Knowledge and Practice Regarding Pressure Injury Prevention among Nurses at King Abdul-Aziz Specialist Hospital

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ABSTRACT

Context: Preventing hospital-acquired pressure injuries (HAPI) poses a significant challenge within tertiary service hospitals. These skin lesions cause discomfort and elevate the risk of severe infections, leading to increased healthcare costs and a high mortality rate due to sepsis. Thus, prevention requires an interdisciplinary approach to care.

Aim: To determine knowledge and practice regarding pressure injury prevention among nurses at King Abdulaziz Specialist Hospital (KAASH).

Methods: A cross-sectional descriptive research design was utilized in the current study. One hundred fifty-two staff nurses who work in inpatient units at KAASH were recruited. The researchers developed the knowledge assessment questionnaire and self-reported practice scale. They were used to assess the nursing staff's knowledge and self-reported practice regarding pressure injury prevention and barriers affecting it.

Results: Out of the 152 participants, most were women (93.4%) and held a bachelor's degree (88.8%). The mean score for nurses' knowledge concerning preventing pressure injuries (PI) was 6.82±1.89 out of 10. Similarly, the mean score for nurses implementing PI prevention practices was 23.48± 2.81 out of 27. A statistically significant relationship was observed between participants' knowledge of PI prevention and their education, experience, source of PI education, and the most recent PI training attended ($p<0.05$). Additionally, a statistically significant association was found between participants' implementation of PI prevention practices and their experience level ($p<0.05$). Furthermore, a significant positive correlation was identified between participants' knowledge and their practices regarding PI prevention ($p<0.05$). The reported barriers to effective PI prevention included a shortage of staff (lack of aids) reported by 85.52% of participants, and inadequate facilities and equipment mentioned by 69.07%.

***Conclusion*:** The results suggest that most nurses possessed a moderate level of knowledge regarding preventing pressure injuries (PI), whereas a significant portion, more than two-thirds of the participants, demonstrated a high degree of commitment to effective PI prevention practices. Developing continuous PI prevention and management training and overcoming barriers to optimal PI prevention practices can be helpful. Finally, monitoring and follow-up are important to ensure the nurses' compliance.

Keywords: Knowledge, practice, pressure injury prevention, nurses

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1. Introduction

The healthcare industry, locally and globally, faces significant challenges in dealing with elderly patients, primarily due to their high acuity levels and multiple health conditions. Additionally, alterations in government-mandated payment incentives have added to these challenges. Among these difficulties, hospital-acquired pressure injuries (HAPI) are a major concern. Patients who develop pressure injuries (PIs) tend to experience longer hospital stays and higher healthcare costs than patients without such injuries *(Lim & Ang, 2017).* Consequently, there has been a growing emphasis on preventing HAPI *(Dreyfus et al., 2018).*

In April *2016*, the *Commission on Patient Safety* provided an estimate indicating that over 2.5 million patients in acute care facilities experienced pressure injuries (PIs), and each year, approximately 60,000 patients succumb to complications related to PIs. PIs were 10.3% in surgical Intensive Care Units (ICUs) and 12.1% in medical ICUs, with severe pressure ulcers (PUs) developing in 3.3% of ICU patients. Another study conducted by *Raynaldo (2020)* reported that 9.8% of ICU patients had pressure ulcers upon admission to the ICU, and during their ICU stay, there was an additional incidence of 7.8%.

The *National Pressure Ulcer Advisory Panel (NPUAP) (2016)* has updated the definition of pressure injury (PI) to include localized damage to the skin and underlying soft tissue, typically occurring over a bony prominence or associated with a medical device. This injury may appear as either unbroken reddened skin or an open, painful ulcer. Such an injury is due to prolonged or intense pressure or a combination of pressure and shear forces. Soft tissue's ability to withstand pressure and shear may also be influenced by factors like microclimate, nutrition, perfusion, underlying health conditions, and the condition of the soft tissue *(Ayello et al., 2017).* In April 2016, the NPUAP substituted the term "pressure ulcer" with "pressure injury" in its Injury Staging System to encompass injuries occurring in intact and ulcerated skin. This system comprises six classes of pressure injury: Grades 1-4, unstageable, and deep tissue injury *(NPUAP, 2016).*

Hospital-acquired pressure injuries (HAPI) are a substantial source of morbidity and mortality and a pressing global health issue. Individuals affected by HAPI often report a diminished quality of life, which can have far-reaching consequences across various aspects of their well-being, including physical, social, psychological, and financial dimensions. Pressure injuries inflict harm by prolonging recovery periods, inducing pain, elevating the risk of infections, impeding mobility, and escalating healthcare expenses for the patient and the healthcare institution *(Grealy & Chaboyer, 2012).*

Furthermore, it is worth noting that HAPI has been documented to extend hospital stays within acute care settings, resulting in significant utilization of healthcare resources and increased costs, as reported by the *National Pressure Ulcer Advisory Panel (NPUAP, 2016).*

In a prospective cohort, investigation carried out in two 24-bed Intensive Care Units (ICUs) within two tertiary care hospitals affiliated with the Ministry of Health in 2013, a total of 84 patients underwent continuous screening until their discharge or demise (with a 30-day limit for censoring). The incidence of hospital-acquired pressure ulcers (PUs) was 39.3% *(Schoonhoven et al., 2002).*

