	50	15.20
Yahoo	17	5.17
Bing	16	4.86
Commonly used social networking sites*		
WhatsApp	259	78.72
Instagram	248	75.38

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Facebook	221	67.17
Messenger	209	63.53
Snapchat	109	33.13
Viber	56	17.02
Twitter	41	12.46
Wechat	12	3.65
Purposes of using internet*		
Chatting with friends and family	295	89.67
Searching study material	295	89.67
Listening songs and watching videos/movies	284	86.32
Posting pictures on different social sites	126	38.30
Preparing assignments	216	65.65
Playing online games	133	40.43
Sending and checking e-mail	89	27.05
Mostly preferred time for internet use		
Night	166	50.46
Evening	147	44.68
Morning	8	2.43
Afternoon	8	2.43
Time spend online daily		
< 3 hour	131	39.82
≥ 3 hours	198	60.18
Mean±SD:2.78±0.90		
Parental control over internet use		
Yes	290	88.15
No	39	11.85

*** Multiple Response**

Table 3 illustrates the prevalence and severity levels of internet addiction among adolescent participants. Among 329 adolescent participants, 43.16% were normal internet users while 56.84% were

identified as having internet addiction. Mild internet addiction was the most common category (37.69%), followed by moderate internet addiction (17.93%) and severe internet dependence (1.22%).

Table 3. Prevalence of Internet Addiction among Adolescent Participants (n=329)

Prevalence of Internet Addiction	Frequency	Percentage
Normal user	142	43.16
Internet addiction	187	56.84
Mild internet addiction	124	37.69
Moderate internet addiction	59	17.93
Severe dependence upon internet	4	1.22

Table 4 depicts that the internet addiction was not statistically associated with age ($p=0.186$), sex ($p=0.334$), grade ($p=0.669$), place of residence ($p=0.415$), source of household income ($p=0.979$)

and type of family ($p=0.457$). The adolescents who had siblings had about 3.7 times (OR=3.733, 95% CI: 1.514-9.204, $P=0.002$), more likely to develop internet addiction than single child adolescents.

Table 4. Association between Prevalence of Internet Addiction and Socio-demographic Variables (n=329)

Variables	Prevalence of Internet Addiction		Chi-square	p-value	OR (95% CI)
	Normal Internet Usage n (%)	Internet Addiction n (%)			
Age					
<17	75 (46.87)	85 (53.13)	1.751	0.186	1.343 (0.867, 2.081)
≥17	67 (39.64)	102 (60.36)			
Sex					
Male	63 (40.38)	93 (59.62)	0.932	0.334	0.806 (0.520, 1.249)
Female	79 (45.66)	94 (54.34)			
Grade					
11	74 (44.31)	93 (55.69)	0.183	0.669	1.100 (0.711, 1.702)
12	68 (41.98)	94 (58.02)			
Place of residence					
Own home	36 (39.56)	55 (60.44)	0.665	0.415	0.815 (0.498, 1.333)
Rented home	106 (44.54)	132 (55.46)			
Source of household income					
Business and service	97 (43.11)	128 (56.89)	0.001	0.979	0.994 (0.622, 1.588)
Agriculture and labour	45 (43.27)	59 (56.73)			

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Type of family					
Nuclear	93 (44.71)	115 (55.29)	0.554	0.457	1.188 (0.754, 1.872)
Joint and extended	49 (40.50)	72 (59.50)			
Number of siblings					
Single child	18 (72)	7 (28.00)	9.172	0.002 *	3.733 (1.514, 9.204)
Having siblings	124 (40.79)	180 (59.21)			

* p-value is significant at <0.05 level

Table 5 shows the Tablet users are about 2.5 times (OR=2.5, 95% CI:1.133-5.487, P=0.020), more likely to develop internet addiction than non-users. Wikipedia and Instagram user about twice (OR=1.95, 95% CI:1.019-3.731, P=0.041 and OR=1.82, 95% CI:1.098 3.019, P=0.020) more likely to develop internet addiction than non-users. Participants engagement in interactive or entertainment-based online activities (chatting OR=1.82, 95% CI:1.120-4.818, P=0.021; listening songs and watching videos/movies OR=1.982, 95% CI:1.048-3.748, P=0.033; playing online games OR=1.82, 95% CI:1.153-2.859, P=0.010 and e-mail user OR=1.721,

95% CI:1.036-2.858, P=0.035) is consistently associated with higher odds of internet addiction. Participants who spent three or more hours online per day have higher odds of internet addiction (OR=3.25, 95% CI:2.054-5.159, P=0.000) than those who spent less than three hours. Participants having internet access at residence (OR=1.160, 95% CI:0.411-3.278, P=0.779) does not significantly affect the likelihood of internet addiction. The use of internet for searching study material (OR=0.599, 95% CI:0.282-1.273, P=0.179) and parental control over internet use (OR=0.547, 95% CI:0.267-1.122, P=0.096) does not significantly increase internet addiction.

Table 5. Association between Prevalence of Internet Addiction and Internet Related Variables (n=329)

Variables	Prevalence of Internet Addiction		Chi-square	p-value	OR (95% CI)
	Normal Internet Usage n (%)	Internet Addiction n (%)			
Tablet user to access internet					
Yes	9 (25.0)	27 (75.0)	5.435	0.020*	2.494 (1.133, 5.487)
No	133 (45.39)	160 (54.61)			
Use of internet at residence					
Yes	135 (42.99)	179 (57.01)	0.79	0.779	1.160 (0.411, 3.278)
No	7 (46.67)	8 (53.33)			
Use Wikipedia as search engines					
Yes	15 (30.0)	35 (70.0)	4.163	0.041*	1.950 (1.019, 3.731)
No	127 (45.52)	152 (54.48)			

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Facebook user					
Yes	84 (38.01)	137 (61.99)	7.284	0.007*	1.892 (1.188, 3.014)
No	58 (53.70)	50 (46.30)			
Instagram user					
Yes	98 (39.52)	150 (60.48)	5.455	0.020*	1.820 (1.098, 3.019)
No	44 (54.32)	37 (45.68)			
Snapchat user					
Yes	38 (34.86)	71 (65.14)	4.576	0.032*	1.675 (1.042, 2.693)
No	104 (47.27)	116 (52.73)			
Messenger user					
Yes	79 (37.80)	130 (62.20)	6.716	0.010*	1.819 (1.155, 2.865)
No	63 (52.50)	57 (47.50)			
Use internet for chatting					
Yes	121 (41.02)	174 (58.98)	5.349	0.021*	2.323 (1.120, 4.818)
No	21 (61.76)	13 (38.24)			
Use internet for listening songs and watching videos/movies					
Yes	116 (40.85)	168 (59.15)	4.540	0.033*	1.982 (1.048, 3.748)
No	26 (57.78)	19 (42.22)			
Use internet for playing online games					
Yes	46 (34.59)	87 (65.41)	6.691	0.010*	1.816 (1.153, 2.859)
No	96 (48.98)	100 (51.02)			
Use internet for e-mail					
Yes	30 (33.71)	59 (66.29)	4.444	0.035*	1.721 (1.036, 2.858)
No	112 (46.67)	128 (53.33)			
Use internet for searching study material					
Yes	131 (44.41)	164 (55.59)	1.806	0.179	0.599 (0.282, 1.273)
No	11 (32.35)	23 (67.65)			
Time spend online daily					
< 3 hour	79 (60.30)	52 (39.70)	26.080	0.000*	3.255 (2.054, 5.159)
≥ 3 hours	63 (31.82)	135 (68.18)			
Parental control over internet use					
Yes	130 (44.83)	160 (55.17)	2.769	0.096	0.547 (0.267, 1.122)
No	12 (30.77)	27 (69.23)			

*p-value is significant at <0.05 level

Discussion

The presented study revealed that the most of the participants used WhatsApp and instagram. Previous studies ^[35] revealed that most of the participants used Whatsapp and face-book. The variation in findings may be due to differences in media preferences. Contradict findings were revealed in the studies ^[35-37], as there were variations in prevalence of internet addiction and this variation might be due to studied conducted in different time frame.

Similar findings were revealed in the study from Nepal ^[38] which concluded that there was not statistically significant association between prevalence of IA with age and sex. This similarity may be due to similar demographic characteristics. Contradict findings were revealed in the studies ^[39] where there was statistically significant association between prevalence of IA with age and sex. Contradict findings were concluded in another studies ^[36, 40] where there was statistically significant association between prevalence of internet addiction and sex. This variation may be due to differences in demographic characteristics and varying levels of exposure to digital devices. The presented study revealed that the adolescents who had siblings had higher chance of developing internet addiction compared with single child adolescents. Previous studies ^[41] revealed that single child family was not significantly associated with internet addiction. This similarity may be due to similar population characteristics in both settings.

This study findings are in lying with the study from India ^[36] which reveals that internet addiction was associated with chatting. This similarity may be due to similar pattern of internet use. The presented study revealed that the using internet for searching study material was not significantly associated with IA where as another study in India ^[36] concluded using internet for coursework was associated with IA. This discrepancy may be due to difference in assignment method and self-regulation in using the internet. Similar findings were revealed in the studies ^[32, 38, 41-42] which concluded that adolescents

who spend more hours online daily was associated with a higher risk of internet addiction. This similarity may be due to similar population characteristics and pattern of internet use. Previous studies ^[43] revealed that duration of internet use was not significantly associated with IA. This discrepancy may be due to the duration of internet use was categorized and analyzed differently across the studies. The presented study revealed that parental control over internet use was not statistically significant associated with IA. Previous studies ^[38, 41] revealed that restrictive parenting approach was found to be significantly associated with IA. This discrepancy may be due to difference in sociocultural norms regarding parenting styles and measurement of parental control across studies.

This study has some limitations. Firstly, as a cross-sectional study, this study identifies associations but cannot establish causal relationships. Secondly, this study was conducted in a single school using purposive and cluster sampling techniques, which limits the generalizability of the findings. Thirdly, the use of a self-administered questionnaire may have introduced response bias, including potential under-reporting or over-reporting of internet usage. Finally, administering the questionnaires in classroom settings during leisure periods may have influenced adolescents' responses due to the presence of peers. Future research on analytical and longitudinal studies could be conducted to establish causal relationships and track patterns of internet addiction over time. Moreover, further studies should explore additional factors influencing internet addiction, including psychological, familial, and academic dimensions.

Conclusion

The prevalence of internet addiction among school going adolescents in an urban Nepal is high. The study identified several factors that were significantly associated with internet addiction, including use of tablet, facebook, instagram, messenger, number of siblings, engaged in entertainment-based online activities and spending longer hours online daily. The study emphasizes

promoting educational and goal-oriented online activities instead of primarily entertainment-focused use as a way to reduce internet addiction. Furthermore, the findings emphasize parental guidance in promoting responsible internet use from an early age, along with clear time limit to reduce the risk of internet addiction. The Government of Nepal should promote healthy screen time through national guidelines and regular monitoring of adolescent internet use.

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Development and Validation of a Fruit and Vegetable Consumption Measurement Tool for School Aged Children in Myanmar

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Abstract

Background: Adequate fruit and vegetable (FV) consumption during childhood is essential for healthy growth, micronutrient adequacy, and long-term prevention of non-communicable diseases. In Myanmar, FV intake remains below World Health Organization (WHO) recommendations, and culturally appropriate, validated tools for assessing FV consumption among young children are limited. This study aimed to develop and validate a culturally appropriate questionnaire to assess fruit and vegetable consumption among elementary school-aged children in Myanmar.

Methods: A multi-phase methodological study was conducted in Yangon Region. Item generation was informed by literature review, WHO dietary guidelines, and contextual input from parents, teachers, and nutrition experts. Content validity was assessed using item-objective congruence (IOC) by three experts. Face validity was explicitly evaluated through pre-testing with participants using cognitive interviewing techniques to assess clarity, comprehension and age appropriateness. The questionnaire was pilot tested among 20 parents of children aged 5–6 years. Internal consistency reliability was assessed using Cronbach's alpha, test-retest reliability using intraclass correlation coefficients (ICC), and construct validity using exploratory factor analysis (EFA).

Results: The final questionnaire comprised eight items across four domains: FV consumption frequency, portion size, variety, and consumption context. IOC values ranged from 0.67 to 1.00, indicating satisfactory content validity. The overall Cronbach's alpha was 0.82, with subscale values ranging from 0.71 to 0.78. EFA supported a four-factor structure consistent with the conceptual framework, explaining 79% of the total variance, with factor loadings ranging from 0.70 to 0.84. Test-retest reliability demonstrated good temporal stability, with ICC values ranging from 0.72 to 0.80 across subscales and an overall ICC of 0.81.

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Conclusions: The FV consumption questionnaire demonstrated satisfactory validity and reliability and is suitable for assessing fruit and vegetable intake among elementary school-aged children in Myanmar. The tool can support dietary surveillance and evaluation of nutrition interventions in similar low- and middle-income settings.

Keywords: Fruit and vegetable consumption; questionnaire development; validity and reliability; school-aged children

Background

High consumption of fruits and vegetables is a fundamental aspect of a healthy diet and is strongly recommended to help reduce the risk of cancer and cardiovascular diseases, which are major contributors to premature death globally and together accounted for about 25.5 million deaths in 2013⁽¹⁾. The World Health Organization (WHO) advises consuming at least 400 g, equivalent to five or more servings, of fruits and vegetables each day⁽²⁾.

Sufficient fruit and vegetable (FV) intake in childhood plays a vital role in supporting healthy growth, ensuring sufficient micronutrient intake, and reducing the risk of non-communicable diseases later in life⁽³⁾. Longitudinal study indicated that dietary behaviours, including fruit and vegetable intake, tend to persist into adulthood, underscoring the importance of promoting healthy eating habits during childhood and adolescence^(4, 5). Based on findings from the World Health Organization's STEPwise approach to surveillance of chronic disease risk factors conducted in several countries, including Mauritius, and supported by Food and Agriculture Organization data, fruit and vegetable intake levels were reported to be below the recommended daily intake of 400 g per person⁽³⁾. A national report assessing dietary patterns in Myanmar using standardized World Health Organization guidelines found that average fruit and vegetable consumption was 230 g per day, which is below the recommended level. Sagaing State reported the highest intake at 301 g per day, while the lowest intake was observed in Tanintharyi Region at 150 g per day. In Yangon, the study area, average fruit and vegetable consumption was 180 g per day, also falling short of WHO recommendations⁽⁶⁾.

