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Pressure ulcer prevention among nurses in Malaysia: a cross-sectional survey

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ABSTRACT

Introduction: Pressure ulcers (PUs) remain a global health issue, contributing to increased morbidity and premature mortality. Nurses play a central role in prevention, underscoring the significant role in addressing this issue through the rapidly evolving healthcare environment. Clinical competence requires sound knowledge, attitude, and practice that contribute to excellent outcomes, focusing on individual patient needs and the changing conditions of the healthcare setting. Therefore, this study is aimed to evaluate nurses' knowledge, attitudes, and practices on preventing PUs.

Methods: This quantitative cross-sectional survey was conducted across three public hospitals in Malaysia. Using the two-stage cluster sampling strategy, registered nurses were recruited (n=210). Data were collected using a self-administered questionnaire with good reliability scores (α=0.76–0.82). Descriptive and inferential analyses were computed to address the objectives.

Results: Findings revealed low knowledge score (M=67.07, SD=7.78), neutral attitudes (M=73.28, SD=10.37), and excellent practices for pressure ulcer prevention (M=86.78, SD=15.05). Nurses' attitudes were positively correlated with their practices ($p<0.05$), though no significant associations were observed between demographic factors and knowledge, attitude, and practice ($p>0.05$).

Conclusions: The findings provide valuable information about nurses' understanding of pressure ulcer prevention that may assist with future strategies and interventions to enhance the knowledge and attitudes among practicing nurses. The identified gaps may be filled with targeted interventions, and future studies looking at variables affecting nurses' attitudes and practices, and the effectiveness of educational interventions can be beneficial.

Keywords: knowledge, nurses, nursing practice, pressure ulcer, pressure ulcer prevention

Introduction

Pressure ulcers are localized injuries to the skin and underlying tissues caused by prolonged pressure, resulting in tissue ischemia and necrosis (Berihu *et al.*, 2020). It has been widely recognized as one of the top five sources of patient harm and adversely affects the patients' well-being with pain, suffering, chronic infection, delayed recovery, increased hospital stay, injury, and mortality (Sari *et al.*, 2019; Berihu *et al.*, 2020; Malinga and Dlungwane, 2020). Numerous reports highlight pressure ulcers as a significant health problem among hospitalized patients, regardless of the advancement of technology and the effectiveness of clinical trials on prevention and treatment (Abu Aqoulah *et al.*, 2018; Halász *et al.*, 2021). The increased incidence of 7 to 71.6% and prevalence rate of 8.8 to 53.2% were relatively high in many given settings, contributing to extremely elevated mortality rates and increased financial burden across the globe (Nasreen *et al.*, 2017; Sari *et al.*, 2019). Beyond the physical impact, pressure ulcers also cause physical and psychological distress for both patients and family members (Galvão *et al.*, 2017). Locally, the increasing trend of pressure ulcer incidence was evidenced from 2014 to 2017, with the states Negeri Sembilan, Pahang, and Selangor as the top three states that recorded the highest incidence (Tai *et al.*, 2018). Furthermore, nurses knowledge in this area was found to be varied from inadequate to good, with perceived

barriers identified as heavy workload and inadequate staff (Sham *et al.*, 2020; Azhar *et al.*, 2022).

The collaboration of healthcare disciplines is indeed essential in the multifaceted effort to prevent pressure ulcers, and nurses, being at the forefront of patient care, are crucial in driving these initiatives (Sham *et al.*, 2020). Comprehensive risk assessment, including factors such as immobility, nutritional status, skin condition, and comorbidities, provides a foundation for tailored preventive strategies. Previous studies that assess knowledge, attitudes, and practices among nurses regarding pressure ulcer prevention are significant. They provide significant information on the issue of pressure ulcers related to nursing practice and suggest some areas for improvement. Findings from previous research indicate poor to moderate levels of knowledge, along with less than satisfactory attitudes and practices, emphasizing the complexity of this issue (Nasreen *et al.*, 2017; Etafa *et al.*, 2018; Ingwu *et al.*, 2019; Kim and Lee, 2019). The increased prevalence of pressure ulcers was reported in the local context. The numbers are comparable to recently reported figures in Europe and North America. However, limited studies were observed. Despite the rising trend of pressure ulcer cases in local states, there is a limited body of research that comprehensively explores nurses' knowledge, attitudes, and practices in pressure ulcer prevention. Existing studies mainly highlight varied knowledge levels and barriers like heavy workload and staff shortages, but a more in-depth understanding of nurses' overall knowledge, attitude, and practice (KAP) is still lacking. Moreover, the Malaysian Nursing Indicator Approach (NIA), a national initiative to measure and monitor nursing-sensitive outcomes, particularly in pressure ulcer prevention, has further guided the direction of this study. The current study is therefore essential for tailoring interventions and strategies that resonate with the specific needs, practices, and challenges of the Malaysian healthcare setting.