Studies have indicated the potential preventability of pressure injuries. The strategy to prevent these injuries is based on two closely linked areas: Identifying the risk of pressure injuries and taking measures to mitigate this risk. Various risk assessment tools evaluate a patient's susceptibility to developing pressure injuries. These tools encompass the Norton, Waterlow, Braden, and the interRAI Pressure Injury Risk Scale. Recent research does not favor one specific tool over the others *(Raynaldo, 2020).* Interestingly, the Braden and Norton risk assessment tools appear more accurate in predicting pressure injury risk than nurses' clinical judgment *(Pancorbo-Hidalgo et al., 2006).*

A multitude of interventions have been examined, showing varying levels of effectiveness. These interventions should target the risk factors identified through risk assessment and be customized to meet the specific requirements of each patient. Interventions include relieving pressure, utilizing specialized mattresses, applying dressings on bony areas, employing monitoring devices, providing nutritional assistance, and utilizing skin moisturizers. Numerous policies and guidelines are available about preventing and managing pressure injuries *(Al-Otaibi et al., 2019).*

Enhancing patient care involves a nearly universally accepted objective: enhancing nursing practice. The results of these efforts may not always be directly assessable through patient-related metrics. However, they can manifest indirectly through enhanced nursing knowledge and proficient practice. This improvement is vital to delivering top-tier care, which includes effective pressure injury prevention *(Banks, 2012).* Additionally, the prevention and management of pressure injuries significant aspect of this endeavor, needs a multidisciplinary health provider team. However, much literature indicates that nurses are the principal implementers of PI prevention. Thus, nurses must be competent and highly educated to prevent and manage PI *(Dreyfus et al., 2018; Lim & Ang, 2017).*

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2. Significance of the study

Published data concerning pressure ulcer (PU) epidemiology in Saudi Arabia is scarce. Two studies conducted in hospital settings have highlighted a substantial burden of PUs. One systematic review examined the results of a five-year implementation of a newly introduced Pressure Ulcer Prevention Program (PUPP) in a tertiary public hospital in Saudi Arabia starting in 2014. The findings indicated a reduction in hospital-acquired pressure ulcers (HAPUs) from 5 cases per 10,000 inpatients recorded to 2 cases per 10,000 inpatients recorded *(Al Mutairi et al., 2020).*

Another study, a prospective cohort investigation in 2016 at King Abdulaziz Medical City-Jeddah, encompassed six general medical and surgical units with a four-week follow-up period in August. Out of 370 admitted patients screened for pressure injuries (PI), only 21 were identified as having PIs upon admission. This study highlighted the prevalence and incidence of hospital-acquired pressure injuries (HAPI). They were 5.7% and 1.6 ulcers per 1000 patient days, respectively *(Al-Hashemi et al., 2019).*

Given this context, the present research aims to make a valuable contribution by examining nurses' existing knowledge and practices regarding preventing pressure injuries. Therefore, this study aims to assess the level of knowledge and self-reported practices related to pressure injury prevention among nurses at KAASH.

3. Aims of the study

- To determine the knowledge level regarding pressure injury prevention among nurses at KAASH.
- To determine the self-reported practices regarding pressure injury prevention among nurses at KAASH.
- To identify the barriers and factors associated with nurses' practice regarding prevention and management.

4. Subjects & Methods

4.1. Research Design

The present study employed a cross-sectional descriptive research design. A cross-sectional study is an observational approach commonly utilized in medical research and social sciences, where data from a particular population or a representative subset is examined at a specific moment *(Crowder, 2017).* The descriptive design details the characteristics of a situation or phenomenon within the population under investigation *(Heppner et al., 2015).*

4.2. Study setting

The research was conducted at King Abdelaziz Specialist Hospital (KAASH), Taif. KAASH is operated by the MOH and is considered one of the major governmental hospitals in the city. It has a 500-bed capacity across departments that provide tertiary health services to patients inside and outside the city *(Ministry of Nurses (MOH), 2017).* Around 250 nurse professionals work in inpatient and critical areas out of 603. This hospital was selected because it is the major hospital in Taif and is an appropriate location for the researchers.

4.3. Subjects

The target population was nurses who work in ICU, CCU, HDU, Oncology, Female Medical & Surgical, Male Medical & Surgical, and Psychiatric at KAASH and who met the inclusion and exclusion criteria.

A convenience sampling technique was used in the present study to recruit the sample. The sample size was 152 staff nurses calculated from the whole target population electronically by using the Raosoft software, which calculated the sample size with the following inputs: 5.0% margin of error (95.0% confidence level) and 250 staff nurses and based on the next equations *(Raosoft, Inc., 2004).*

$$x = Z(^{c}/_{100})^{2} r(100-r)$$

$$n = {}^{Nx}/_{((N-1)E^{2}+x)}$$

$$E = \mathrm{Sqrt}[{}^{(N-n)x}/_{n(N-1)}]$$

Inclusion criteria: Nurses who work in the units as mentioned above. They have more than six months of work experience and pass the orientation period after recruitment.

Exclusion criteria: Nurses working in other units such as ER, OPD, Dialysis, OR, CCL, Endoscopy, and Optha or the newly recruited nurses.