Additionally, a cross-sectional study employing the WHO STEPs methodology was conducted in

both urban and rural areas of the Yangon Region. The study included 1,486 adults aged 25–74 years. Results showed that mean daily fruit intake was 0.8 servings for men and 0.6 servings for women, while average vegetable intake was 2.2 servings for men and 1.2 servings for women⁽⁷⁾.

To achieve current fruit and vegetable intake recommendations, many countries have implemented targeted campaigns and tools aimed at increasing fruit and vegetable consumption to recommended levels⁽⁸⁾. Reliable measurement of FV consumption is a prerequisite for understanding dietary patterns, identifying determinants of inadequate intake, and evaluating the effectiveness of nutrition interventions. Existing FV assessment tools are often developed in high-income settings and may not be culturally appropriate for Myanmar due to differences in food types, portion sizes, eating contexts, and child comprehension. Furthermore, many tools have not undergone rigorous psychometric validation among Myanmar school-aged children.

To address these gaps, this study aimed to develop and validate a culturally appropriate FV consumption questionnaire for elementary school-aged children in Myanmar. The tool was designed to capture key dimensions of FV intake while remaining simple, feasible, and suitable for use in school-based surveys and intervention studies.

Methods

Study Design and Setting

A multi-phase methodological study was conducted to develop and validate a fruit and vegetable (FV) consumption questionnaire for elementary school-aged children in Myanmar. The pilot study was implemented between April and May 2025 in Yangon Region. The development process followed established guidelines for health-related

questionnaire development and psychometric validation, including sequential phases of item generation, expert content validation, pre-testing, pilot testing, and statistical evaluation of reliability and validity.

The study was conducted in two sequential phases. The first phase was a pilot validation involving 20 elementary school-aged children which was consistent with recommended sample sizes for pre-testing and preliminary validation of questionnaires. Methodological guidelines suggested that pilot samples of approximately 15–30 participants were sufficient to assess face validity, clarity, feasibility, and to identify potential issues in questionnaire design. Given that the present instrument was brief (eight items) and designed for a relatively homogeneous target population, this sample size was considered adequate to achieve the objectives of pilot testing. Furthermore, the pilot phase was not intended for definitive psychometric evaluation but rather to refine the tool prior to the main validation study with a larger sample.

The second phase constituted the main validation study, which included 120 parents of the elementary school-aged children. This sample size was determined based on commonly recommended subject-to-item ratios for exploratory factor analysis, typically ranging from 10 to 15 participants per item. Given that the questionnaire comprised eight items, a minimum sample of 80–120 participants was considered adequate to ensure stable factor solutions and reliable estimation of psychometric properties. Therefore, a sample size of 120 participants was deemed sufficient for assessing internal consistency, construct validity, and test-retest reliability.

Target Population

The respondents for this study were parents of school-aged children, not the children themselves. The questionnaire was designed to capture children's fruit and vegetable consumption as reported by parents, who are primarily responsible for meal preparation and supervision at this age.

Data were collected using an interviewer-assisted format, in which trained interviewers guided parents through the questionnaire to improve recall accuracy and minimize reporting errors. This approach was chosen because young children may have limited ability to reliably recall and quantify their dietary intake.

Phase 1: Item Generation and Conceptual Framework

An initial pool of questionnaire items was developed based on a conceptual framework that defined FV consumption as a multidimensional construct. Four domains were specified a priori: (1) FV consumption frequency, (2) portion size, (3) FV variety, and (4) consumption context (e.g., meals, snacks, school vs. home).

Item generation involved three complementary approaches. First, a narrative review of existing FV consumption questionnaires was conducted to identify commonly used items, response options, and recall periods. Second, international and regional dietary guidelines, including the WHO recommendation of at least five servings of FV per day^(2, 9), were reviewed to ensure alignment with global standards. Third, contextual inputs were obtained through informal consultations with parents, primary school teachers, and nutrition professionals to ensure that items reflected locally available fruits and vegetables, typical portion sizes, and common eating practices in Myanmar.

Items were drafted in simple language suitable for the parents and initially developed in Myanmar language. Visual examples and portion descriptions using familiar household measures were incorporated to improve comprehension.

Phase 2: Content Validity Assessment

Content validity was assessed using the item-objective congruence (IOC) method. An expert panel consisting of 3 members with backgrounds in nutrition, public health, pediatrics, education, and dietary assessment independently reviewed each item. Experts rated item relevance to the intended

construct using a three-point scale (-1 = not relevant, 0 = uncertain, +1 = relevant).

IOC values were calculated for each item by averaging expert ratings. Items with IOC values below the predefined threshold of 0.50 were either revised for clarity or removed. Expert feedback was also used to refine wording, adjust response options, and ensure age appropriateness and cultural relevance.

Phase 3: Face Validity and Pre-testing

The revised questionnaire was pre-tested with parents of 10 children from the target age group to assess face validity, clarity, and comprehension. Cognitive interviewing techniques were applied, whereby children were asked to explain questions in their own words and describe how they selected their answers.

Pre-testing focused on identifying ambiguous wording, unfamiliar food items, and difficulties in estimating portion sizes or frequency. Based on feedback, minor modifications were made, including simplifying sentence structure, replacing uncommon food examples with locally familiar items, and refining visual or descriptive aids.

Phase 4: Pilot Testing and Data Collection

The finalized questionnaire was pilot tested among 20 parents of the elementary school-aged children recruited from one primary school using convenience sampling. Data collection was conducted by trained interviewers using an interviewer-assisted format to reduce missing data and enhance response accuracy.

Each interview lasted approximately 40 minutes. Sociodemographic information, including age and sex, was also collected to describe the study sample.

Methodological guidelines for questionnaire development recommend pilot sample sizes of approximately 15–30 participants for identifying comprehension problems and estimating internal consistency in brief scales. Given the limited number

of items and the narrow age range of participants, the selected sample size was sufficient to achieve the objectives of the pilot validation.

Phase 5: Reliability and Validity Assessment

Internal Consistency Reliability

Internal consistency reliability of the overall questionnaire and individual subscales was assessed using Cronbach's alpha coefficient. Alpha values of 0.70 or higher were considered acceptable for group-level comparisons.

Test-Retest Reliability

To assess temporal stability, test-retest reliability was evaluated in a subsample of 10 parents, who completed the questionnaire twice with a two-week interval between administrations. The questionnaire captured children's dietary intake based on parental report, and both administrations were conducted using an interviewer-assisted approach to ensure consistency and comprehension. Intraclass correlation coefficients (ICC) were calculated, with values ≥ 0.60 interpreted as acceptable reliability.

Construct Validity

Construct validity was examined using exploratory factor analysis (EFA). Prior to factor extraction, sampling adequacy was assessed using the Kaiser-Meyer-Olkin (KMO) measure⁽¹⁰⁾, and Bartlett's test of sphericity⁽¹¹⁾ was performed to confirm factorability of the correlation matrix.

EFA was conducted using principal component extraction with varimax rotation. Factors with eigenvalues greater than 1.0 were retained, and items with factor loadings ≥ 0.40 were considered to load meaningfully on a factor. The resulting factor structure was compared with the predefined conceptual domains.

Statistical Analysis

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) Version 24 software. Descriptive statistics were used to summarize participant characteristics. Reliability

and validity analyses were conducted according to standard psychometric procedures, with statistical significance set at $p < 0.05$ where applicable.

Ethical Considerations

The Research Ethics Review Committee for Research Involving Human Subjects at Chulalongkorn University granted ethical approval for the study (COA No. 119/67). Written consents were obtained from all participants.

Results

Participant Characteristics

A total of 20 parents of elementary school-aged children participated in the pilot validation study. The mean age of the parents was 33 years ($SD = 8.0$),

and all participants were female. All participants completed the questionnaire with no major missing responses, indicating good feasibility of administration in the school setting.

Content Validity

Content validity assessment demonstrated strong agreement among experts regarding item relevance. IOC values for individual items ranged from 0.67 to 1.00. All retained items met or exceeded the predefined IOC threshold of 0.50, indicating satisfactory content validity.

Items with lower IOC values during the initial review were revised to improve clarity and cultural relevance, particularly for portion size descriptions and examples of locally available fruits and vegetables.

Table 1. Item-Objective Congruence (IOC) values for FV questionnaire items

Item No.	Questionnaire item (Summary)	Domain	IOC value
1	Frequency of fruit consumption per day	Frequency	1.00
2	Frequency of vegetable consumption per day	Frequency	1.00
3	Typical portion size of fruits	Portion size	0.67
4	Typical portion size of vegetables	Portion size	0.67
5	Variety of fruits consumed in past week	Variety	1.00
6	Variety of vegetables consumed in past week	Variety	1.00
7	FV consumption at main meals	Consumption context	0.67
8	FV consumption as snacks	Consumption context	0.67

Internal Consistency Reliability

The overall questionnaire demonstrated acceptable internal consistency, with a Cronbach's alpha coefficient of 0.82. Subscale reliability coefficients ranged from 0.71 to 0.78 across the four conceptual domains (frequency, portion size, variety, and consumption context).

Removal of individual items did not substantially increase alpha values, suggesting that all retained items contributed meaningfully to the overall scale.

Table 2. Internal consistency reliability (Cronbach's alpha) of the FV questionnaire and subscales

Scale	Number of Items	Cronbach's alpha
Overall FV questionnaire	8	0.82
FV consumption frequency	2	0.76
FV portion size	2	0.71
FV variety	2	0.78
FV consumption context	2	0.73

Construct Validity

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.78, indicating that the data were suitable for factor analysis. Bartlett's test of sphericity was statistically significant ($\chi^2 = 356.4$, $df = 28$, $p < 0.001$), confirming sufficient correlations among items.

Exploratory factor analysis identified a four-factor solution consistent with the predefined conceptual framework. The retained factors explained 79% of the total variance. All items loaded strongly on their respective factors, with factor loadings ranging from 0.70 to 0.84.

Test-Retest Reliability

Test-retest reliability analysis conducted among a subsample of 20 participants demonstrated acceptable temporal stability. Intraclass correlation coefficients (ICC) ranged from 0.72 to 0.80 across subscales, indicating that the questionnaire produced consistent results over time. The overall FV questionnaire showed good stability, with an ICC of 0.81.

Table 3. Test-retest reliability of the FV questionnaire

Scale	Number of Items	Intraclass correlation coefficient
Overall FV questionnaire	8	0.81
FV consumption frequency	2	0.78
FV portion size	2	0.72
FV variety	2	0.80
FV consumption context	2	0.74

Discussion

This study developed and validated a brief, culturally appropriate questionnaire to assess fruit and vegetable consumption among elementary

school-aged children in Myanmar. The instrument demonstrated satisfactory content validity, internal consistency reliability, construct validity, and test-retest reliability, providing convergent evidence for its psychometric robustness. It was similar to a European study from developed and tested a questionnaire measuring personal, social, and environmental correlates of fruit and vegetable intake in 10–11-year-old children and reported psychometric evidence (reliability and validity)⁽¹²⁾. A study from United States had similar design in which evaluated the test-retest reliability and convergent validity of two brief fruit and vegetable intake questionnaires designed for 8- to 12-year-old children, supporting reproducibility and validity of brief intake tools⁽¹³⁾.

High IOC values reflected strong expert agreement regarding item relevance and conceptual alignment, particularly for items assessing consumption frequency and variety^(14, 15). A study in Enugu state, Nigeria reported that most items achieved acceptable IOC values (0.57–1.00), indicating strong consistency with content objectives which is similar to this study⁽¹⁶⁾. The acceptable IOC values observed for portion size and consumption context items suggest that these more complex constructs were nevertheless appropriately operationalized for young children within the Myanmar dietary context.

The overall internal consistency of the questionnaire was good, and subscale reliability coefficients were within the acceptable range for behavioral measurement tools. Given that each subscale comprised only two items, alpha values between 0.71 and 0.78 are considered appropriate⁽¹⁷⁾ and consistent with psychometric expectations for brief scales, supporting the efficiency of the instrument without compromising reliability. Also, a study from Vietnam demonstrated that high internal consistency (Cronbach's $\alpha = 0.864$) and a clear factor structure supporting construct validity of the K6 scale which is consistent with this study⁽¹⁸⁾.

Construct validity was further supported by the exploratory factor analysis, which yielded

a clear four-factor structure aligned with the conceptual framework which is similar a study from development of the ASKFV-SE tool⁽¹⁹⁾. The high proportion of variance explained indicates that the questionnaire effectively captures key dimensions of fruit and vegetable consumption behavior. The absence of cross-loadings strengthens confidence in the distinctiveness of each domain.

Test-retest reliability findings demonstrated good temporal stability, indicating that the questionnaire measures habitual dietary behaviors rather than short-term variability. The consistency observed across content validity, internal consistency, factor structure, and temporal stability provides strong evidence of the overall reliability and validity of the instrument.

Several limitations should be acknowledged. The validation was conducted using a convenience sample from a single school, which may limit generalizability to other populations or settings. Although the pilot sample size was adequate for preliminary validation, larger and more diverse samples are needed in future studies to confirm the factor structure and generalizability of the questionnaire. Future research should evaluate the performance of the questionnaire in larger and more diverse samples, including rural areas, and examine criterion validity against dietary recalls or observational measures.

Overall, the validated questionnaire offers a practical and psychometrically sound tool for assessing fruit and vegetable consumption among Myanmar school children. Its use may support dietary surveillance, inform the design and evaluation of nutrition interventions, and contribute to evidence-based public health strategies aimed at improving child nutrition in similar low- and middle-income contexts. Specifically, this tool holds significant implications for nursing professionals, enabling them to effectively assess children's dietary patterns, monitor the impact of health promotion initiatives, and tailor nutritional guidance within clinical and community settings.

Conclusion

The developed FV consumption questionnaire is a valid and reliable instrument for assessing FV intake among elementary school-aged children in Myanmar. Its application can strengthen dietary surveillance and support evidence-based nutrition programming.

Ethical Considerations

The SWITCH intervention development process was conducted under the ethical approval of the parent study granted by the Institution Review Board of Chulalongkorn University (COA No. 119/67). Written informed consents were obtained from the participants.