Generally, the study explores the levels of KAP among nurses in pressure ulcer prevention. The study intends to evaluate how well nurses comprehend the principles of pressure ulcer prevention, their attitudes toward these preventive measures, and the extent to which they apply them in practice. The relationships between knowledge, attitudes, and practices and the differences in knowledge, attitudes, and practices based on demographic attributes were further examined to discover the possible influencing factors to pressure ulcer prevention among nurses. Findings from this study may inform the development of targeted training programs, guide policy improvements, and support updates to nursing curricula to enhance the quality of patient care and help reduce the incidence of pressure ulcers.

Materials and Methods

Study design and setting

A quantitative design cross-sectional survey was conducted to determine the nurses' knowledge, attitudes, and practices in pressure ulcer prevention. Three public hospitals were chosen as the study setting based on the reported prevalence rate and their secondary and tertiary care provision to a high-density population. This section enabled the inclusion of diverse perspectives and practices of nurses working in environments catering to a wide range of patient conditions.

Population and sampling

Given the nature of patients' risk of developing pressure ulcers with their medical conditions and limited mobility, registered nurses working in medical-surgical, orthopedics, and intensive care units were chosen for the study population. The focus in these critical care domains aimed to capture insights from those most actively engaged in preventive care. All nurses who are directly involved in patient care with a minimal experience of one year and available during the study period were included in the study, whilst nurse administrators and currently on leave were excluded. The two-stage cluster sampling was employed to allow for a structured and systematic selection of participants while minimizing selection bias, enhancing the reliability of the findings. Three hospitals were selected from Selangor state randomly in the first stage, followed by the random selection of nurses within those hospitals in the second stage. By targeting diverse hospital units and employing robust sampling techniques, the study provides a comprehensive view of pressure ulcer prevention practices and factors influencing them in Malaysian healthcare settings. The targeted sample size was determined using Raosoft with a 95% confidence level, 5% margin of error, 50% response distribution, added 10% attrition rate (n=210).

Data collection and analysis

The data collection commenced from April 2022 to June 2022. A self-administered questionnaire with the adopted instrument was used and distributed in person to the identified samples with the assistance of the nurse managers. Part A includes the demographic details (age, gender, level of education, year of working experience and current clinical working area), Part B; 22-MCQ items of Pressure Ulcer Knowledge Questionnaire (Nuru *et al.*, 2015) (α = 0.76), Part C; 15 practice items with 3-point Likert scale (α = 0.76), and Part D; 15 attitudes items using the 5-point Likert scale (α=.82) (Moore and Price, 2004). A pilot study was conducted on 21 samples for reliability and validity of the instrument and revealed a high reliability value for each measure (α>0.7), and no modifications were made to the instrument before the actual data collection. The raw data was cleaned and organized to eliminate possible errors before analysis.

The Statistical Package for the Social Sciences (SPSS) version 26 was then used for computing and analysis. Descriptive statistics, including frequency distributions with percentages, means, and standard deviations (SD), were employed to summarize and present the demographic characteristics of the participants and a detailed overview of nurses' knowledge, attitudes, and practices related to pressure ulcer prevention. The of score for each measure was adapted from previous authors with knowledge, very low (60%), low (60%-69%), moderate (70%-79%), high (80%-89%), and very high (90%-100%); attitude, negative (<71.70%), neutral (71.70%-84.92%) and positive (>84.92%); practice, very low (60%), low (60%-69%), moderate (70%-79%), high (80%-89%) and very high (90%-100%) (Hu, Sae-Sia and Kitrungrote, 2021). Since the data did not meet the assumptions for normal distribution, non-parametric tests were utilized for further analysis, ensuring the validity and robustness of the findings. Mann-Whitney U-test was used to measure the difference in KAP between genders, whilst Kruskal-Wallis was utilized to look at the difference across years of experience and clinical working area. In addition, Spearman's rho explored relationships between variables. The significance level was set at $p<0.05$.