4.4. Tools of data collection

4.4.1. Self-Administered Questionnaire

The researchers developed the questionnaire based on the existing literature *Dalvand et al. (2018); Tirgari et al. (2018).* It assessed the nursing staff's knowledge and self-reported practice regarding pressure injury prevention and barriers affecting it through 26 questions grouped under three parts. The first part of the questionnaire included (6) questions (open-ended and close-ended questions) about demographic data and additionally related previous pressure injury training (unit, gender, level of education, work experience, source of PI education, last attended training on PI).

The second section pertained to assessing nurses' knowledge regarding pressure injury prevention and consisted of ten statements such as "In bedridden patients' immobility is the most important factor for pressure injury formation," "Only nurses can prevent developing PI," "Pain assessment scale is the risk assessment scale for pressure injury development." The statements were evaluated using a 3-point Likert-type scale. Respondents could choose from three options: "true," "false," or "I do not know."

Scoring system

Each correct response was assigned a score of 1, while incorrect answers and responses of "I do not know" received a score of 0. The highest achievable score on this tool was 10, which was subsequently multiplied by 10 to yield a maximum score of 100. Following this, the scores were categorized as follows:

- Low if the scores were less than 60% (< 6 out of 10)
- Moderate if the scores range from 60 – 80% (6- 8)
- High for scores of 81 % or more (> 8 out of 10)

The third part of the questionnaire was multiple choices, with multiple answers regarding the barriers to PI prevention that the nurses may face during work, such as "What are the barriers that affect the quality of care provided in preventing

pressure injury?" and the nurses were asked to choose from multiple responses such as lack of time, unstable patients, shortage of staff. It is arranged according to the number of participants responding from the higher to the lower perceived barriers.

4.4.2. Self-Reported Practice Scale

The researchers developed the questionnaire based on the existing literature *Hu et al. (2021); Tirgari et al. (2018).* This scale included nine items related to the existing nurses' practice toward PI prevention, such as "I assess the patient's skin and observe the risk factors," "I document all data," and "I assess and provide management of pain." It is a self-reported scale.

Scoring system

A 3-point Likert-type scale rates each item as rarely, sometimes, and always. Rarely was given a "one" score, sometimes was given "two" scores, and always was given "three" scores. The possible range of scores is between 9 to 27. The highest scores indicate better engagement in good PI preventive practices and vice versa. This score was multiplied by ten and divided by 27 to get the result out of 100, then categorized as follows:

- low for scores less than 60% (<16.2 out of 27)
- Moderate for scores ranging from 60 – 80% (16.2- 21.6)
- high for scores of 81 % or more (> 21.87 out of 27)

4.5. Procedures

Following the receipt of authorization to proceed with the research from the Research and Studies Department at Taif's Health Affairs, the researchers convened with the designated contact within the research department. Subsequently, they met with the Nursing Director at KAASH to initiate discussions regarding the study's objectives and to seek her endorsement and cooperation.

Ethical Consideration: Ethics approval was obtained from the KAASH in 2022 for this study. Approvals were also sought from the Director of Health Affairs, and (Human et al. approval from Protecting Human Research Participants Online was completed (PHRP). The key ethical principles highlighted autonomy, informed consent, anonymity, confidentiality, and minimizing harm.

Autonomy and Informed Consent: A fundamental ethical imperative in conducting this research was to uphold participants' autonomy by acquiring informed consent. Individuals taking part in a study must possess comprehensive knowledge about the study's objectives, methodologies, data handling procedures, potential risks, and potential benefits. This crucial information was explicitly outlined in the cover letter distributed by the researchers alongside the questionnaire. Returning the completed questionnaire was regarded as an implicit agreement to participate in the study. The principle of autonomy empowers participants to provide their voluntary agreement, decline participation, or withdraw from the research at any juncture.

Anonymity and confidentiality: Throughout this study, utmost care was taken to uphold confidentiality and anonymity. This commitment was upheld during recruitment, data collection, analysis, and the reporting of findings. Access to the information was restricted solely to the researchers and the statistician. Additionally, participants were explicitly informed that their data would be coded with numerical identifiers to safeguard their confidentiality. Furthermore, under KAASH policy, the data was stored and disposed of appropriately.

In this research, the English version of the questionnaire underwent a content validity assessment conducted by five experienced senior staff nurses with expertise in pressure injury prevention. No modifications were carried out according to the experts' feedback. The total Cronbach's alpha coefficient for the overall scale is 0.794. For the nurses' knowledge regarding pressure injury prevention, Cronbach's alpha is 0.815, while it stands at 0.615 for nurses' practices in pressure injury prevention. These values signify that the questions and their respective scales are reliable for measuring the study's objectives. The techniques employed for measuring variables indicate the extent of stability and consistency exhibited by the questionnaire. It can be considered reliable since it consistently yields the same results each time the factor is measured. This method is applied to assess the questionnaire's overall reliability and the mean of the entire questionnaire.

Data collection was conducted via a questionnaire distributed through a shared link. Head nurses and managers within the WhatsApp group facilitated the distribution of the questionnaire to all participants. A cover letter was included with the questionnaire, offering details about the study's subject, its importance, objectives, advantages, potential risks, the procedure for sharing research outcomes, and the participant's right to opt out.

The average time needed to complete the questionnaire was 10 to 20 minutes, and the participants were asked to fill out the link and send it directly. The questionnaire was completed within two weeks, approximately between (August 15, 2022, to August 29, 2022) with 152 participants.

A pilot study involved 25 participants to verify the questionnaire's reliability. No changes were made to the instrument; therefore, all the pilot study participants were recruited.