Declaration of conflicts of interest statement – Nil

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Effectiveness of Simulation-based learning on Self-Confidence, Satisfaction and Knowledge Acquisition Among Undergraduate Nursing Students

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Abstract

Stroke remains a leading cause of global mortality, necessitating rapid clinical response. While Simulation-Based Education (SBE) is recognized for improving door-to-needle time, its impact on nursing students requires further investigation in the Indian context. This study aimed to determine the effectiveness of simulation-based learning on self-confidence, satisfaction and knowledge acquisition among undergraduate nursing students. The study also explored the relationship between self-confidence, satisfaction and knowledge among undergraduate nursing students. A quantitative, one group pretest post-test design was employed at Chirayu Simulation centre in Bhopal. Using enumerative sampling, 53 nursing interns participated. Data were collected using NLN student satisfaction and self-confidence scale and a validated knowledge questionnaire. The participants were divided into six groups; each group was administered with pretest followed with simulation involving standardized patient and post-test using the same tool. The mean scores showed a marked improvement in knowledge (34.81 ± 4.21) compared to pretest (12.98 ± 2.32). Likewise, student satisfaction rose sharply following the intervention (78.21 ± 6.31) compared to pre-test (33.15 ± 4.42). Pertaining to correlation, it was found that there was a significant correlation between self-confidence and student satisfaction ($p = 0.042$). Intensive, role-based simulation is a powerful catalyst for bridging the theory-practice gap in stroke care. The study advocates the necessity of evolving nursing curricula beyond technical skills to systematically integrate psychosocial elements of emergency care.

Key words: Simulation-based Learning, Stroke management, Self-confidence, student satisfaction

Introduction

Globally, stroke remains the second leading cause of death ⁽¹⁾. Statistics reveal that the mortality

burden of stroke trails closely behind ischemic heart disease in regions such as England and Wales. In 2022, stroke accounted for 5.1% of all official deaths, representing a 0.8% increase from 2021 ⁽²⁾.

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The National Stroke Service Model (2021) endorses an exemplary door-to-needle (DTN) time of 20 minutes ⁽³⁾, as gold-standard evidence indicates this timeline can be further reduced to approximately 15 minutes through simulation training ⁽⁴⁾. This reduction in time is critical, given that cerebral ischemia destroys approximately 1.9 million neurons every minute, resulting in irreversible neurological damage ⁽⁵⁾. Consequently, the primary goals of simulation training are to enhance clinical precision during the preliminary assessment of stroke patients and to improve comprehension of management strategies to minimize DTN time utilizing the National Institutes of Health Stroke Scale (NIHSS).

Traditionally, nursing education relied heavily on direct bedside experience; however, a shifting healthcare landscape marked by stringent patient safety protocols and intricate ethical constraints has drastically reduced clinical access for undergraduates ⁽⁶⁾. To navigate these limitations, academic institutions worldwide have adopted Simulation-Based Education (SBE) as a fundamental element of their nursing programs. SBE serves as a critical link between classroom and hospital, providing a secure, risk-free environment where students can convert theoretical concepts into practical proficiency ^(7,8). The clinical urgency of acute stroke management makes it an ideal candidate for such realistic simulation training ⁽⁹⁾. Recent methodological research has further refined this approach by constructing and validating standardized simulation scripts specifically for rapid stroke recognition, ensuring that learners encounter both typical and atypical neurological symptoms in a controlled setting ⁽¹⁰⁾.

Given that nurses constitute the largest segment of the healthcare workforce and manage the majority of acute stroke care, their proficiency is central to patient outcomes. While generalized clinical training is common, the escalating global burden of stroke necessitates more specialized, tailored education ⁽¹¹⁾. Research indicates that without targeted, stroke-specific instruction, patients may suffer from

suboptimal management, longer hospitalizations, and preventable complications ⁽¹²⁾. Conversely, implementing interactive, high-fidelity teaching methodologies empowers nurses to refine their clinical judgment and technical competencies, directly correlating with improved patient survival and recovery ^(10, 11). In addition, medical errors remain a significant threat to patient safety, which is always the primary goal of any healthcare system. For instance, data from Saudi Arabia projected that up to 46% of hospital mortality could be linked to errors committed by the healthcare team ⁽¹³⁾, highlighting a crucial gap that must be addressed through robust training frameworks.

Based on this perspective, nursing education must systemically prepare students and new graduates to rapidly detect early signs and symptoms of clinically declining patients so that preventable risks are mitigated. To address this issue, SBE has emerged as an essential strategy, creating a controlled environment that protects patient safety while simultaneously permitting learners to exercise critical decision-making and problem-solving skills ⁽¹⁴⁾. This serves as a concrete bridge between theory and practice, which has remained a persistent challenge in nursing education for decades. Furthermore, simulation experiences equip nursing students with the practical skills required to deliver high-quality patient care ⁽¹⁵⁾.

While the advantages of SBE are well-documented globally, the current literature is deprived of a deep exploration into intensive, multidimensional stroke simulations, particularly for final-year nursing interns within the Indian healthcare context. Most notable is the distinct research gap regarding simulations that combine complex neurological manifestations using standardized patients while integrating the emotional domain, such as interacting with grieving families. This study addresses that void by evaluating how Simulation-Based Learning (SBL) impacts knowledge, self-confidence, and overall satisfaction among nursing interns. By incorporating both the technical and psychosocial complexities of acute stroke management, this research aims to establish a framework for improving intern

preparedness and alleviating human-factor delays in critical, time-sensitive stroke care.

Objectives

1. To determine the effectiveness of simulation-based learning on self-confidence, satisfaction, and knowledge acquisition among undergraduate nursing students.
2. To explore the relationship between self-confidence, satisfaction, and knowledge among undergraduate nursing students.

Operational Definitions

- Knowledge Acquisition: Refers to the objective understanding and theoretical mastery of acute stroke assessment and management protocols.
- Self-Confidence: Defined as the students' self-perceived clinical competence and readiness to perform critical interventions during a stroke emergency.
- Satisfaction: Refers to the learners' subjective evaluation of the relevance and instructional effectiveness of the simulation.

Methodology

Study Design

This study utilized a quantitative, quasi-experimental, single-group pre-test-post-test design to evaluate the impact of simulation-based learning on nursing interns.

Study Setting and Population

The research was carried out at the Chirayu Medical College and Hospital Simulation Centre, Bhopal, India. The target population comprised final-year B.Sc. Nursing interns enrolled at the Chirayu College of Nursing.

Sampling Procedure

A total enumerative sampling method was adopted, soliciting the entire available final-year

interns. This method was specifically chosen to eliminate selection bias and ensure complete representation resulting in a final sample size of 53 participants. The inclusion criteria required participants to be B.Sc. Nursing interns pursuing their final year of study. To prevent information contamination between participants and protect the internal validity of the study, the entire intervention was completed within a single day in 2023. The layout of the simulation centre was used to physically isolate groups, ensuring that students who completed the scenario could not interact with those waiting.

Study Instrument and Validation Process

Data were gathered using a comprehensive four-part data collection instrument:

1. Part I: Comprised of participants demographic data.
2. Parts II & III (NLN Scales): Utilized standardized instruments from the National League for Nursing (NLN) ⁽¹⁶⁾. This included an 8-item Self-confidence scale and a 5-item Satisfaction scale. Both instruments used a 5-point Likert scale. Self-confidence scores were categorized as high (30+), moderate (20–29), and low (below 20).
3. Part IV: Consisted of a 5-item multiple-choice questionnaire focused on the specific clinical knowledge required for the stroke simulation scenario, developed by the investigators and content-validated by experts.

Intervention

The 53 eligible interns were organized into six small groups (five groups of nine students and one group of eight students). To prevent pre-exposure to scenario, individual roles including physicians, nurses, and observers were briefed in separate rooms. Each group underwent a continuous 60-minute simulation experience structured into four distinct, sequential stages(Fig.1):

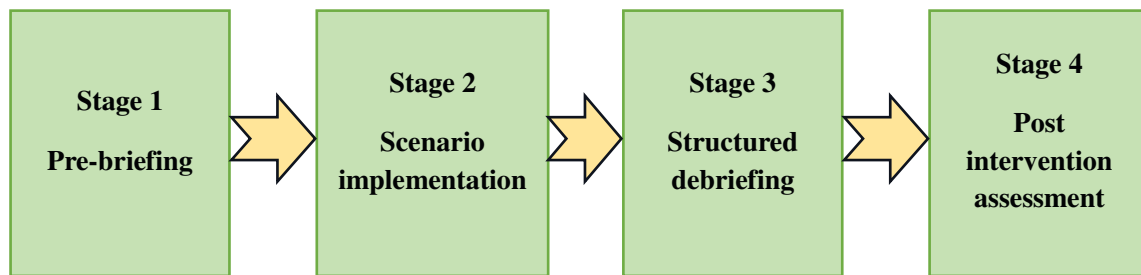


Figure 1: Sequential stages of simulation experience

Stage 1: Pre-briefing (10 minutes): Focused on simulation centre orientation, equipment usage guidelines, and establishing a safe psychological environment for active learning.

Stage 2: Scenario Implementation (20–25 minutes): Participants actively engaged in acute stroke management. High clinical realism was achieved using a Registered Nurse enacted as standardized patient, who followed a scripted presentation displaying left-sided hemiplegia, facial palsy, and unilateral neglect.

Stage 3: Structured Debriefing (25–30 minutes): Facilitated immediately post-scenario by the investigators. This phase allowed for deep reflective practice, observer feedback, and the clarification of vital clinical parameters.

Stage 4: Post-intervention Assessment: A post-test was administered in a dedicated area before students exited the simulation centre, using the exact same tools as the pre-test.

Ethical Concerns

Institutional ethical approval was formally granted by the Research Advisory Committee of the institution (Reference no.8305b/CCON/PO/2023 dated 10.04.2023). Prior to data collection, all potential participants received a comprehensive overview of the objectives of the study. Written informed consent was obtained from each intern, explicitly emphasizing that participation was entirely voluntary. Refusal to provide consent or choose not to participate was handled strictly as an ethical requirement of autonomy rather than a clinical exclusion criterion, ensuring that no academic or

personal penalties applied to any student. Participant anonymity and data confidentiality were strictly maintained throughout.

Data Analysis

Quantitative data were processed and analyzed via descriptive and inferential statistics using SPSS version 20 software.

Results

Table 1 describes socio-demographic characteristics of the participants. The mean age was approximately 22 years and predominantly they were females (66%) and all participants had prior exposure to simulation training. Further, they self-reported that Lecture cum Discussion (58.5%) was the best teaching method.

Table 1. Socio-demographic Profile of the Participants
(N=53)

Demographic Variables	Frequency (%)
Age (Years) [Mean ± SD]	22.11 ± 0.67
21	9 (17.0)
22	29(54.7)
23	15(28.3)
Gender	
Male	18(34.0)
Female	35 (66.0)

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Program	
B.Sc Nursing, IV year	53 (100)
Attended Simulation-based Class	
Yes	53 (100)
No	0 (0.0)

Best teaching method reported	
Lecture + Discussion	31 (58.5)
Simulation	13 (24.5)
Lecture + Demonstration	9 (17.0)

Table 2 demonstrates pretest statistics that were uniformly low baseline scores across all domains with mean percentage ranging between 32.5% and 38.1%.

Table 2. Descriptive Statistics of variables among the participants in pretest

N=53

Variables	Mean	SD	Mean%	Median	Range
Knowledge	1.906	1.097	38.1%	2	0 - 4
Self-confidence	12.98	2.325	32.5%	13	9 - 20
Satisfaction	33.15	4.426	36.8%	32	26 - 45
Debrief and Reflection	16.64	2.994	37.0%	16	11 - 24
Clinical Reasoning	9.358	1.665	37.4%	9	7 - 14
Clinical Learning	7.151	1.725	35.8%	7	4 - 12

Paired *t*- tests revealed highly significant post intervention improvement ($p < 0.001$) in all core outcomes, demonstrating substantial gains in objective knowledge, self-confidence and satisfaction (Table 3)

Table 3. Effectiveness of Simulation-Based Learning on Core Outcomes (N=53)

Core outcomes	Mean	SD	% Change	t- value	p- value
Knowledge					
Pre- test	12.98	2.32	168.2%	29.10	<0.001
Post test	34.81	4.21			
Self confidence					
Pre- test	1.91	1.09	151.8%	19.61	<0.001
Post test	4.81	0.39			
Satisfaction					
Pre- test	33.15	4.42	135.9%	50.60	<0.001
Post test	78.21	6.31			

Bivariate Pearson correlation analysis indicated a weak, statistically significant positive relationship between baseline self-confidence and student satisfaction ($r = 0.281$, $p = 0.042$). No statistically

significant correlations were observed between baseline knowledge and self-confidence ($r = 0.203$, $p = 0.145$) and between knowledge and satisfaction ($r = 0.070$, $p = 0.617$) (Table 4).

Table 4: Correlation Matrix between Core Variables (N=53)

Core variables	Mean	SD	<i>r</i>	<i>p</i> -value
Knowledge	1.90	1.09	0.203	0.145
Self-confidence	12.98	2.32		
Knowledge	1.90	1.09	0.070	0.617
Satisfaction	33.15	4.42		
Self-confidence	12.98	2.32	0.281	0.042*
Satisfaction	33.15	4.42		

Discussion

The overwhelming global disruption caused by the COVID-19 pandemic necessitated a fundamental renovation of nursing pedagogy. With traditional, direct patient contact truncated to ensure student and patient safety, nurse educators were forced to identify innovative alternatives to meet crucial educational milestones. This shift emphasized the imperative for academic institutions to remain at the spearhead of Simulation-Based Learning (SBL). As a consequence, this study evaluated the impact of SBL to establish a data-driven foundation for refining institutional training policies.

Our results confirm that SBL significantly strengthens both student self-confidence and satisfaction. Post-intervention scores showed a marked improvement in self-confidence (34.81) compared to baseline (12.98). Likewise, student satisfaction rose sharply following the intervention (78.21) compared to the pre-test (33.15). These outcomes align closely with established nursing literature, which strongly advocates for the integration of structured simulation into core curricula to

maximize clinical engagement and optimize learning outcomes^(17, 18, 19).

Interestingly, while a significant correlation was identified between participant confidence and satisfaction, the relationship between objective knowledge acquisition and these self-perceived metrics was not statistically significant in the baseline data. These results are conceptually congruent with the work of Cho and Kim (2023)⁽²⁰⁾, who noted elevated satisfaction and confidence levels exceeding 4.2 out of 5 following simulation interventions. Furthermore, our findings mirror those of Gaspar and Banayat (2024)⁽²¹⁾, whose participants reported high average ratings for satisfaction (4.46) and confidence (4.44). The harmony of these scores across diverse studies reinforces the role of SBL as a high-impact pedagogical tool for amplifying student preparedness. A key driver of these positive outcomes was the baseline correlation identified between student satisfaction and their perceived self-confidence ($r = 0.281$), suggesting that as learners feel more supported and satisfied within a controlled simulation environment, their professional self-assurance grows. However, the ultimate success of SBL depends heavily on robust instructional design.