Ethical concern

This study adhered to the ethical principles outlined in the Declaration of Helsinki and Malaysian Good Clinical Practice Guideline throughout the research and ensured appropriate ethical standards are upheld. This study was reviewed and approved by the institutional committee (UG/MR/1039) and the Medical Research Ethics Committee (MREC) (21-02390-Y2A). Participants were informed of the study, ensuring no potential risk or cost, and that any conflict of interest was avoided. The participants consented to being fully autonomous with written consent, given the right to withdraw at any time, and were kept anonymous during the study period. The collected data remained protected throughout the process, from collection to publishing. All data was securely stored in a password-protected computer system with access strictly limited to the researchers only to prevent data breaches.

Table 1. Demographic characteristics of participants (n=200)

Demographic	n (%)
Age	
21-30 years old	85 (42.5)
31-40 years old	86 (43.0)
41-50 years old	27 (13.5)
Above 50 years old	2 (1.0)
Gender	
Male	24 (12.0)
Female	176 (88.0)
Level of education	
Diploma of Nursing	145 (72.5)
Post-basic certificate / Advanced Diploma	39 (19.5)
Bachelor of Nursing	16 (8.0)
Working experience	
Less than 5 years	53 (26.5)
5 to 10 years	88 (44.0)
11 to 15 years	23 (11.5)
16 to 20 years	22 (11.0)
More than 20 years	14 (7.0)
Working area	
Medical	65 (32.5)
Surgical	44 (22.0)
Orthopaedics	48 (24.0)
Intensive Care Unit	43 (21.5)

Results

Demographic characteristics

A total of 200 nurses from three public hospitals in Selangor participated out of 210 nurses approached, yielding a response rate of 95%. Demographic details are summarized in Table 1. The majority of participants (88%) were female, with 12% being male. Regarding age distribution, 43.0% of participants were aged 31 to 40 years, while only 1.0% were over 51 years old. In terms of educational qualifications, 72.5% held a diploma, 19.5% possessed a post-basic certificate or advanced diploma, and 8.0% had a bachelor's degree. Work experience varied, with 44.0% of participants having worked between five to ten years and 7.0% having more than twenty years of experience. Regarding ward distribution, 32.5% were from medical wards, followed by 24.0% from orthopaedic wards, 22.0% from surgical wards, and 21.5% from intensive care units.

The knowledge, attitude, and practice toward the prevention of pressure ulcers among nurses

Table 2 presents the distribution of nurses' knowledge, attitude, and practice regarding pressure ulcer prevention among the nurses in this study. The findings revealed a concerning gap in knowledge, with the overall mean score indicating a low level of knowledge (M=67.07, SD=7.78). Specifically, 46 participants (23.0%) were categorized as having a very low level of knowledge, while only a small minority, 9 participants (4.5%), demonstrated a high level of knowledge. This finding indicates the need for a focused

Table 2. The knowledge, attitude, and practice toward the prevention of pressure ulcers (n=200)

Measures	Mean (SD)	n, (%)
Knowledge	67.07 (±7.78)	
Very low (<60%)		46 (23.0)
Low (60 – 69.99%)		82 (41.0)
Moderate (70 – 79.99%)		63 (31.5)
High (80 – 89.99%)		9 (4.5)
Very high (90 – 100%)		0 (0)
Attitude	73.28 (±10.37)	
Negative (<71.70%)		78 (39)
Neutral (71.70% - 84.92%)		96 (48)
Positive (>84.92%)		26 (13)
Practice	86.78 (±15.05)	
Very low (<60%)		13 (6.5)
Low (60-69.99%)		10 (5.0)
Moderate (70 – 79.99%)		14 (7.0)
High (80 – 89.99%)		52 (26.0)
Very high (90 – 100%)		111 (55.5)

Table 3. The knowledge, attitude, and practice scores across domains of pressure ulcer prevention (n=200)