4.6. Data analysis

Data analysis used Statistical Package for the Social Sciences (SPSS) version 26. Various statistical techniques were employed to achieve the study's objectives. Descriptive statistics, including frequencies, means, and standard deviations (SD), were utilized to describe the levels of knowledge and practices of participants regarding the prevention of pressure injuries. The responses of participants, including "true," "false," and "I do not know," were presented as frequencies and percentages.

The overall mean score was computed in the knowledge domain, ranging from a minimum of zero to a maximum of 10. Within the practices domain, the mean score for each item was calculated, with possible values ranging from a minimum of 1 to a maximum of 3. The practice domain's total mean score was also determined, with a potential range from 9 to 27.

In the exploration of variations in participants' knowledge and practices based on categorical independent variables with more than two categories (e.g., education), one-way analysis of variance (ANOVA) was employed in cases where categorical independent variables had only two categories (e.g., gender), independent sample t-tests were used to investigate differences in knowledge and practices. Furthermore, Pearson correlation tests examined the relationship between knowledge and practices.

5. Results

Figure 1 illustrates the gender distribution among the study participants (n=152). It shows that 142(93.4%) of participants are females, while 10(6.6%) are males.

Figure 2 illustrates the sample distribution according to participants' education. It shows that participants with bachelor's degrees constitute 135(88.8%) of the study sample, and those with master's degrees or more constitute 9(5.9%). Those with diplomas constitute 8(5.3%) of the study sample.

Figure 3 illustrates the participants' years of experience; those who have 1-5 years of experience constitute 59(38.8%) of the participants, those who have 6-10 years constitute 51(33.6%) of the study sample, and 22(14.5%) have above ten years of experience, while the lowest number of the nurses who participated in this study were 20(13.2%) were below one year.

Table 1 shows that the source of PI education for more than half (55.9%) of participants is a university. The source of PI education for 35.5% of them is in-service education. In comparison, the source of PI education for 3.9% of them is conferences. Additionally, 53.3% of the studied nurses attended PI training for less than one year, and 24.3% attended PI training for 1-2 years.

Table 2 shows the frequency and percentage of true and false answers for each item in the knowledge domain about PI prevention. The total mean score of nurses' knowledge about PI prevention is 6.82±1.89 out of 10. The table shows that 84.2% of nurses answered "Only nurses can prevent developing PI" correctly, while 15.8% answered incorrectly. In addition, 80.9% of nurses answered "Air mattress can prevent developing PI without positioning" correctly, while 19.1% answered incorrectly. Also, 78.9% of the studied nurses answered correctly, "Pain assessment scale is the risk assessment scale for pressure injury development," and 75.7% answered correctly, "In bedridden patients' immobility is the most important factor for pressure injury formation." Besides, 75% of them answered correctly, "Partial skin loss with a blister is the correct answer for the sign of stage 3 pressure injury."

In contrast, 75.7% of the studied nurses answered incorrectly, "Cleansing soil and using skin barrier cream activity is appropriate for preventing maceration," and 44.7% answered incorrectly, "There are more than three positions that can usually be used when repositioning a patient." Besides, 30.3% of the nurses answered incorrectly, "Use a pillow under the patient's leg to prevent heel injury."

Figure 4 illustrates that 91(59.9%) of participants had a moderate knowledge level about PI prevention, 31(20.4%) of them had a high knowledge level, and 30(19.7%) had a low knowledge level.

Table 3 shows the highest percentage of nurses' engagement in PI preventive practice; 81.6% of nurses choose always for "I document all data." At the same time, the lowest practice among the studied nurses (21.1%) chose always for "I use water-filled gloves under the patient's leg." Also, shows that the mean score of documentation of all data is 2.81, and the mean score for the patient's skin assessment and risk factors observation is 2.79. The average score for assessing and managing pain and incorporating routine skincare tasks is 2.78. Conversely, the average score for utilizing a water-filled glove under the patient's leg is 1.91 out of three. Considering all aspects of nurses' practices related to pressure injury prevention, the overall mean score is 23.48± 2.81 out of a possible 27.

Figure 5 illustrates that over three-fourths, 120(78.94 %) of participants have a high level of engagement in good PI prevention practices. In comparison, 32(21.05%) of them have a moderate level of engagement in good PI prevention practices.

Table 4 analyzes the association between nurses' knowledge and their demographic characteristics. It reveals that there is no statistically significant relationship between the mean knowledge scores regarding pressure injury (PI) prevention based on gender ($p>0.05$). However, statistically significant associations were found in the mean knowledge scores concerning PI prevention regarding education, experience, the source of PI education, and the last time they attended PI training ($p<0.05$).

A Tukey post hoc test further clarified these findings. Specifically, it reveals a statistically significant relationship between nurses with a diploma and those with a master's degree, favoring those with a master's degree. This finding indicates that nurses holding a master's degree exhibit significantly higher levels of knowledge about PI prevention.

Similarly, a significant relationship was observed between mean knowledge scores based on nurses' years of experience ($p<0.05$). The Tukey post hoc test within this context highlighted a significant difference between participants with less than one year of experience and those with over ten years of experience, favoring the latter. This finding implies that nurses with over ten years of experience possess significantly higher knowledge levels regarding PI prevention.