Furthermore, the findings of the present study are in line with earlier research that employed comparable metrics, in relation to the work of Gaspar and Banayat (2024) ⁽²¹⁾, which established a positive correlation between student self-confidence and overall satisfaction. Such findings imply that the deep cognitive and emotional involvement enhanced by simulation is a prerequisite for cultivating professional confidence in nursing learners ⁽²²⁾. Moreover, the role of SBL as a foundational teaching strategy was fortified by evidence demonstrating student satisfaction and self-confidence directly correlate with improved clinical competence ⁽²³⁾.

Limitations

This study was limited by a single-group, pre-test-post-test quasi-experimental design and a localized sample size of 53 participants from a single institution, which restricts global generalizability. Because the post-test evaluation was administered immediately following the intervention, the data captures short-term cognitive gains and psychological responses rather than long-term retention. This immediate timing may also account for the lack of baseline correlation observed between objective knowledge and self-confidence metrics. Additionally, due to the lack of a true randomized control group, the study faces inherent causality constraints; external confounding variables, such as varying student academic capabilities or prior exposure to clinical stroke environments, could have influenced post-intervention scores.

Conclusion

The findings of this study determine that SBL is a highly effective pedagogical strategy that significantly strengthens both student satisfaction and self-confidence. Participants observed that faculty-tailored simulations matched their specific learning styles, permitting them to effectively master essential clinical skills. Nursing educators must prioritize these structural characteristics and evidence-based practices in their simulation designs to optimize SBL. Our findings highlight that four core elements

collaboration, active support, high expectations, and diverse learning pathways are most strongly associated with positive student outcomes.

Beyond academic benefits, these findings offer a framework for meaningful institutional and educational reform. To bridge the theory-practice gap and augment teaching beyond classrooms, simulation must be structurally intertwined within the nursing education framework. This integration helps systematically incorporate psychosocial elements, communication, and team dynamics, which boosts overall intern readiness and mitigates acute clinical risks.

Policy Implications and Recommendations

At a policy level, these outcomes advocate for a mandatory curriculum overhaul by nursing governing councils to formalize high-fidelity simulation hours as a standard prerequisite for undergraduate licensing. Educational policies should mandate structured training and certification pathways for nursing faculty to ensure proficiency in running debriefing sessions, which are essential to maximize learner satisfaction. Additionally, future nursing education research should prioritize randomized controlled trials (RCTs) utilizing larger, multi-centric sample sizes across diverse regional backgrounds to establish generalizable benchmarks and confirm long-term knowledge retention.

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Conflict of Interest: None.

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Factors Predicting Hypertensive Disorders in Pregnant Women

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Abstract

Background: Hypertensive disorders during pregnancy is increasing among pregnant women worldwide. Two main risk factors were genetic factors and unhealthy behaviors. Limited research evidences could explain the predicting factors related to health behaviors.

Methods: This descriptive analytic research aimed to examine factors predicting the development of hypertensive disorders among pregnant women. Studied sample was pregnant women attended antenatal care services in Pathumthani hospital, Thailand. One hundred and forty pregnant women at 20-36 weeks of gestation were recruited using purposive sampling and systematic random sampling. Data were collected using health behavior questionnaire and medical records. Binary logistic regression was used to analyze the data.

Results: Three significant predictive factors for the development of hypertensive disorders among Thai pregnant women were: 1) total risk scores of personal data, dietary patterns and exercise (odd ratio 2.076, 95% CI 1.516, 2.842), 2) excessive gestational weight gain (odd ratio 2.076, 95% CI 1.516, 2.842), and 3) gestational diabetes mellitus (odd ratio 1.614, 95% CI 1.284, 2.028), $p < .01$.

Conclusion: Assessment of dietary pattern, early detection and monitoring of excessive gestational weight gain, gestational diabetes could be used to predict the development of hypertensive disorders. These findings should be used to design effective intervention to prevent and reduce hypertensive disorders among pregnant women.

Keywords: Hypertensive disorders; preeclampsia, pregnant women

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Introduction

Hypertensive disorders during pregnancy are increasing global concern because of leading causes of maternal and fetal morbidity and mortality. It is considered the significance health problem among pregnant women worldwide. Given that it is among the top three direct causes of maternal death. Globally, it is estimated that the prevalence of hypertensive disorders is 5%-10% among pregnant women. The prevalence had varying rates across regions. The African region reported the highest prevalence of 22.20%. The American and Western Pacific region had the rates of 8.04%. The European region had intermediate rates of 5.90%. The Eastern Mediterranean region reported the lowest rates of 5.10%¹. Definition and classification of hypertensive disorders of pregnancy can be summarized into two groups: chronic hypertension and gestational hypertension. The main criteria of diagnosis are systolic blood pressure of 140 mmHg and diastolic blood pressure of 90 mmHg or higher. Hypertension developed before pregnancy and in the first 20 weeks of gestation is classified as chronic hypertension (Socol et al., 2024). Gestational hypertension is more likely to develop after 20 weeks of gestation. Both chronic hypertension and gestational hypertension can progress to severe pathophysiology, preeclampsia and eclampsia, related to the disposing risk factors. Previous research reported that 3.7-4.5% of pregnancy complicated by preeclampsia in southeast Asia region².

Preeclampsia can be categorized into two classes: preeclampsia without severe features and preeclampsia with severe features³. Its severe features include systolic blood pressure of 160 mmHg, diastolic blood pressure of 110 mmHg or higher, neurovascular and organ dysfunction. The most common manifestations are headache, visual disturbance, impaired hepatic function, renal insufficiency, thrombocytopenia, and pulmonary edema. Finally, severe features gradually develop HELLP syndrome, hemolytic, elevated liver enzyme, and low platelet, and eclampsia⁴. These pathophysiological symptoms have impacts on pregnancy and the development of the fetus due to endothelial cell dysfunction

and uteroplacental deficiency. Pregnant women complicated by hypertensive disorders are at higher risk for pregnancy complications and adverse perinatal outcomes. Maternal effects include abortion, preterm labor, abruptio placenta, postpartum hemorrhage, eclampsia, and maternal death⁵. Adverse perinatal outcomes are small for gestational age, low birth weight, preterm birth, fetal distress, birth asphyxia, stillbirth, and neonatal death⁶.

Previous research revealed that known risk factors associated with hypertensive disorders of pregnancy are genetic risk factors and cardiometabolic risk factors. Genetic risk factors include familial history of hypertension which 19 genome loci affecting blood pressure traits, kidney function, maintenance of proteostasis in pregnancy serum, the development of placenta, and remodeling of uterine spiral arteries⁷. Cardiometabolic risk factors are maternal age, pre-pregnancy body mass index, gestational weight gain, and diabetes⁸. Pregnant women with advanced maternal age over 35 years are more likely to develop hypertensive disorders due to cumulative of risk factors. The prevalence of hypertensive disorders among pregnant women with overweight and obesity are 17.50% to 22.20%⁹.

In addition, cardiometabolic health also affects the development of hypertensive disorders during pregnancy due to systemic vascular inflammation, impaired vasodilation, reduction in vascular integrity. These cardiovascular manifestations are associated with unhealthy behaviors such as consumptions of foods containing trans fatty acids, saturated fat, sodium, smoking, alcohol drinking, and lack of exercise¹⁰. Prior research reported that digested fructose would be metabolized only in liver cells, fatty acid and then low-density lipoprotein cholesterol were produced. In addition, overweight and obesity, dyslipidemia, hyperglycemia, and hyperinsulinemia are the risk factors for development of hypertension¹¹. Atherosclerosis develops in case of dyslipidemia, elevated of triglycerides, very low-density lipoprotein-cholesterol, and total cholesterol¹². The main pathophysiology of hypertensive disorders are endothelial dysfunction and atherosclerosis. Endothelial cell dysfunction

occurs because of raising of oxidative stress, vessel inflammation, decreasing of nitric oxide, and vasoconstriction. Arterial endothelial cells play a vital role in the regulation of vascular tone through synthesis and release of contracting and relaxing substances such as nitric oxide, endothelin, thromboxane, and angiotensin. Nitric oxide is a powerful blood pressure lowering vasodilator, that is generated by endothelial nitric oxide synthase (eNOS)¹³. Endothelin-1, thromboxane A2, and angiotensin II are vasoconstrictor substances that are produced by vascular endothelial cells¹⁴. Moreover, pregnant women with overweight, obesity, and diabetes are more likely to develop hypertensive disorders because of sharing these risk factors¹⁵.

Prior research evidences revealed that hypertensive disorders during pregnancy can be prevented by reducing unhealthy behaviors, modification of healthy dietary patterns and regular exercise. However, evidences of known risk factors predicting hypertensive disorders is limited. Knowing additional risk factors would be helpful to promote self-management to prevent hypertensive complications among pregnant women. This study aimed to explore typical risk factors of hypertensive disorders among Thai pregnant women in order to suggest some additional implications for health care providers and nursing education aiming to promote preventive behaviors and reduce the incidence of hypertensive disorders among pregnant women. The development of hypertensive disorders, maternal and fetal complications are considered preventable through pre-pregnancy health promotion, early detection, and concise management during pregnancy. Pre-pregnancy health promotion can be achieved by understanding of its known typical risk factors. Despite the growing acknowledgement of the development of hypertensive disorders during pregnancy, clearly understanding specific etiology remains limited. This gap in knowledge can hinder effective preventable strategies and the formulation of maternal health care policies. There is an urgent need for comprehensive research in this area.

Materials and Methods

Study Design and Setting

Cross-sectional analytic research was designed to examine the predicting factors for the development of hypertensive disorders among pregnant women in this study. It was conducted in Pathumthani hospital, Thailand. The study setting was tertiary care and referral center of pregnant women with high risk and complications. Inclusion criteria for participant recruitment were: 1) aged 18 years and above, 2) had 20-36 weeks of gestation, and 3) had no other severe complications. Exclusion criteria were: 1) showed development of preeclampsia with severe features, 2) refused to participate in the study.

Study Sample

The required sample size was calculated using expected proportion (p) from the previous study reported that hypertensive disorders affect 5% to 10% of all pregnancy¹⁶. Therefore, the proportion used in the formular was 10% ($p=0.1$). The desired 95% confidence level was used to calculate the sample size. Acceptance margin of error (d) was 0.05. The formular for sample size calculation was $N=Z^2 [p (1-p) / d^2]$. The calculated sample size was 138.29. As a result, one hundred and forty subjects at 20-36 weeks of gestation were recruited using purposive sampling and systematic random sampling. Firstly, pregnant women at 20-36 weeks of gestation were approached because hypertensive disorders were more likely to develop during this period of pregnancy. Secondly, the eligible participants were obtained using systematic random sampling through every second cases from antenatal list book.

Description of the Tool

Data were collected using health behavior questionnaire comprising 3 parts: Demographics, pregnancy and childbirth histories, dietary and exercise patterns. Dietary patterns focused on overconsumption of foods and drinks containing high fructose trans-fat, animal fat, and sodium. The total risk scores could be 1-20. It was

classified into four groups: Low risk (1-5), moderate risk (6-10), high risk (11-15), and very high risk (16-20). The index of item-objective congruence validity was 0.75 and Cronbach's alpha coefficient of reliability was 0.85.

Data Collection Process

Potential participants were approached and invited to join the study during attending antenatal visit. Data were collected after obtaining written informed consent. The health behavior questionnaire was distributed to pregnant women who met the inclusion criteria during attending for antenatal services from March to December, 2024. Then, the development of hypertensive disorders was recorded from medical diagnosis.

Ethical Concerns

This study was approved by Institutional Review Board of Eastern Asia University, No SN2565-42, March 20, 2024. Participant's rights and privacy were protected during data collection and management of data.

Data Analysis

Descriptive data were analyzed using frequency, percentage, mean and standard deviation. Binary logistic regression with enter method was used to analyze predictive variables of the total risk scores for the development of hypertensive disorders among pregnant women.

Results

Thai pregnant women participated in this study aged 18-40 years. Most of them were educated at vocational/diploma level, working in office or business and had adequate income. The characteristics of participants, pregnancy and childbirth histories was presented (Table 1, Table 2, and Table 3). The risk factors included dietary patterns and regular exercise. Dietary patterns were intake of fructose beverages

and foods containing high in trans-fat, animal fat, and sodium. Most of the studied participants had moderate risk (26.42%) and high risk (30.00%). Total risk factor scores for the development of hypertensive disorders were presented in Table 4. Three significant predictive variables for development of hypertensive disorders among Thai pregnant women were total risk scores of dietary patterns and exercise (odd ratio 2.076, 95% CI 1.516, 2.842), excessive gestational weight gain (odd ratio 1.307, 95% CI 1.193, 1.431), and gestational diabetes mellitus (odd ratio 1.614, 95% CI 1.284, 2.028), $p < .01$. (Table 5) as follows.

Table 1. Participants' characteristics were classified by personal data

Personal data	Frequency	Percentage
1. Age (Year)		
18-20	12	8.57
21-35	108	77.14
36-40	20	14.28
2. Educational level		
Bachelor degree	52	37.15
Vocational/ Diploma	88	62.85
3. Occupational		
Official/Business	92	65.42
Self-employed	48	34.28
4. Income (Baht)		
10,000-20,000	44	31.42
20,001-50,000	75	53.58
>50,000	21	15.00
Total	140	100.00

Table 2. Participants' characteristics were classified by pregnancy and childbirth histories

Pregnancy and childbirth histories	Frequency	Percentage
1. Gravidity		
First pregnancy	45	32.14
Second-third	92	65.72
Fourth-fifth	3	2.14
2. Abortion		
None	112	80.00
History of previous abortion	28	20.00
3. Childbirth		
Nulliparous	48	34.28
Multiparous	92	65.72
4. Preterm birth		
None	124	88.58
History of preterm birth	16	11.42
5. Giving birth of >4,000 g newborn		
None	136	97.14
History of giving birth of >4,000 g newborn	4	2.86
7. Giving birth of 2,500 g newborn		
None	132	94.28
History of giving birth of 2,500 g newborn	8	5.72
8. Giving birth of newborn with congenital anomalies or stillbirth		
None	134	95.72
History of giving birth of stillbirth	6	4.28
9. Family history of diabetes		
None	95	67.85
Family history of diabetes	45	32.15
Total	140	100.00

Table 3. Participants' characteristics were classified by risk factors

Risk factors	Frequency	Percentage
1. Beverages containing fructose		
Yes	85	60.00
No	55	40.00

Continue....