Domain	Knowledge		Attitude		Practice	
	Mean (SD)	Level	Mean (SD)	Level	Mean (SD)	Level
Factor for pressure ulcer formation	67.25 (21.91)	Low	67.62 (9.47)	Negative	88.08 (17.47)	High
Risk assessment	87.40 (15.31)	High	76.56 (13.97)	Neutral	91.13 (16.50)	Very high
Skin care	72.80 (11.86)	Moderate	-		87.75 (17.12)	High
Nutrition to maintain healthy skin	14.00 (16.49)	Very low	68.20 (20.66)	Negative	80.50 (21.73)	High
Management of mechanical load	70.17 (26.81)	Moderate	81.20 (18.55)	Neutral	87.67 (18.40)	High
Education program for family and staff	76.50 (25.01)	Moderate	80.65 (18.46)	Neutral	77.08 (18.26)	Moderate

*Notes: knowledge, very low (60%), low (60%-69%), moderate (70% – 79%), high (80% – 89%), and very high (90% – 100%); attitude, negative (<71.70%), neutral (71.70% – 84.92%) and positive (>84.92%); practice, very low (60%), low (60% – 69%), moderate (70% – 79%), high (80% – 89%) and very high (90% – 100%).

educational intervention to improve the knowledge deficiency among nurses.

By contrast, the nurses' attitudes toward pressure ulcer prevention were generally neutral (M=73.28, SD=10.37). Hence, there is room for fostering more positive attitudes toward prevention efforts, as the finding shows that nurses may not have overtly negative attitudes. Surprisingly, the level of practice was found to be high (M= 86.78, SD=15.05). This suggests nurses a Surprisingly actively prevent pressure ulcers despite the gaps in knowledge and possess neutral attitudes.

Table 3 illustrates the detailed findings on knowledge, attitudes, and practices across various critical domains related to pressure ulcer prevention. Overall, significant disparities in knowledge were found across the measured domains. While a high level of knowledge in conducting risk assessments (M=87.40, SD=15.31), the nurses' understanding of the role of nutrition in maintaining healthy skin was found to be limited (M=14.00, SD=16.49). Moreover, the nurses' attitudes presented mixed results, with unfavourable attitudes toward understanding the multifaceted factors contributing to pressure ulcer formation (M=68.20, SD=20.66). Similarly, the attitudes toward the significance of nutrition in preventing pressure ulcers were found to be negative (M=67.62, SD=9.47). In terms of practices, the participants displayed varying levels of engagement. Moderate practice levels were observed in educating staff and family members (M=77.08, SD=18.26), suggesting the need for more structured efforts to promote awareness among caregivers. Conversely, there was an exceptionally high level of practice in risk assessment (M=91.13, SD=16.50, reflecting strong adherence to clinical protocols in this domain.

The relationship between nurses' knowledge, attitude, and practice in pressure ulcer prevention

Table 4 presents the relationships between nurses' knowledge, attitudes, and practices in pressure ulcer prevention, offering valuable insights into how these factors are interconnected. A weak but statistically significant positive correlation was found between nurses' attitudes and practices ($r = 0.20$, $p < 0.02$). This indicates that even modest improvements in nurses' attitudes toward pressure ulcer prevention could positively influence their preventive practices. Such a finding highlights the potential impact of fostering positive attitudes through training, motivation, and organizational support to further enhance practice standards. In contrast, no significant relationships were observed between knowledge and attitude or between knowledge and practice ($p > 0.05$).

Table 4. The relationship between nurses' knowledge, attitude, and practice in pressure ulcers prevention

Measure	*r*	p-value
Knowledge and attitude	0.03	0.68
Knowledge and practice	0.13	0.07
Attitude and practice	0.20	0.01*

*Notes: Spearman-rho correlational analysis was computed, p<0.05.

The difference between nurses' knowledge, attitude, and practice in pressure ulcer prevention across demographic variables

The analysis of differences in pressure ulcer prevention across demographic variables was conducted to examine the influence of age, gender, years of experience, educational background, and clinical unit on nurses' levels of knowledge, attitudes, and practices (Table 5). The results showed no significant differences across demographic variables ($p>0.05$). This suggests that the nurses' knowledge, attitudes, and practices are consistent regardless of their demographic characteristics. Consequently, factors such as work experience and educational background do not appear to account for the observed gaps in knowledge, attitudes, or practices.