Moreover, the source of PI education also displayed a statistically significant relationship with mean knowledge scores ($p<0.05$). The Tukey post hoc test clarified this by indicating a significant difference between participants educated at a university and those from other educational sources, favoring the latter. Nurses whose PI knowledge was derived from "other" sources exhibited significantly higher knowledge about PI prevention.

Lastly, a statistically significant relationship exists in knowledge scores regarding the last time nurses attended PI training ($p<0.05$). The Tukey post hoc test indicated a significant difference between participants who attended training within less than one year and those who had never attended training, favoring those who attended training more than two years ago. This finding suggests that nurses who

attended training sessions over two years ago possess significantly higher knowledge about PI prevention.

Table 5 shows no statistically significant relation in the mean score of participants' practices about PI prevention concerning their gender, education, source of education, and last time they attended PI training ($p>0.05$). In contrast, there exists a statistically significant association in the mean score of participants' practices regarding pressure injury (PI) prevention concerning their level of experience ($p<0.05$). Tukey post hoc test showed that the statistically significant relation is between participants who have experience below one year and participants who have experience more than ten years in favor of participants who have experience from 6-10 years. This finding means that nurses with experience from 6-10 years have a significantly higher level of practice in PI prevention.

Figure 6 illustrates a statistically significant positive correlation between participants' knowledge and their self-reported practices concerning PI prevention ($r=0.387$, $p<0.05$). This finding signifies that as participants' knowledge about PI prevention increases, their reported practices for preventing PI also increase.

Table 6 The table shows the most common barriers to implementing pressure injury prevention practices. They were a shortage of staff (85.52%), followed by inadequate facilities and equipment (69.07%), followed by lack of time (56.57%). On the other hand, the least common barrier is forgetting (14.47%), and 18.42% reported that lack of support and monitoring from heads and managers are also barriers.

6. Discussion

Nurses must have the appropriate knowledge, competencies, and critical thinking functionality throughout providing professional and effective care. Because of this, and based on their background knowledge, they can determine which patients should have preventative procedures and which should undergo preventive precautions. The range of knowledge nurses possess regarding pressure ulcer prevention is directly linked to the quality of care they deliver and the duration of patients' hospital stays. Conversely, a deficiency in nurses' knowledge or a failure to put that knowledge into practice can contribute to the occurrence of pressure ulcers and might exacerbate existing ones *(Lima-Serrano et al., 2018)*. This study aims to determine knowledge and practice regarding pressure injury prevention among King Abdulaziz Specialist Hospital (KAASH) nurses.

Regarding nurses' levels of knowledge in pressure injury (PI) prevention, the findings from this study reveal that more than half of them possess a moderate level of knowledge, approximately one-fifth of them have a high level of knowledge, and another one-fifth have a low level of knowledge with a mean score of 6.82±1.89 out of 10. This distribution may be attributed to factors like heavy workloads and a shortage of staff, which can impact their ability to participate in regularly conducted PI prevention programs at the hospital.

A similar cross-sectional, descriptive study conducted by *Aydın et al. (2019)* included 347 nurses who attended the 2013 and 2015 Wound Management Congresses. Their study found that the average score for knowledge and practices related to pressure injuries was 57.37±14.26 out of 100 points. Interestingly, *Li et al. (2023)* conducted a clinical trial involving 950 critical care nurses recruited from 15 hospitals across six provinces in China to assess the knowledge, attitudes, and practices of pressure injury prevention among Chinese critical care nurses. Notably, the results of their study closely mirrored the findings of this study concerning knowledge about pressure injury prevention, with an average score of 6.27±1.37 out of 9 points (69.6%±15.2%).

Numerous research studies have employed the validated "Pressure Ulcer Knowledge Test Tool (PUKT)," originally developed by *Beeckman et al. (2010)*. The findings displayed that the knowledge means score among 212 Ethiopian nurses was 11.31±5.97 (43.5%) out of 26, with 91.5% having inadequate knowledge of pressure injury prevention *(Ebi et al., 2019)*, and among 89 Iranian critical care nurses was 11.61±3.32 out of 26 (44.65%) *(Tirgari et al., 2018)*. Moreover, a study involving 282 Korean nurses revealed" a moderate level of knowledge regarding pressure ulcer prevention among 60.1% of total nurses *(Kim & Lee, 2019)*. In contrast, another study with 1,806 Chinese nurses reported a higher mean score for pressure injury prevention knowledge, averaging 77.45% (31.76±2.58 out of 41), and found that 58.3% of participants possessed sufficient knowledge in PI prevention *(Jiang et al., 2020)*.

Among studies that employed the Pressure Ulcer Prevention Knowledge Assessment Tool (PUPKAT), one involving 510 Chinese ICU nurses disclosed that the mean knowledge scores were 65.82±9.29 out of 100%. Interestingly, only 5.1% of the participants exhibited adequate pressure injury prevention knowledge, scoring 80 out of 100 *(Hu et al., 2021)*. Moreover, 406 Turkish nurses had 11.80±3.28 out of 26, with 9.4% of participants having sufficient PUPKAT scores (score <16; 60%) *(Dirgar et al., 2022)*. Similarly, *Aydogan and Caliskan (2019)* reported that 390 Turkish ICU nurses had 11.54±2.91 (44.3%) out of 26, with 5.9% having sufficient PUPKAT scores (≥60%). All the findings, whether they were categorized as inadequate or moderate, might be attributed to variations in sample size, geographical regions, and the chosen threshold for defining satisfactory knowledge. Additionally, the differences could be linked to variances in nurses' educational backgrounds, professional experience, and other unidentified factors associated with the study settings.