2. Foods containing trans-fat		
Yes	68	48.57
No	72	51.43
3. Foods containing animal fat		
Yes	56	40.00
No	84	60.00
4. Foods containing high in sodium		
Yes	65	46.43
No	75	53.57
5. Regular exercise		
Yes	42	30.00
No	98	70.00
6. Excessive gestational weight gain		
Yes	44	31.43
No	96	68.57
7. Gestational diabetes mellitus		
Yes	33	23.56
No	107	76.44
Total	140	100.00

Table 4. Participants' characteristics were classified by Total risk factor scores of dietary patterns and exercise

Total risk factor scores	Frequency	Percentage
1-5	61	43.58
6-10	37	26.42
11-15	42	30.00
16-20	-	-
Total	140	100.00

Table 5. Predictive variables for development of hypertensive disorders among Thai pregnant women

Predictive variable	Hypertensive disorders		p-value	Odd ratio	95% CI	
	Yes (n, %)	No (n, %)			Lower	Upper
1. Total risk scores	39 (27.86)	101 (72.14)	.000	2.076	1.516	2.842
2. Excessive gestational weight gain			.000	1.307	1.193	1.431
3. Gestational diabetes mellitus			.000	1.614	1.284	2.028

Discussion

The incidence of hypertensive disorders among pregnant women participated in this study was 27.86% due to the tertiary and referral center of the study setting. The global incidence of hypertensive disorders of 204 countries reported in Scientific Report, 2025 was increasing from 15.24% in 1990 to 48.7% in 2021¹⁷. The total risk scores of dietary patterns and exercise including overconsumption of foods and beverages containing high in fructose, trans-fat, animal fat, sodium and lack of regular exercise could predict the development of hypertensive disorders among Thai pregnant women. This finding was supported by the previous research reports that most of beverages contain high-fructose corn syrup and sucrose (glucose and fructose). Intake of sweetened drinks for a long period was associated with oxidative stress, pre-inflammatory stage, endothelial cell dysfunction, and vasoconstriction resulting in the development of hypertensive disorders^{1, 13}. In addition, arterial endothelial cell released vasoconstrictor substances that included endothelin-1, thromboxane A2, and angiotensin II. Moreover, high intake of fructose has been shown to diminish the production of nitric oxide, vasodilator substance, of endothelial cell produced. As a result, hypertensive disorders developed (Siddiqui, Rossi, 2024). In addition, excessive fructose intake behaviors could induce dyslipidemia, elevated triglycerides, lipogenesis, leptin resistance, insulin resistance, visceral obesity, result in excessive gestational weight gain and development of gestational diabetes⁹.

Overconsumption of bakery foods containing Trans-fat are more likely to develop dyslipidemia which was the leading cause of atherosclerosis and hypertensive disorders¹⁸. High consumption of animal fat particularly saturated fat from red meat, processed meat, and butter, is associated with an increased risk of thickening of arterial vessels and high blood pressure. In addition, intake of foods high in animal fat were considered to be the risk factors of increasing of subcutaneous fat, visceral fat, overweight and obesity which are additional known risk factors of high blood pressure¹⁹. Moreover, consumption of foods containing high in sodium including sodium chloride, sodium bicarbonate, sodium glutamate, were reported to be the risk factor for the development of hypertension because of increasing of sodium and water retention in vascular circulation²⁰. These unhealthy dietary patterns were associated with pre-pregnancy overweight, obesity, and excess gestational weight gain which could increase the risk for development of hypertensive disorders²¹.

Pregnant women who gained gestational weight more than recommendation of Institute of Medicine (11.5-16.0 kg) are more likely to develop hypertensive disorders²². In this study, 31.43% of pregnant women developed hypertensive disorders had excessive gestational weight gain. It was supported by previous research evidences revealed that excessive gestation weight gain leads to abdominal obesity, endothelial cell dysfunction, and cardiometabolic risk^{23, 24}. Moreover, excessive

gestational weight gain was associated with the development of gestational diabetes²⁵. Thirty-three (23.56%) of pregnant women with hypertensive disorders participated in this study also developed gestational diabetes because of sharing risk factors that include hyperglycemia, dyslipidemia, insulin resistance, and arterial endothelial dysfunction^{26, 27}.

Conclusion

Hypertensive disorders among pregnant women including chronic hypertension, gestational hypertension, preeclampsia without severe features, and preeclampsia with severe features would share similar risk factors depending on the duration, dosage of exposures and severity of its pathophysiology. The findings of this study revealed that three risk factors could predict the development of hypertensive disorders among pregnant women that included the total risk scores of dietary pattern and exercise, excessive gestational weight gain, and gestational diabetes. Promoting of healthy dietary intake by avoiding consumption of beverage containing fructose could be suggested. Excessive gestational weight gain and gestational diabetes were associated with the development of hypertensive disorders among pregnant women. Therefore, effective interventions, modification of healthy dietary pattern and lifestyle, should be designed to prevent excessive gestational weight gain and gestational diabetes. As a result, the development of hypertensive disorders and its complications among pregnant women could be minimized. These findings should be integrated into nursing education and practice, maternal-child nursing and Midwifery, particularly in antenatal care.

Ethical Approval

The research approval was granted by ethical research committee of Eastern Asia University, Thailand with study number SN2565-42, March 20, 2023. Informed consent was obtained from all participants before recruiting to the study.

Competing Interest: The authors declare that there are no conflicts of interest associated with this manuscript.

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Effectiveness of IEC on Suicide Knowledge and Prevention Among Adolescents in Cuttack using a Quasi Experimental Design

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Abstract

Background of the Study: Information, Education, and Communication (IEC) materials play a crucial role in promoting behavioral change by increasing awareness about important health issues. In India, suicide is a leading cause of death among individuals aged 15–39 years, emphasizing the urgent need for effective awareness and prevention strategies, especially among adolescents.

Aim of the Study: The study aimed to evaluate the effectiveness of an IEC program on knowledge regarding suicide and its prevention among adolescents, and to determine the association between post-test knowledge levels and selected socio-demographic variables.

Methodology: A quasi-experimental one-group pre-test and post-test design was adopted for the study. The research was conducted among 50 adolescent students selected through simple random sampling from two higher secondary colleges in Cuttack, Odisha. A structured questionnaire comprising 30 multiple-choice questions was used to assess knowledge. A pilot study was conducted to ensure feasibility. The pre-test was administered prior to the IEC intervention, followed by a post-test after one week. Ethical clearance and informed consent were obtained. Data were analyzed using SPSS version 21, applying both descriptive and inferential statistics.

Results: The findings showed a significant improvement in knowledge levels following the IEC intervention. The mean pre-test score was 6.82 (SD = 4.93), which increased to 21.30 (SD = 4.31) in the post-test. The mean difference of 14.48 was statistically significant ($t = 16.5$, $p < 0.001$). A significant association was also found between post-test knowledge and selected socio-demographic variables.

Conclusion: The IEC program was highly effective in enhancing adolescents' knowledge regarding suicide and its prevention. The study highlights the importance of implementing structured awareness programs in educational settings to address knowledge gaps and promote mental health.

Key Words: Effectiveness, Information Education Communication, Suicide Prevention, Adolescents, Knowledge

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Introduction

In the United States, suicide ranks as the second leading cause of death among individuals aged 10 to 34.⁽¹⁾ Suicide is a serious mental health issue worldwide, affecting people of all ages. Although children and teens have lower suicide rates than older people, it is the third leading cause of death for those aged 15 to 19.⁽²⁾ Boys generally have higher suicide rates than girls globally, but in countries like Bangladesh, China, India, and Nepal, more girls die from suicide than boys. Over the years, the overall suicide rates among teens have gone down. However, there have been increases in South East Asia and South America during the same period.⁽³⁾

Over the past 15 years, the incidence of suicidal behaviors among youth has steadily risen, a trend that has only accelerated during the COVID-19 pandemic.⁽⁴⁾ This ongoing increase places a significant burden on mental health services, necessitating substantial advancements in both risk detection and intervention delivery to mitigate this risk.⁽⁵⁾ There are numerous reasons why students may choose to end their lives prematurely, such as experiencing depression due to a troubled relationship, facing family issues, or being subjected to bullying at school. Globally, suicide ranks as the tenth leading cause of death.⁽⁶⁾

Approximately one third of individuals experiencing suicidal ideation ultimately proceed to attempt suicide. Furthermore, more than 60% of those who die by suicide have sought medical care within the month preceding their death, with 34% doing so within the week prior, and 8.5% on the same day. Consequently, presentations to the emergency department involving suicidal thoughts must be recognized as critical opportunities for effective suicide prevention.⁽⁷⁾

Suicidal behaviours among Indian adolescents are common but poorly measured. Previous suicide attempts are known to be a strong predictor of future suicide risk. Suicidal behaviours are generally regarded to be on a continuum, beginning with passive death wishes or suicidal ideation, proceeding to the development of detailed plans, and ending

with suicide attempts. Adolescent suicide behaviours globally are, in many instances, impulsive and may not always be related with underlying mental health conditions. Furthermore, it is widely acknowledged that suicide behaviour in childhood and adolescence can result in recurrent comparable acts or attempts in later life, highlighting the pressing need for intervention by mental health specialists.⁽⁸⁻¹⁰⁾

Prompt identification of at-risk youth is crucial for implementing timely treatments to mitigate suicide risk. Nonetheless, teenagers in distress or contemplating suicide frequently refrain from seeking assistance, with less than one-third actively pursuing support.⁽¹¹⁾ Their hesitance to acknowledge and reveal their need for assistance early underscores the necessity of improving risk identification capabilities among those who frequently interact with teenagers and are strategically placed to intervene in crises. Since school and home are fundamental venues for youth development and socialisation,⁽¹²⁾ parents and teachers are optimal candidates to implement interventions that facilitate the recognition of early warning signs of suicidal behaviour and enable confident action.⁽¹³⁾ Family constitutes an essential source of support and security for at-risk adolescents, particularly through parental ties.⁽¹⁴⁾

Suicide is a critical global public health issue, leading to approximately 800,000 deaths each year, with 77% of these fatalities occurring in low- and middle-income countries (LMICs).⁽¹⁵⁾ It is the fourth leading cause of death among young people aged 15 to 29 years. Adolescents are particularly at risk due to various factors, including academic pressure, interpersonal conflicts, identity development, and the transition to adulthood, all of which significantly affect their mental, emotional, and social well-being. In countries such as India and Pakistan, these challenges are further complicated by mental health stigma, limited access to services, underreporting of incidents, and cultural barriers to seeking help. Although adolescents often turn to their peers for support, these peers often lack the necessary knowledge and skills to intervene effectively.⁽¹⁶⁾

Educational programs have been consistently shown to be an effective strategy for enhancing suicide prevention knowledge and reducing risk behaviors among adolescents. A systematic review of 13 randomized controlled trials (RCTs) indicated that youth who participated in educational interventions had a significantly lower risk of suicide-related behavior (0.31 times) compared to those who did not participate.⁽¹⁷⁾ Another systematic review of 14 studies on school-based gatekeeper training demonstrated significant improvements in gatekeepers' knowledge, attitudes, self-efficacy, and willingness to intervene.⁽¹⁸⁾ An RCT assessing the Signs of Suicide program showed a notable decrease in suicide attempts over a 3-month follow-up period.⁽¹⁹⁾ Furthermore, a large-scale RCT of the Youth Aware of Mental Health (YAM) program, which involved over 11,110 secondary school students across 10 European countries, found a 55% reduction in suicide attempts and a 50% decrease in severe suicidal ideation at 12 months post-intervention compared to control groups.⁽²⁰⁾

In light of international evidence underscoring the success of educational interventions, it is imperative to address the deficiency of culturally adapted, rigorously evaluated suicide prevention programs in South Asian regions, particularly India. Indian studies have reported suicide as one of the leading causes of death among youth aged 15–39 years, with increases in suicidal ideation and self-harm behaviors.⁽²¹⁾ Dasgupta et al. (2023) developed IEC brochures for suicide prevention among college students, identifying knowledge gaps and the need for awareness materials tailored to Indian youth.⁽²²⁾ Recent multi-state implementation research led by ICMR (2025) emphasized the absence of structured, evidence-based suicide prevention models in Indian campuses.⁽²³⁾ Project SAMA (2025) further highlighted that India lacks integrated whole-school mental health approaches, underscoring the need for culturally adapted interventions for adolescents. Against this backdrop, amid mental

health challenges in Cuttack,⁽²⁴⁾ this study will assess the impact of a customized IEC intervention on enhancing suicide awareness, prevention capabilities, and mental well-being among adolescents, bridging this gap in the Indian context.

Aim

This study aims to evaluate the effectiveness of an Information, Education, and Communication (IEC) intervention in improving adolescents' knowledge of suicide and its prevention within selected higher secondary education councils in Cuttack, by comparing pre- and post-intervention knowledge scores and examining the association between post-intervention knowledge and selected socio-demographic variables. It is hypothesized that adolescents will demonstrate a statistically significant increase in knowledge about suicide and its prevention following the IEC intervention compared to baseline levels, and that post-intervention knowledge will be significantly associated with selected socio-demographic factors.

Methodology

Study Design and Setting

The present study adopted a quantitative evaluative, quasi-experimental one-group pre-test and post-test design to assess the effectiveness of the IEC program. The study was conducted among adolescent students of Biren Mitra Women's College of Higher Secondary Education, Cuttack, Odisha, which was selected based on feasibility, accessibility, and willingness of the institution to participate. The study was carried out over a period of four weeks from 01 August 2024 to 01 September 2024.

Sampling

The study population consisted of adolescent students studying in the selected higher secondary institution at the time of data collection. A simple random sampling technique was used to select the

sample. The sample size was 50 students, chosen based on the study requirements and availability of eligible participants. Students who met the inclusion criteria and were present during the data collection period were considered for participation.