Discussions

The knowledge, attitude, and practice toward the prevention of pressure ulcers among nurses

Knowledge is essential for preventing pressure ulcers, as understanding the risks and contributing conditions enhances nursing care. This study highlights a concerning knowledge deficit of pressure ulcer prevention among nurses across three public hospitals, emphasizing a critical area for improvement. Similar findings from other studies documenting insufficient knowledge among nurses (Nasreen *et al.*, 2017; Azhar *et al.*, 2022) suggest that this issue exceeds local settings and represents a global challenge in healthcare systems. Knowledge gaps may impede good practice in pressure ulcer prevention among nurses. Thus, it could lead to an increased prevalence of pressure ulcers, adverse patient outcomes with potential morbidity, and increased length

Table 5. The difference between knowledge, attitude, and practice across the demographic variables

Measure	n	Knowledge				Attitude				Practice			
		Median (IQR)	Z	X^2 (df)	p	Median (IQR)	Z	X^2 (df)	p	Median (IQR)	Z	X^2 (df)	p
Gender													
Male	24	15.50 (2.75)	-0.65		0.52	3.63 (0.82)	-0.15		0.88	2.70 (0.47)	-0.34		0.74
Female	176	15.00 (2.00)				3.73 (0.60)				2.73 (0.45)			
Working experience													
< 5 years	53	15.00 (2.00)		5.74 (4)	0.22	3.67 (0.53)		5.33 (4)	0.26	2.80 (0.33)		3.44 (4)	0.49
5-10 years	88	15.00 (2.75)				3.73 (0.63)				2.67 (0.53)			
11-15 years	23	14.00 (2.00)				3.73 (0.47)				2.73 (0.47)			
16-20 years	22	15.00 (2.25)				3.53 (0.58)				2.87 (0.33)			
>20 years	53	15.00 (2.25)				3.80 (0.80)				2.80 (0.33)			
Working area													
Medical	65	15.00 (2.00)		0.96 (3)	0.81	3.67 (0.67)		2.60 (3)	0.46	2.73 (0.43)		2.13 (3)	0.55
Surgical	44	14.50 (2.75)				3.73 (0.58)				2.73 (0.58)			
Ortho	48	15.00 (2.75)				3.63 (0.52)				2.70 (0.52)			
Intensive Care Unit	43	15.00 (2.00)				3.73 (0.60)				2.80 (0.33)			

*Notes: Mann-Whitney U-test was computed for 2 categorical variables; Kruskal-Wallis was computed for more than 2 categorical variables; p<0.05.

of stay (LOS). Most participants were diploma-qualified nurses, which may have limited their level of knowledge. They may not have been exposed to a comprehensive understanding of pressure ulcer prevention strategies during their basic training in a diploma program. Additionally, the lack of of training focusing on pressure ulcer prevention may have further influenced the current level of knowledge. They may have only relied on traditional and outdated practices with a lack of updated information and evidence-based guidelines. Therefore, this finding indicates regular, updated training programs, such as nursing workshops comprising theoretical and practical input to address the knowledge gap. The availability of evidence-based guidelines in printed material or digital form may empower nurses to use pressure ulcer preventive strategies (Kandula, 2025).

It is routine for nurses to conduct patient assessments upon hospital admission, which explains why "Risk assessment" emerged as the domain with the the highest percentage of correct answers. This aligns with nurses' expected responsibility to recognize and address the risk identified to eliminate any potential complication at an early stage of care. In contrast, other studies identified " nutrition " as the most substantial area of knowledge (Kim and Lee, 2019; Halász *et al.*, 2021). Nurses in this study demonstrated a lack of understanding of the importance of good nutrition in preserving skin health and averting pressure ulcers. One probable explanation is the nurses' dependency on dieticians available in the clinical areas to provide dietary advice to patients, which has further hindered the integration of this element of nutrition in nursing practice. Hence, the finding hints at the need for enhanced knowledge describing the essential role of a nutritious diet in maintaining skin integrity and reducing the risk of pressure ulcer incidence. Targeted interventions with comprehensive, up-to-date knowledge in areas like nutrition, organized by healthcare institutions, can be done to improve this area of nursing practice. Ultimately, this effort may result in more holistic care and effective prevention strategies in healthcare settings. More than a quarter of the nurses in the current study possess a negative attitude, while nearly half have a neutral one. Similar findings in Ethiopia and Klang Valley public hospitals indicate a global trend of less favorable attitudes among nurses toward pressure ulcer prevention (Etafa *et al.*, 2018; Azhar *et al.*, 2022). Varied attitudes are observed across different studies, with Finnish nurses showing favorable attitudes in contrast to nurses in this study (Parisod *et al.*, 2022). The neutral attitudes among the nurses in this study may be linked to inadequate training, limited knowledge, and barriers like insufficient resources and specific guidelines. Nurses in this study display a particularly neutral attitude toward mechanical load control. Contrary findings from Durban and other studies indicate variations in attitudes toward factors contributing to pressure ulcer formation and prevention 2,16. Nurses in this study exhibit a negative attitude toward the importance of nutrition in maintaining healthy skin. This contrasts with another finding, where negative attitudes were associated with personal competency rather than nutritional importance (Parisod *et al.*, 2022). Some participants also perceived pressure ulcer prevention as a time-consuming procedure. Similar perceptions were noted in a study among nurses from rehabilitation hospitals (Kaddourah, Abu-Shaheen and Al-Tannir, 2016).