However, the results highlight that most nurses strongly commit to pressure injury (PI) prevention practices. This finding could be attributed to the increased emphasis on PI prevention within nursing departments in Saudi Arabia in recent years. Notably, healthcare authorities have established an online reporting system where hospital managers regularly report data on HAPI (Hospital-Acquired Pressure Injury) incidents. This platform allows for comparing hospital data using standard national and international benchmarks. Pressure injuries are considered a crucial nursing quality indicator, and their assessment is mandated in each department before data reporting occurs.

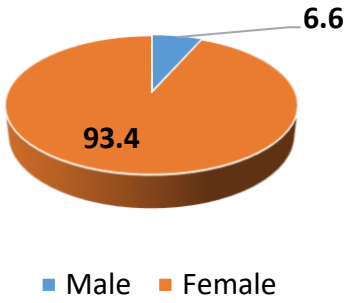

Figure (1): Percentage distribution of participants' gender (n = 152).

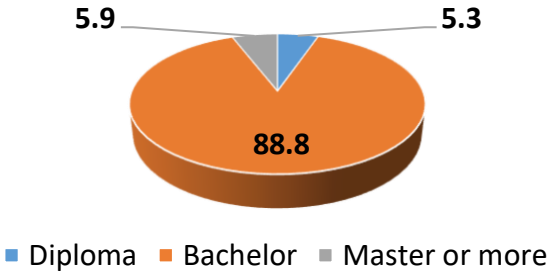

Figure (2): Percentage distribution of participants' education (n = 152).

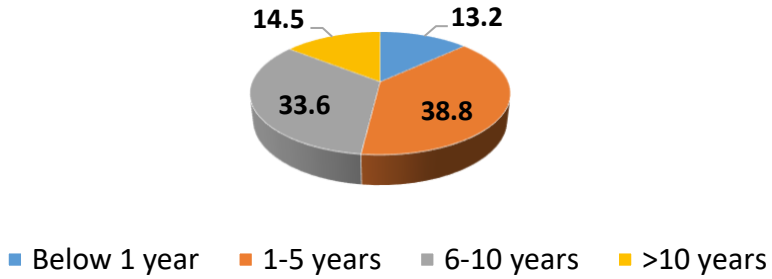

Figure (3): Percentage distribution of participants' gender (n = 152).

Table (1): Frequency and percentage distribution of studied nurses' PI education and training (n= 152).

Variables	Number	Percentage (%)
Source of PI Education		
In-service education	54	35.5
University	85	55.9
Conference	6	3.9
Others	7	4.6
Last time attended PI training		
Less than one year	81	53.3
1-2 years	37	24.3
More than two years	22	14.5
Never	12	7.9

Tables (2): Frequency and percentage distribution of nurses' knowledge regarding pressure injury prevention (n=152).

Item	True		False, I do not know	
	No.	%	No.	%
In bedridden patients' immobility is the most important factor for pressure injury formation	115	75.7	37	24.3
Only nurses can prevent the development of PI	128	84.2	24	15.8
The pain assessment scale is the risk assessment scale for pressure injury development	120	78.9	32	21.1
Partial skin loss with a blister is the correct answer for the sign of stage 3 pressure injury	114	75.0	38	25.0
There are more than three positions can usually be used when repositioning a patient	84	55.3	68	44.7
Topical cream only is the appropriate method for skin care	108	71.1	44	28.9
An air mattress can prevent developing PI without positioning	123	80.9	29	19.1
Cleansing soil and using skin barrier cream activity is appropriate for preventing maceration	37	24.3	115	75.7
Use a pillow under the patient's leg to prevent heel injury	106	69.7	46	30.3
High protein and high calories need to be offered to a bedridden patient who has a BMI < 18.5	102	67.1	50	32.9
Total Mean± SD (Range)	6.82± 1.89 (0-10)			

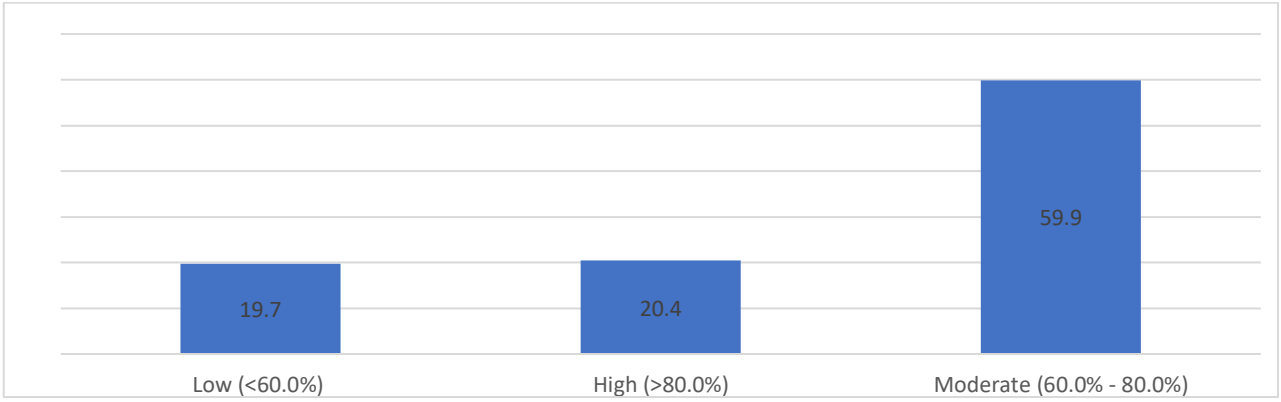

Figure (4): Percentage distribution of participants' total knowledge about PI prevention (n= 152).