Study Instrument

The data collection tool was a structured knowledge questionnaire developed by the investigator based on an extensive review of literature and guidance from experts in psychiatric nursing and pediatric nursing. The instrument consisted of two main sections: Section A, which covered demographic variables, and Section B, which assessed knowledge regarding suicide and its prevention using multiple-choice questions. The tool was reviewed by subject experts to ensure content validity, and modifications were made according to their suggestions. Reliability of the tool was established through the test-retest method, and the Karl Pearson correlation coefficient was reported as 0.84, indicating high reliability.

Intervention Details

The intervention in the study was an IEC program on suicide and its prevention. The IEC package was designed to improve students' knowledge through structured information delivered in a classroom setting using PowerPoint presentation. The intervention was administered after the pre-test, and the post-test was conducted 7 days later to determine the change in knowledge following exposure to the IEC program.

Data Collection Process

Prior to data collection, formal permission was obtained from the ethical committee of DRIEMS University, School of Nursing, and from the principal of Biren Mitra Women's College. The

researcher explained the purpose of the study to the participants and obtained informed consent before administering the tool. The pre-test was conducted using a self-report questionnaire, followed by the IEC intervention, and then the post-test after 7 days. The study followed a structured procedure to ensure uniformity, confidentiality, and smooth administration of the data collection process.

Ethical Concerns

Ethical approval was obtained before the main study, and the researcher ensured that the participants' rights were protected throughout the research process. Confidentiality of the information collected from the students was maintained, and anonymity was assured. Participation was voluntary, and students were informed that they could withdraw from the study at any time without penalty. Special attention was given to ensure that the topic was handled sensitively because it involved suicide-related knowledge.

Data Analysis

The collected data were analyzed using descriptive and inferential statistics. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize demographic data and knowledge scores. Inferential statistics, specifically the paired t-test, were used to determine the effectiveness of the IEC intervention by comparing pre-test and post-test knowledge scores. The chi-square test was used to examine the association between knowledge level and selected demographic variables. The analysis was carried out using statistical software IBM Version 25.0 as per the study plan, and the results were interpreted in relation to the study objectives.

Results

The study results were presented in the table and diagrammatic methods after the analysis.

Table 1. Socio-Demographic Characteristics of the Participants**(n=50)**

Socio-Demographic Variable	Category	Frequency (n)	Percentage (%)
Age in Years	Below 16	0	0.0
	16 - 18	46	92.0
	18 - 20	4	8.0
	More than 20	0	0.0
Religion	Hindu	36	72.0
	Muslim	9	18.0
	Christian	5	10.0
Place of Residence	Rural	37	74.0
	Urban	13	26.0
Type of Diet	Veg	8	16.0
	Non-veg	42	84.0
Type of Family	Nuclear	41	82.0
	Joint Family	9	18.0
	Extended	0	0.0
Year of Class	+2 1st year	50	100.0
	+2 2nd year	0	0.0
Father's Education	Primary education	8	16.0
	Secondary education	18	36.0
	Diploma / Degree	24	48.0
Mother's Education	Primary education	23	46.0
	Secondary education	18	36.0
	Diploma / Degree	9	18.0
Father's Occupation	Worker	8	16.0
	Farmer	6	12.0
	Business man	21	42.0
	Govt. employee	15	30.0
Mother's Occupation	House wife	32	64.0
	Private job	11	22.0
	Government job	7	14.0
Family Monthly Income	Rs 30000 - Rs 50000	36	72.0
	Rs 50000 - Rs 1 lac	11	22.0
	Rs 1 lac - Rs 2 lac	3	6.0
	Rs 2 lac and above	0	0.0

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Family History of any Mental Illness	Yes	1	2.0
	No	49	98.0
Previous Experience in Attending Any Suicide Awareness Program	Yes	4	8.0
	No	46	92.0
Source of Information	Mass Media	5	10.0
	Internet	42	84.0
	Textbook	3	6.0

Among the 50 adolescents surveyed, a significant majority were aged between 16 and 18 years (92.0%), identified as Hindu (72.0%), and lived in rural areas (74.0%). A notable prevalence of non-vegetarian dietary habits (84.0%) and nuclear family structures (82.0%) was evident, with all participants enrolled in the first year of the +2 program (100.0%). In terms of parental education, 48.0% of fathers possessed a diploma or degree, whereas 46.0% of mothers had completed only

primary education. The most common occupation among fathers was business (42.0%), while the majority of mothers were housewives (64.0%). The predominant family monthly income fell within the ₹30,000–₹50,000 range (72.0%). An overwhelming majority reported no family history of mental illness (98.0%) and no prior exposure to suicide awareness programs (92.0%). The internet was identified as the primary source of information on suicide and its prevention (84.0%).

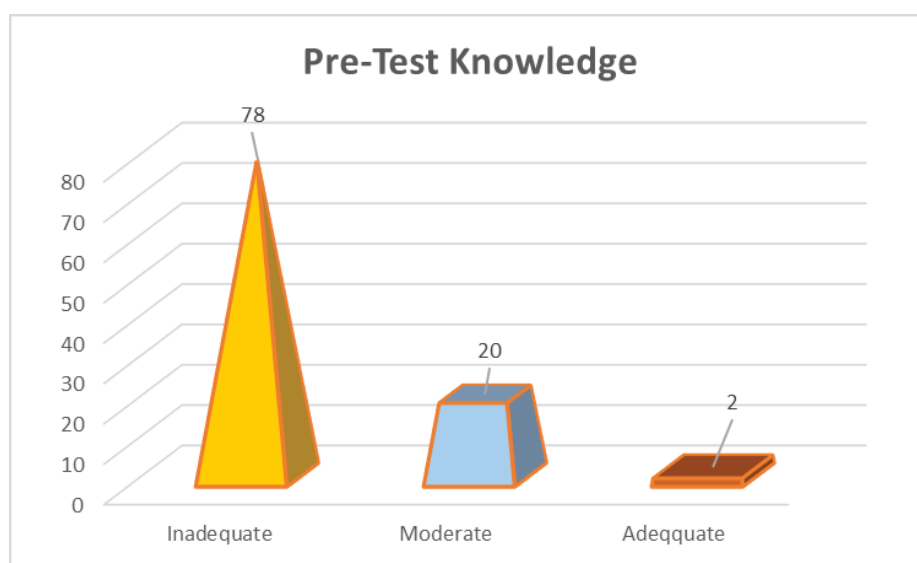


Figure 1: Percentage Distribution of Samples According to Pre-Test Level of Knowledge about suicide and its prevention among adolescent students at a higher secondary college in Cuttack, Odisha

The figure illustrates pre-test knowledge levels regarding suicide and its prevention among adolescent students at a higher secondary college in Cuttack, Odisha. Results show 78% had inadequate knowledge, 20% moderate knowledge, and 2% adequate knowledge. This distribution indicates a

knowledge deficit in the studied population, with most students lacking understanding of suicide risk factors and preventive strategies. These findings highlight the need for targeted interventions and awareness programs to enhance health literacy and prevention measures.

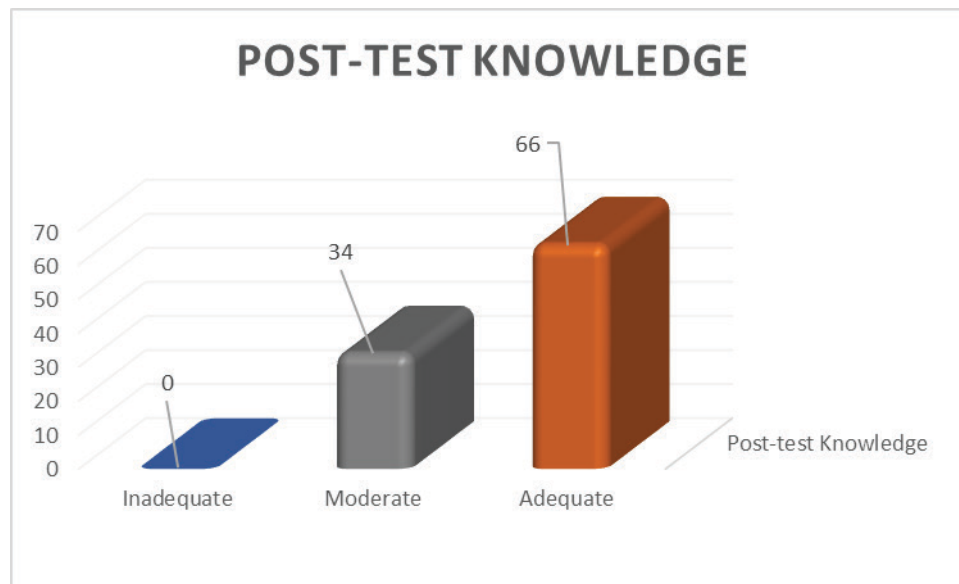


Figure 2: Percentage Distribution of Samples According to Post-Test Level of Knowledge Regarding about suicide and its prevention among adolescent students at a higher secondary college in Cuttack, Odisha

The figure shows the post-test distribution of knowledge regarding suicide and its prevention among students at a higher secondary college in Cuttack, Odisha. Results reveal improvement following the intervention, with 66% of respondents having adequate knowledge, 34% moderate knowledge, and 0% in the inadequate category. This distribution shows a shift from the pre-test baseline,

highlighting the program's effectiveness in enhancing understanding of suicide risk factors, warning signs, and preventive strategies. The elimination of inadequate knowledge and predominance of awareness underscore interventions' potential to bridge knowledge gaps, promote mental health literacy, and equip adolescents with suicide prevention competencies.

Table 2. Mean, Mean Difference, Standard Deviation and Paired 't' test Value of Samples during Pre-test and Post-test

(n = 50)

Test	Mean	Mean Difference	Standard Deviation	Paired 't' test	p-value
Pre-Test	6.82	14.48	4.93	16.5	0.001***
Post-Test	21.30		4.31	(df = 49)	

*** Significant at p=value < than 0.05

Table - II indicates that the pretest mean score was 6.82 with a standard deviation of 4.93, while the posttest mean score was 21.30 with a standard deviation of 4.31. The disparity in average score was 14.48.

The computed paired 't' value was 16.5 (with 49 degrees of freedom), exceeding the tabulated value of 3.46 ($P < 0.001$ level). Consequently, there was a notable disparity between pre-test and post-test knowledge levels concerning suicide and its prevention among adolescent. This disparity was

attributable to the efficacy of the Information, Education and Communication Program concerning suicide and its prevention. Consequently, the hypothesis (H1) was accepted.

Discussion

The present quasi-experimental study was conducted to evaluate the effectiveness of Information, Education and Communication (IEC) intervention in improving knowledge of suicide prevention amongst adolescent students of Cuttack, Odisha. The discussion is concerned with the main findings relating to baseline knowledge, effectiveness of the intervention and its association with socio-demographic variables, interpreted in light of the national and global literature available.

The findings suggest that most of the participants in the study were in late adolescence, a developmental stage that is generally accepted as a vulnerable period for the onset of mental health problems and suicidal behaviours. Most of the participants belonged to the rural background and nuclear family type, which is consistent with the usual demographic profile of the participants observed in similar studies conducted in India, where mental health information and services are not easily accessible. Furthermore, disparities in parental education and poor exposure to mental health awareness programs point towards deficits in mental health literacy. Such contextual factors are in line with Indian and global evidence on the influence of family environment, educational background and accessibility of information on adolescents' awareness and ability to cope with mental health issues.

Inadequate knowledge about suicide prevention was found among participants at the baseline assessment. This finding is consistent with a number of national studies that have found poor awareness and misconceptions about mental health and suicide among adolescents, especially in school settings where structured mental health education is often lacking. Comparable patterns have been identified worldwide, suggesting that adolescents tend to lack accurate knowledge and help-seeking attitudes before specific educational interventions.

The level of knowledge of the participants showed a marked change with a visible shift from poor to adequate and moderate levels of knowledge due to IEC intervention. This suggests the benefits of structured educational interventions to increase awareness of suicide prevention. Our findings corroborate earlier interventional studies done overseas and in India, which have shown that school-based educational programs significantly improve students' knowledge regarding the risk factors, warning signs and preventive measures of suicide. Similarly, studies by Miller and Eckert, Johnson et al. and Patel and Singh reported significant improvements in knowledge following educational interventions, supporting the role of IEC approaches as effective tools in the promotion of adolescent mental health. ⁽²⁵⁻²⁷⁾

The improvement noted is consistent with the general recommendation of global mental health organisations that mental health education in schools may be an important part of early prevention. Adolescence is a critical phase for shaping attitudes, knowledge and behaviours related to mental health and timely educational interventions can help reduce stigma and promote help-seeking practices.

The study did not find significant association of baseline knowledge with sociodemographic variables such as age, gender and socioeconomic status. This points to a general lack of awareness of suicide prevention across all demographic groups. Similar findings have been documented in international studies. For instance, studies by Lee and Kim suggest that baseline knowledge deficits exist regardless of sociodemographic differences. ⁽²⁸⁾ These findings show the importance of putting in place universal, not selective, mental health education programmes in schools to ensure full coverage.

To summarise, the discussion highlights the positive impact of IEC interventions on adolescents' knowledge of suicide prevention and the significance of systematic implementation of such programs in traditional educational environments. These findings are consistent with national and international literature, and contribute to the

evidence base for adopting school-based mental health education as an important prevention strategy.

The research possesses multiple constraints. The study employed a one-group pre-test post-test design lacking a control group, thus precluding the attribution of knowledge changes exclusively to the IEC program. The limited sample of 50 adolescent girls from certain higher secondary institutions in Cuttack constrains generalisability. The evaluation of knowledge occurred solely one week post-intervention, leaving long-term retention and behavioural effects unexamined. The employment of a self-reported, longitudinal questionnaire may have introduced testing and response biases. The context-specific IEC material and the use of a single facilitator may restrict its applicability to diverse situations and people.

Conclusion

This study found that the Information, Education, and Communication (IEC) intervention improved teenage students' suicide prevention knowledge. After the instructional workshop, many pupils understood suicide prevention better. The results show that structured educational programs can improve adolescents' suicide prevention knowledge. The study also found that socio-demographic factors affected students' baseline knowledge, emphasising the necessity for inclusive and varied educational techniques.

The findings affect education and public health policies. To raise awareness, eliminate stigma, and encourage early help-seeking in teenagers, suicide prevention education should be part of life skills and mental health education in schools. State and federal governments should promote frequent, age-appropriate IEC programs on mental health and suicide prevention in schools. Policies should also train teachers, school nurses, and counsellors to identify at-risk pupils and provide advice or referrals. School-based mental health interventions can be strengthened by education and health sectors to identify psychological distress early and improve adolescent well-being.