The nurses' pressure ulcer prevention practices in this study were generally at a high level. A similar study in Malaysia reported even higher practice scores among nurses in public hospitals (Sham *et al.*, 2020). In contrast, studies in Ethiopia (Getie *et al.*, 2020) and Kenya (Njau, Mwenda and Njoroge, 2019) recorded moderate scores, showcasing differences in practice levels. Despite the low level of knowledge observed in the current study, nurses demonstrated strong preventative practices. The study identifies "risk assessment" as the dimension that achieved a very high level of practice in pressure ulcer prevention. In comparison, a study in China reported a different result, with the domain "postural change"

reaching the highest mean score in the level of practice among ICU nurses (Zhang *et al.*, 2021). This disparity suggests variations in practice focus across different regions or healthcare settings.

Most nurses in this study demonstrated a strong commitment to thorough risk assessment for pressure ulcer prevention. They consistently used risk assessment scales, documented relevant data, and conducted skin assessments guided by standard nursing care. The dimension of "education programs for family and staff" exhibits the most moderate level of practice in pressure ulcer prevention among nurses in the study. Practice levels varied across different dimensions, with the lowest mean score found in the themes "nutrition for pressure ulcer prevention" and "use of risk instruments" (Zhang *et al.*, 2021). This suggests a global challenge in specific areas of pressure ulcer prevention practices. Despite the lower level of practice in education programs, more than half of the nurses always practice advising patients or caregivers regarding pressure ulcer care before discharge. Nurses recognized the importance of involving patients' relatives in preventative care, acknowledging their significant role, especially post-discharge. The moderate level of practice can be further enhanced to a higher level by recognizing the importance of empowering patients and their family members, including caregivers, in pressure ulcer prevention.

The Relationship between Knowledge, Attitude, and Practice Regarding Pressure Ulcer Prevention

The current finding revealed a weak, but statistically significant relationship between nurses' attitudes and practices regarding pressure ulcer prevention. Similarly, a study in Iran among ICU nurses in educational health centres found a significant positive association between attitudes and practices (Khojastehfar, Najafi Ghezeljeh and Haghani, 2020). The positive relationship between attitude and practice suggests that nurses with a favourable attitude are more likely to have good practices in preventing pressure ulcers. Nurses with good attitudes realize that pressure ulcers are preventable and are committed to engaging with preventative strategies to prevent the incidence of pressure ulcers among the patients they care for. However, a weak, positive, and non-significant relationship between knowledge and both attitude and practice was found in this study. In parallel, the findings from a similar study among nurses at the National Orthopedics Hospital in Enugu, Nigeria (Ingwu *et al.*, 2019), suggested that nurses' practices were not directly influenced by their level of knowledge. However, some studies have reported a significant and positive correlation between knowledge and attitude (Barakat-Johnson *et al.*, 2018; Halász *et al.*, 2021; Nahar *et al.*, 2021), where an increase in knowledge was reported to be associated with a more positive attitude and improved practice. This interesting finding suggests that, regardless of the low level of knowledge among the nurses regarding pressure ulcer prevention, it did not directly affect their attitudes or practices. Heavy workloads, inadequate staffing, or a lack of time to implement preventive measures could be confounding factors that limit knowledge translation into practice. Nurses possess positive attitudes, engage in routine preventive practices, and adhere to basic protocols. Still, factors such as insufficient resources or overwhelming work pressures might deter the complete application of knowledge in preventing pressure ulcers. Thus, it is essential to address these systemic barriers to improve both knowledge application and attitudes towards pressure ulcer prevention.