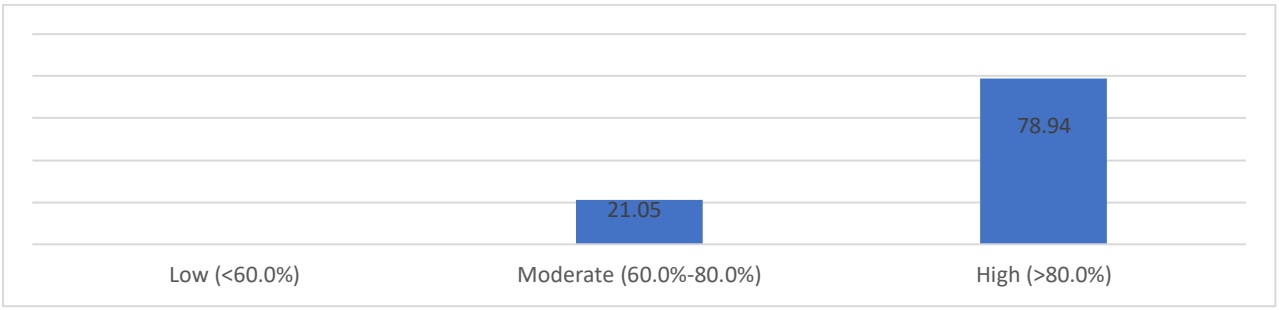

Figure (5): Percentage distribution of participants' total reported practice in PI prevention (n= 152).

Table (3): Nurses' practices regarding pressure injury prevention (n= 152).

Item	Always		Sometimes		Rarely		Mean±SD
	No.	%	No.	%	No.	%	
I assess the patient's skin and observe the risk factors	121	79.6	31	20.4	0	0	2.79±0.40
I document all data	124	81.6	28	18.4	0	0	2.81±0.38
I assess and provide management of pain	120	78.9	32	21.1	0	0	2.78±0.40
I perform skin care as a routine work	120	78.9	31	20.4	1	0.7	2.78±0.42
I used water filled glove under the patient's leg	32	21.1	75	49.3	45	29.6	1.91±0.70
I use or advise caregivers to use creams or oils	58	38.2	82	53.9	12	7.9	2.30±0.60
I pay more attention to pressure points	119	78.3	32	21.1	1	0.7	2.77±0.43
I turn a patient position every two hours	100	65.8	51	33.6	1	0.7	2.65±0.49
I Advise the patient or caregiver	104	68.4	43	28.3	5	3.3	2.65±0.54
Total Mean± SD (Range)	23.48± 2.81 (9-27)						

Table (4): Association between nurses' knowledge regarding PI prevention and demographic characteristics (n = 152).

Nurses' knowledge	Mean±SD	t/f statistics	p-value*
Gender			
Male	59.00±29.60	-1.604 (150)	0.111[a]
Female	68.87±17.90		
Education			
Diploma	55.00±30.70	3.198 (2, 149)	0.044[b]
Bachelor	68.37±17.83		
Master	77.77±17.87		
Experience			
Below one year	53.00±12.18	5.568 (3, 148)	0.001[b]
1-5 years	69.49±18.60		
6-10	70.98±21.00		
>10 years	72.27±13.06		
Source of PI Education			
In-service education	72.59±16.95	2.674 (3, 148)	0.049[b]
University	64.47±20.38		
Conference	73.33±12.11		
Others	75.71±7.86		
Last time attended PI training			
Less than one year	70.98±17.57	6.786 (3, 148)	0.000[b]
1-2 years	67.02±15.78		
More than two years	71.81±19.18		
Never	46.66±23.48		

**a: an independent sample t-test, b: One-Way ANOVA*

Table (5): Association between nurses' practices regarding PI prevention and demographic characteristics (n = 152).

Nurses' practices	Mean±SD	t/f statistics	p-value*
Gender			
Male	23.70±3.02	0.254 (150)	0.800[a]
Female	23.46±2.81		
Education			
Diploma	24.62±1.92	0.698 (2, 149)	0.499[b]
Bachelor	23.42±2.87		
Master	23.33±2.64		
Experience			
Below one year	19.45±2.41	22.940 (3, 148)	0.000*[b]
1-5 years	24.15±2.58		
6-10	24.23±2.13		
>10 years	23.59±2.10		
Source of PI Education			
In-service education	24.07±1.94	2.167 (3, 148)	0.094[b]
University	22.98±3.30		
Conference	23.66±2.33		
Others	24.71±1.11		
Last time attended PI training			
Less than one year	23.82±2.70	0.955 (3, 148)	0.416[b]
1-2 years	22.94±3.23		
More than two years	23.31±2.43		
Never	23.08±2.84		