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Effect of Educational Program on Women's Knowledge and Self Care Practices Regarding Menorrhagia at Jazan community

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Abstract

Background: Menorrhagia is a condition characterized by heavy menstrual bleeding during menstrual cycle and occurs when the women must change the pad within less than two hours or when the menstrual bleeding lasts up to 7 days or more. This study aimed to evaluate the effect of educational program on women's knowledge and self-care practices regarding menorrhagia. Methodology. A quasi-experimental **Study Design** was followed. The study was conducted at Jazan community. A purposive sample included 100 women suffered from menorrhagia. Two tools were used tool (I): A Structured interviewing questionnaire, tool (II) Assessment women's self-care practices regarding menorrhagia to assess self-care practices of women with heavy menstrual period.

Results: The study illustrated that less than one quarter of the studied women had good knowledge pre-intervention while, nearly three quarter of them had good knowledge post-intervention. Also, more than one third of the studied women had satisfactory self-care practices regarding menorrhagia pre-intervention while, more than three quarters of them had satisfactory self-care practices post-intervention ($p \leq 0.001$).

Conclusion & Recommendations: the educational program had significant improvement in women's knowledge and self-care practices regarding menorrhagia post-intervention and follow-up phases. Designing screening program is very important for early detection of women with menorrhagia.

Key Words: Educational program, Menorrhagia, Self-care practices, Women's knowledge.

Introduction

Heavy menstrual bleeding (Menorrhagia) is one of the most common problems affecting women

and presenting a major global public health concern affects 5% to 58% of women of reproductive age worldwide. It affects more than 10 million American women each year. This means that about one out of

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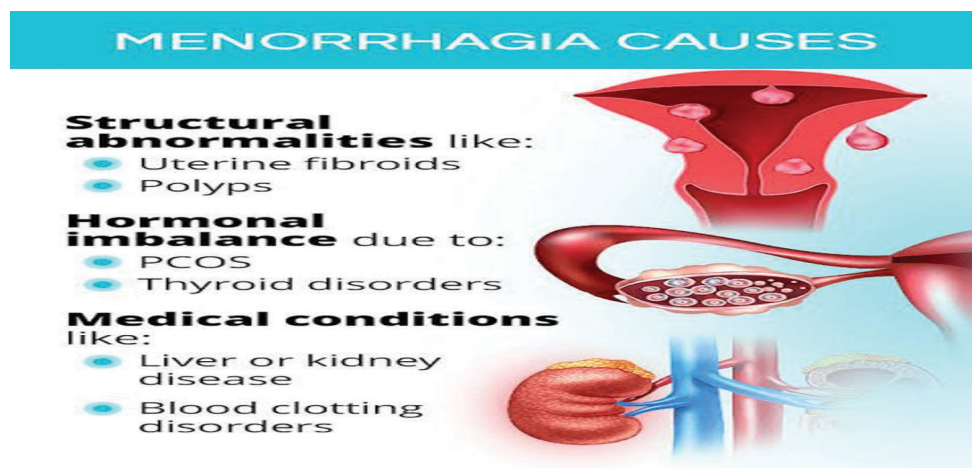
every five women has heavy menstrual bleeding ¹. Menorrhagia can occur due to uterine-related problems as tumors of the uterus that called uterine fibroids or polyps, cancer of the uterus or cervix, certain types of birth control as intrauterine device. Problems related to pregnancy, such as a miscarriage or ectopic pregnancy can cause abnormal bleeding. Hormone-related problems and bleeding-related disorders, such as platelet function disorder led to heavy menstrual bleeding. ².

Diagnosis of menorrhagia occurs through the following investigation as blood test, Pap test and endometrial biopsy. Tissue samples are taken from the inside lining of woman's uterus or "endometrium" to find out cancer or other abnormal cells. Ultrasound or Sono hystrogram is done after fluid is injected through a tube into the uterus by way of woman's vagina and cervix. ³. Management of menorrhagia depends on the cause of bleeding, seriousness of the condition, woman's age, general health, medical history, woman's response to certain medicines, procedures or therapies and woman's wants and needs. Drug Therapy as iron supplements, ibuprofen, birth control pills, intrauterine contraceptive device, hormone therapy and anti-inflammatory drugs may reduce the amount of bleeding ⁴.

Self-care measures of menorrhagia following a healthy lifestyle, that involve eating lots of fruits and vegetables, reducing fat, sugar and salt intake and exercise. Women should eat fiber and iron-rich diet also, drink aplenty of water during the heavy menstrual period to compensate the depletion,

consumption of vitamin C with iron-rich foods can help body to best absorb sources of iron, avoid beverages that decrease the amount of absorption such as coffee and caffeinated teas as green and black tea ⁵. Other measures followed during menorrhagia as take a warm bath or use a heating pad for cramps, aromatherapy to create a relaxation, follow relaxation technique, stay at home when feeling weak, get rest when tired ⁶.

Nurses play important role in the management of menorrhagia, give health education to women about the characteristics of the normal menstrual cycle, teach women with menorrhagia about types of treatment, self-care measures and follow healthy lifestyle. They also monitor vital sign as pulse and blood pressure when woman's feels fatigued⁷. Menorrhagia has significant effects on personal, social, family and working women and thereby reduces their quality of life. It has negative effects on women's quality of life. Therefore, women with menorrhagia should be investigated and effective approaches should be designed ⁸. It is a major cause of gynecological diseases that affect 1-5 women living in Europe and North America in a period of their reproductive age also, about 9-14% of women in reproductive age lose 80mL blood in each cycle. This proportion shows similar frequency in developing countries as well. It was indicated that 12% of the adolescents in Nigeria complained about menorrhagia with blood loss over 80ml. ⁹. This study aimed to evaluate the effect of educational program on women's knowledge and self-care practices regarding menorrhagia.



Heavy Menstrual Bleeding: Treatment Map

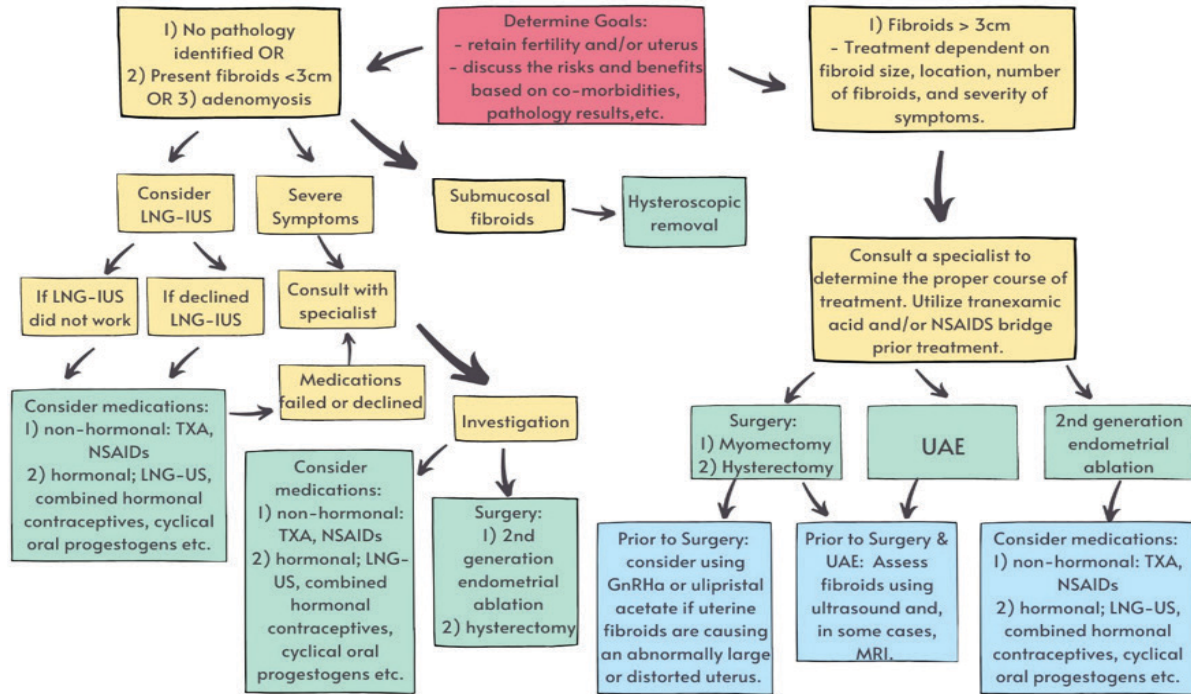


Figure (1): Munro MG, Critchley HO, Broder MS, Fraser IS. FIGO classification system (PALM-COEIN) for causes of abnormal uterine bleeding in nongravid women of reproductive age. *Int J Gynaecol Obstet.* 2023 Apr;113(1):3-13

Methodology

Research Design

A quasi-experimental study design (time series study, one group) was followed to fulfill the aim of the study. This study was conducted at Jazan Community. A purposive sample was selected from women's jazan community. The sample size included all women who suffered from menorrhagia for a period of nine months which included 100 women.

Tools of data Collection

Tool I: Structured interviewing questionnaire was designed by the researcher after reviewing related national and international literature^{10, 11, 7} and consisted of three parts: **Part (1):** Socio demographic data of studied women. **Part (2):** Women's menstrual

history. **Part (3):** Women's knowledge regarding menorrhagia which included the following sections that divided into 3 sections as follow: **Section (A)** Women's knowledge about the menstrual cycle. **Section (B):** Women's knowledge about menorrhagia. **Section (c)** Women's knowledge about the treatment of menorrhagia

Tool II: Assessing women's self-care practices regarding menorrhagia: it was adapted from¹² and modified by the researcher for assessing self-care practice of women with menorrhagia and included 47 items that divided into 3 parts as following. Part (A): Diet regimen. Part (B): Personal hygiene. Part (C): Exercises. **Supporting tool: Educational program:** Was designed by the researcher after reviewing related national and international literature, written in simple Arabic language to suit the level of

women's understanding and supported with colored illustrated pictures. **This study was** conducted on 10% of the total period of data collection (3 weeks) to evaluate clarity and applicability of tools used for data collection. Minor modifications were done in the form of clarification of sentences.

Tools Validity & Reliability

The tools of data collection were tested and reviewed for its content validity to test content validity. The researcher reviewed the tools for clarity of sentences, consistency and appropriateness of content, the sequence of items, accuracy, relevance and applicability of tools. **The reliability was done by Cronbach's alpha coefficient test** which revealed that each of the two tools consisted of relatively homogenous items as indicated by the moderate to high reliability of tools, the internal consistency of the tools was as the follows: structured interviewing questionnaire was (0.93) and women's self-care practices was (0.87).

Ethical Considerations

An official permission from Committee for Research Ethics - Jazan University with reference number (REC-46/06/1318). The aim of the study was explained to each woman before applying the tools to gain their confidence and cooperation. Each woman had freedom to withdraw from study at any time without obligation. The study had no physical, social or psychological risks on the women. Confidentiality and privacy were ensured throughout the study process and the women were assured that all data was used only for research purpose.

Field work: The study was carried out at the beginning of October 2022 to the end of June 2023 covering 9 months, to fulfill the aim of the current study.

Interviewing and assessment phase: At the beginning of the interview the researcher greeted with the participant women, introduced herself to the participant women, explained the purpose of the study and provided the women with all information

about the study (purpose, duration, and activities) and took oral consent to participate in the study. Data was collected through structured interviewing questionnaire to collect women's demographic data, menstrual history, history of contraceptive method, family history, women's clinical data about menorrhagia and women's knowledge regarding menorrhagia. Then, used women's self-care practice regarding menorrhagia to assess self-care practices of women with menorrhagia. The average time required for completing the questionnaire was around (20-30 minutes).

Planning phase: Based on the results obtained from pretest assessment of women's knowledge and self-care practices regarding menorrhagia and review of relevant literature, the researcher designed the educational guidelines in an Arabic language supported by figures and included two parts theoretical & practical. The sessions' number and its content were determined, using different teaching methods such as lecture, group discussion, demonstration, re demonstrations, with the assistance of instructional media as videos presented on laptop.

Implementation phase: The researcher was explained purpose of the study to the participant women and provided all information about the study, and the process of the study was explained to gain confidence and trust. Also, oral consent was taken from all participant women. Interviewed the participant women to assess demographic data, menstrual history, history of contraceptive method, family history, women's clinical data about menorrhagia, women's knowledge regarding menorrhagia and women's self-care practice regarding menorrhagia, divided the study sample into 10 groups each group included 10 women, applied the educational guidelines through interactive four sessions for three days per week, the duration of each session was conducted for 45-60 minutes, and then classified the session into one theoretical session and three practical sessions.

The theoretical session: At the beginning of this session the researcher gave the women the educational guidelines and introduced an orientation

of the educational guidelines including the general and specific objectives by using Arabic language to suit all level of women's education. Then, started by the introduction of the theoretical part of the educational guidelines and provided women with general knowledge about menorrhagia, definition of menorrhagia, factors affecting menorrhagia, causes of menorrhagia.

The practical sessions: This session started by feedback about the previous session and introduction of the objectives of the new session then, the researcher provided women with knowledge about investigations of menorrhagia, treatment of menorrhagia, pain relieving measures and nursing role during menorrhagia. Then implied the implementation of the practical part of the educational guidelines and included assessment of the impact of menorrhagia on quality of life and social functioning, got feedback and re demonstration of the previous session and introduction of the objectives of the new session. Then re demonstrated information about personal hygiene, sports and psychological pressure to women. **Finally**, gave 5 minutes to all women to ask question then clarify the question.

Evaluation phase: This phase was utilized to evaluate the effect of educational guidelines on improving women's knowledge and self-care practice regarding menorrhagia. It was done by using the same format of tool that was used for pre-test. All tools of data collection were used pre- and 4 weeks

post- intervention (posttest) and follow up was done 8 weeks after intervention.

Statistical Analysis

The collected data was coded, organized, categorized, tabulated and analyzed by using appropriate statistical methods. Data was verified prior to computerized entry. The Statistical Package for Social Sciences (SPSS version 22) was used followed by data tabulation and analysis. Descriptive statistics were applied (e.g., mean, standard deviations, frequencies and percentages). Paired t-test, Chi-square test, Fisher Exact Test and Pearson correlation coefficients were used. For all the statistical tests done, p-value > 0.05 indicated no statistically significant difference, p-value <0.05 indicated a statistically significant difference, and p-value ≤ 0.001 indicated a highly statistically significant difference

Results

Table (1) reveals that 60.0% of studied women aged ≥ 35 years old with mean age 33.03±10.91 and 56.0% of them were from rural areas. Regarding education level 52.0% of women had secondary education and 67.0% of them were housewives also, 75.0% of studied women were married. Regarding women's income about 60.0% of women had insufficient income and 78.0% of them had nuclear family.