The Difference Between Knowledge, Attitude, And Practice Across the Demographic Variables

No significant differences were found between gender, clinical working area, or years of experience and the nurses' knowledge of pressure ulcer prevention was found in the current study. The finding parallels the study findings, concluding that nurses' working experience did not significantly affect their knowledge of pressure ulcer prevention (Ebi, Hirko and Mijena, 2019). However, other studies have reported contrasting results, with a significant correlation found between gender and knowledge levels (Qaddumi and Khawaldeh, 2014), as well as a positive influence of years of working experience on knowledge (Nasreen *et al.*, 2017; Malinga and Dlungwane, 2020). The current findings suggest that demographic factors, such as gender and work experience, may not contribute to nurses' knowledge of pressure ulcer prevention. The probable reason is that most nurses may not regularly update their knowledge on pressure ulcer prevention in CPD activities, which can help maintain high levels of knowledge despite their demographic characteristics.

The current study found that nurses' attitudes toward pressure ulcer prevention were not significantly influenced by gender, work experience, or clinical working area. This aligns with a study that found no statistical significance between attitudes and participants' clinical working areas (Malinga and Dlungwane, 2020). However, some studies have indicated that gender can significantly affect attitudes toward pressure ulcer prevention (Etafa *et al.*, 2018; Khojastehfar, Najafi Ghezeljeh and Haghani, 2020), and there is evidence suggesting that work experience can influence attitudes as well (Khojastehfar, Najafi Ghezeljeh and Haghani, 2020). These discrepancies may be attributed to differences in cultural and institutional contexts, and the scope of the training and education programs available to nurses in different settings.

The current findings show no significant differences between demographic attributes and nurses' practices in pressure ulcer prevention. This aligns with a local study that reported non-significant associations between practice scores and demographic variables (Sham *et al.*,

2020). However, other studies have found significant associations between years of working experience and nurses' practices (Nasreen *et al.*, 2017; Nahar *et al.*, 2021). Similarly, nurses' working experience was significantly linked to their practices regarding pressure ulcer prevention in Nigeria (Uba *et al.*, 2015). These discrepancies may reflect differences in work environments and institutional support, suggesting that experience alone may not ensure high-quality practice.

The findings also suggest that external factors, such as staff shortages and heavy workloads, may be significant barriers preventing nurses from consistently applying their knowledge and maintaining best practices for pressure ulcer care. Understaffing and high patient turnover may contribute to a lack of time and resources to properly implement prevention strategies, regardless of their demographic characteristics or years of experience. Addressing these systemic challenges may improve the quality of pressure ulcer prevention practices in clinical settings. A major strength of this study is the use of validated instruments and a high response rate. This enhances generalizability, as nurses share similar training and education in preventing pressure ulcers. However, potential limitations include response bias due to the self-administered questionnaire.

Conclusion

This study evaluated Malaysian nurses' knowledge, attitudes, and practices (KAP) regarding pressure ulcer prevention. The findings revealed a knowledge gap but also highlighted generally favorable attitudes and good preventive practices among nurses. Critical areas for improvement, emphasizing that the positive correlation between attitude and practice underscores the importance of fostering constructive attitudes through targeted, evidence-based training programs.

Sustaining high practice levels and positive attitudes requires ongoing professional development and adherence to updated clinical guidelines. However, systemic barriers, such as staffing shortages, excessive workloads, and limited resources, pose significant challenges to improvement. Addressing these issues is crucial for optimizing patient care and enhancing pressure ulcer prevention efforts.

Further research is needed to explore and mitigate barriers to knowledge acquisition and application, including organizational support, resource availability, and workload management. Additionally, future research is encouraged to use regression-based methods to control potential confounders and identify independent predictors of KAP outcomes. Such investigations will provide deeper insights into improving nursing care standards. In the long-term, these efforts can reduce pressure ulcer incidence, enhance patient safety, and reinforce nurses' pivotal role in delivering high-quality care.

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Availability of data and materials

The data supporting the findings of this study are not publicly available due to the ethical restrictions but may be made available from the corresponding author on reasonable request and with permission from ethical boards.

Authors' contributions

First author, Nordianna Seman: contributed to the original conceptualization of the study, methodology, study supervision, revise and finalize the manuscript writing

Second author, Nasreen: Seek for literatures and works on the data collection and analysis.

Third author, Nur Liyana Nabihah: Seek for literatures, collected data, data analysis and writing the first draft.

Declaration of Interest

The authors declare no potential conflict of interest.

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