Table 1. Distribution of the studied women according to demographic data (n=100)

Demographic data	No.	%
Age (years)		
20-<25	18	18.0
25-≥35	22	22.0
≥ 35	60	60.0
Mean ±SD	33.03±10.91	
Residence		
Rural	56	56.0
Urban	44	44.0

Continue....

Secondary education	52	52.0
Educational level		
Read and write	3	3.0
Primary education	30	30.0
University education	15	15.0
Occupation		
Housewife	67	67.0
Working	33	33.0
Marital status		
Married	75	75.0
Single	20	20.0
Divorced	3	3.0
Widow	2	2.0
Monthly income		
Sufficient	40	40.0
In sufficient	60	60.0
Type of family		
Nuclear	78	78.0
Extended	22	22.0

Table (2) shows that 80.0% of women had their menarche at age 12<14 years, 80.0% of studied women stated that the period between menstruation was regular. Concerning, the change in menstrual

cycle, about 70.0% of studied women stated that they had Change for 3months straight in the menstrual cycle. Regarding the duration of menstruation, 80.0% of them reported that they didn't have menorrhagia.

Table 2. Distribution of the studied women according to their menstrual history (n=100).

Menstrual history	No.	%
Age of menarche (years)		
10 < 12	20	20.0
12 < 14	80	80.0

Continue....

Mean ±SD	12.86±1.16	
Duration between the end of menstruation and the beginning of the next		
< 21 days	40	40.0
21-25 days	40	40.0
26 – 30 days	20	20.0
Period between menstruation		
Regular	80	80.0
Irregular	20	20.0
Change in the nature of the menstrual cycle during menorrhagia for 3months straight		
Yes	70	70.0
No	30	30.0
Type of changes (n=70)		
Amount of menstruation	20	28.6
Pain during menstruation	40	57.1
Days of menstruation	10	14.3
Duration of menstruation		
< 3 days	10	10.0
3 < 5 days	10	10.0
5 < 7 days	40	40.0
≥ 7 days	40	40.0

Table (3) Illustrated that there was a positive statistically significant correlation between total knowledge and total self-care practices scores regarding menorrhagia at pre intervention, post intervention and follow-up phase ($p < 0.001$).

Table 3. Correlation between total knowledge, and total self-care practices scores of the studied women regarding menorrhagia at pre-intervention, post-intervention and at follow up phases (n=100).

Variables	Total Knowledge score					
	Pre-intervention		Post-intervention		Follow-up	
	R	P value	R	P value	r	P value
Total self-care practice score	0.870	0.000**	0.904	0.000**	0.861	0.000**

****A Highly Statistically significant ($p \leq 0.001$)**

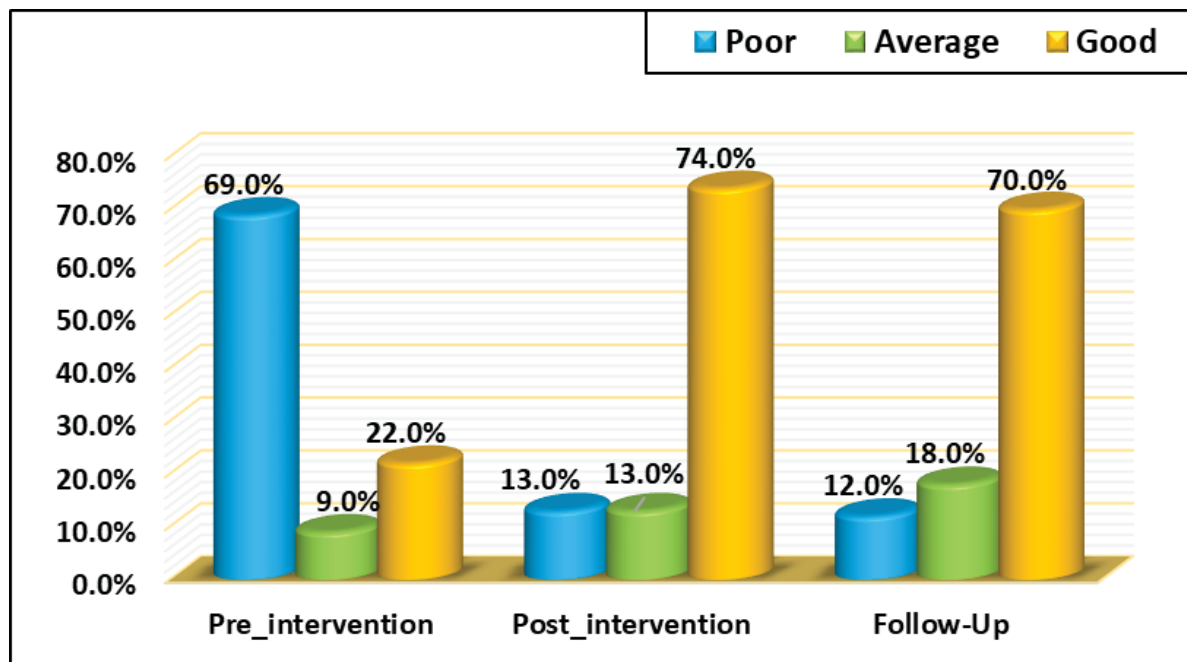


Figure (2) (n=100): This figure shows the distribution of studied women's total knowledge regarding menorrhagia at pre- intervention was poor 69.0%, post- intervention was good 74.0% and at follow-up phases was good 70.0 %

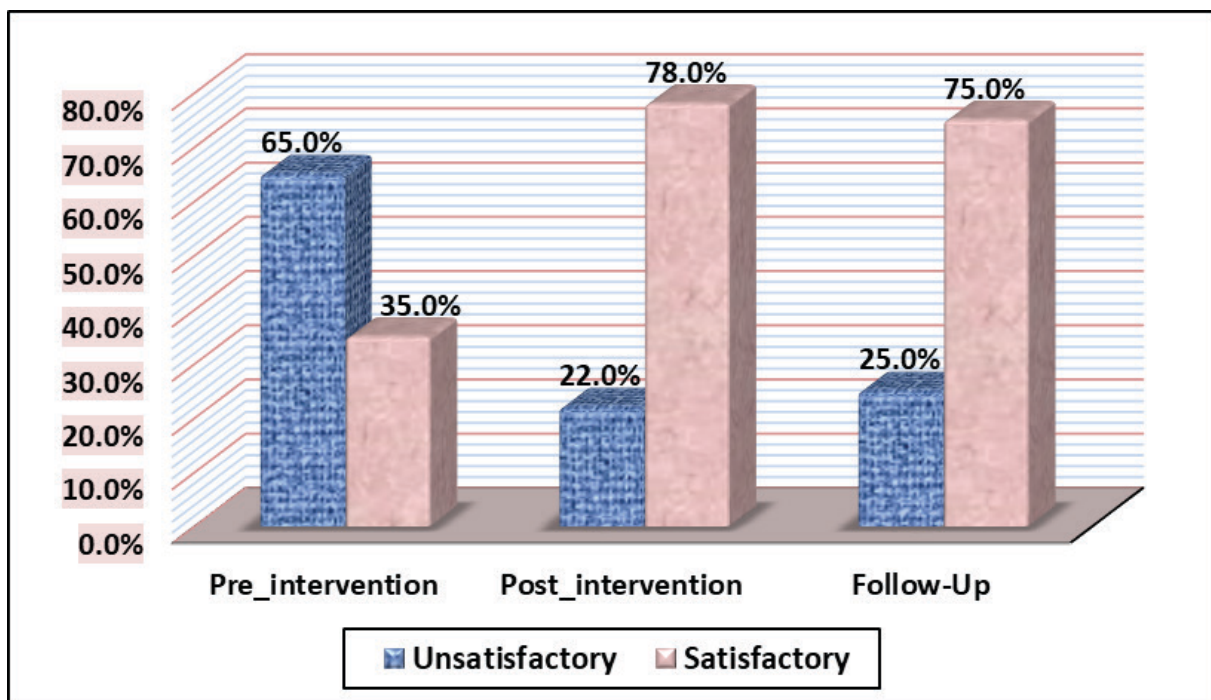


Figure (3) (n=100): This figure clears distribution of studied women's total self-care practices score regarding menorrhagia at pre-intervention was unsatisfactory 65% post-intervention was satisfactory 78% and at follow up phases also were satisfactory 75%.

Discussion

Regarding demographic characteristics and menstrual history of the studied women the results of the current study revealed that three fifth of studied women aged ≥ 35 years old with mean age 33.03 ± 10.91 years and more than half of them were from rural areas. Most women had their menarche at age $12 < 14$ years with mean 12.86 ± 1.16 years and the period between their menstruation was regular. This result is supported by *Da Silva Filho et al., (2021)*¹³ who studied "The difficult journey to treatment for women suffering from heavy menstrual bleeding: a multi-national survey" revealed that the mean age of women was 34.3 year and nearly half of them were from rural areas. Onset of menarche occurred at a mean age of 12.7 years; and more than half of the sample studied had regular period between menstruations.

The present study results also illustrated that more than two third of studied women experienced the symptoms of menorrhagia over 6 consecutive menstrual cycles and two fifth of them changed the sanitary napkin once every two hours. This result agrees with *Lavin et al., (2022)*¹⁴ who studied "Significant gynecological bleeding in women with low von Wille brand factor levels" revealed that nearly three quarters of the studied women had symptoms of menorrhagia over 6 months, and more than two third of them change the pad every 2 hours.

Concerning studied women's knowledge regarding menstrual cycle the current study revealed that there was statistically significant improvement in all items of women's knowledge about menstrual cycle post intervention and at follow up phase compared with pre-intervention. This result is supported by *Devi, (2020)*¹⁵ who studied "Effect of Structured Teaching Program on Knowledge Regarding Menstrual Hygiene among Adolescent Girls in Selected Colleges, Bangalore" revealed that the majority of the studied sample had inadequate knowledge regarding menstrual cycle such as age of menarche, hormonal change during menstruation and menstrual hygiene while, after intervention the majority of participants had adequate knowledge about menstrual cycle.

Regarding studied women's knowledge about menorrhagia, the current study revealed that there was a highly statistically significant improvement in all items of women's knowledge about menorrhagia post intervention and at follow-up phase compared with pre-intervention. This might be because of well- developed, clear, comprehensive and coloured guidelines and researcher ability to motivate the studied women to acquire more information regarding menorrhagia.

This result is congruent with *Sourav et al., (2021)*⁷ who illustrated that there was significant improvement in women's knowledge regarding menorrhagia post-intervention. In addition, *Protheroe et al., (2024)*¹⁶ who studied "Effectiveness of a computerized decision aid in primary care on decision making and quality of life in menorrhagia" revealed that there was highly significant difference between study and control groups regarding menorrhagia, satisfactory knowledge regarding diagnosis of menorrhagia pre- intervention that improved post-intervention.

Concerning studied women's total knowledge score regarding menorrhagia the current study revealed that there was highly statistically significant improvement in women's knowledge post-intervention and at follow up phase compared to pre-intervention, this could be due to the positive effect of educational guidelines and using various teaching methods that help women to ask questions, acquire and retain correct knowledge. This result is in the same line with *Kanagasabai, et al., (2022)*¹⁷ who studied "Interventions to improve access to care for abnormal uterine bleeding: A systematic scoping review" revealed that there was significant increase in women's knowledge post intervention compared to pre-intervention.

The current study demonstrated that there was highly statistically significant difference between mean scores of diet items regarding menorrhagia at pre, post and at follow up phases. This result is congruent with *Tansaz, (2023)*¹⁸ who studied "Menorrhagia management in Iranian traditional medicine" revealed that there was highly significant increase in women adherence to diet regimen at post and at follow-up phase of program application.

Regarding studied women's reported self-care practices about sports during menorrhagia, the current study revealed that there was highly statistically significant difference between mean scores of sports items regarding menorrhagia at pre, post and at follow-up phases. The current study results are supported by *Gupta et al., (2021)*¹⁹ who studied "Effect of Diet, Physical Activity, and Psychosocial Factors, on Menstrual Cycle Abnormalities in College Students of Karad, Maharashtra, India" illustrated that there was significant improvement regarding following adequate exercise program and compliance with permitted physical activities post intervention that resulted in minimizing manifestations of menorrhagia and health improvement.

Regarding the study of women's total self-care practices score regarding menorrhagia, the current study revealed that there was a highly significant improvement in women's self-care practice score regarding menorrhagia at post and at follow-up phase. This result is congruent with *Al-Husban et al., (2024)*¹² who revealed that there was highly statistically significant improvement in women practice regarding menorrhagia at post and at follow-up phase of program implementation.

Concerning the correlation between studied women total knowledge and self-care practices the current study showed that there was a positive statistically significant correlation between total knowledge and total self-care practice scores regarding menorrhagia at pre, post and at follow-up phases of intervention. The study result is agreed with *Armour, (2022)*²⁰ who studied "Using an online intervention to improve menstrual health literacy and self-management in young women: a pilot study" illustrated that there was significant correlation between studied participants total knowledge and self-management practices post-intervention.

Conclusion

The findings of this study concluded that there was statistically significant improvement in all items of women's knowledge regarding menorrhagia

at post intervention and at follow up phase of educational guidelines compared with pre-intervention. Also, there was highly statistically significant difference between mean scores of self-care practices regarding menorrhagia at pre, post and at follow up phases. However, it is important to note that there was a highly significant relation between studied women's total self-care practices score. There was a positive statistically significant correlation between total knowledge and total self-care practices scores regarding menorrhagia at pre, post and at follow-up phases.

Recommendations

In the light of the findings of the current study, the following recommendations can be suggested:

- Designing screening program for early detection of women with menorrhagia.
- Raising women's awareness about menorrhagia related risk factors should be a priority to ensure early diagnosis of menorrhagia.
- Replication of the study on large sample size in different settings for generalization of results.

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Conflicts of Interest: The researcher declares that there is no conflict-of-interest statement

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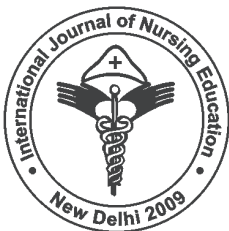
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