**a: an independent sample t-test, b: One-Way ANOVA*

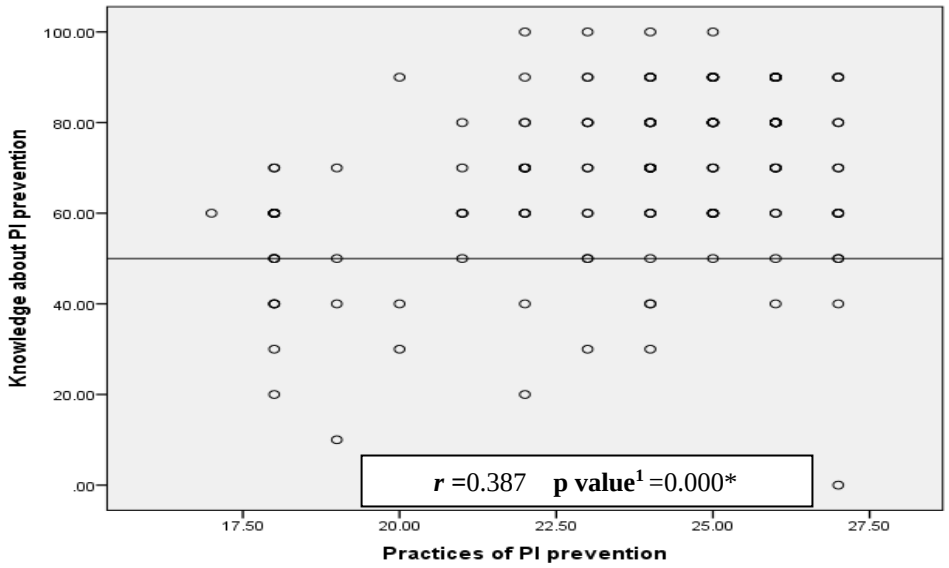

Figure (6): Spearman rho correlation between nurses' PI knowledge and self-reported preventive practices (n = 152).

Table (6): Frequency and percentage distribution of barriers to preventing pressure injury (n = 152).

Barrier	Frequency	%
Lack of time	86	56.57
Unstable patient	76	50.0
Lack of training resources	45	29.60
Shortage of staff (lack of aids)	130	85.52
Inadequate facilities and equipment	105	69.07
I Forget to do	22	14.47
Lack of Support monitoring from head managers	28	18.42

The results aligned with a study conducted in China by *Jiang et al. (2020),* where they found that more than two-thirds of nurses (n=1,806), 78.2%, exhibited commendable pressure injury (PI) prevention practices. This finding closely resembled a prior study by *Hu et al. (2021),* who reported that most participants (68.80%) indicated proficient PI prevention practices.

Regarding the association between nurses' knowledge of pressure injury (PI) prevention and participant demographic factors, the findings reveal a statistically significant correlation in the mean knowledge scores based on education ($p<0.05$). As the level of education increased, there was a corresponding increase in the nurses' mean knowledge scores. This finding suggests that nurses with master's degrees possess significantly higher knowledge about PI prevention than those who have completed diploma programs. Several factors may contribute to this observation. Nurses with master's degrees often receive more focused education, especially in subjects related to geriatric nursing care or critical care. Additionally, nurses with master's degrees typically have lighter workloads, which may allow them to engage more effectively in PI prevention education programs. This finding aligns with the outcomes of several other studies, including those by *Köse and colleagues (2016), Aydın et al. (2019), Jiang et al. (2020), Awoke et al. (2022), and Li et al. (2023),* which all found that nurses with bachelor's degrees had higher mean scores compared to nurses who completed associate degree programs.

Concerning the statistically significant association in the mean knowledge scores of participants concerning the last time they attended pressure injury (PI) training ($p<0.05$), it becomes evident that nurses who underwent training more than two years ago possessed notably higher levels of knowledge about PI prevention. This phenomenon could be attributed to their accumulated experience, as they may have encountered numerous cases of patients with PI and have been exposed to multiple PI prevention education programs. This discovery aligns with the outcomes reported by *Tirgari et al. (2018), Ebi et al. (2019), and Aydın et al. (2019),* all of whom found that nurses who had undergone training in PI prevention exhibited higher levels of knowledge in comparison to those who had not received such training. This finding underscores the importance of continuous education and in-service training in PI prevention. Conversely, *Jiang et al. (2020) and Hu et al. (2021)* discovered no statistically significant correlation between knowledge scores related to PI prevention and prior training attendance.

Moreover, there exists a statistically significant association between the mean practice scores of participants in pressure injury (PI) prevention and their years of professional experience ($p<0.05$). The findings reveal that nurses with 6-10 years of experience, 1-5 years of experience, and over ten years of experience demonstrate significantly higher levels of competence in PI prevention compared to those with less than one year of experience. Nurses with more extensive years of experience tend to exhibit greater confidence and proficiency, distinguishing them from their less experienced peers.

A dedicated wound management unit and a PI improvement project have been established in the current hospital setting, prioritizing ongoing nursing education. Longer years of experience offer nurses more opportunities to partake in PI prevention training, which may enhance their adherence to PI prevention practices. A comparable result was documented in a study by *Jiang et al. (2020),* where the duration of service and the number of PI prevention training sessions attended were identified as factors that influenced nurses' behaviors in PI prevention. Remarkably, individuals with over five years of service and more than five years of work experience demonstrated the highest scores in terms of their behaviors. This finding implies that cumulative training can progressively improve nurses' practices and enhance their ability to prevent PIs over time.

However, it is worth noting that some studies, such as those by *Hu et al. (2021)* and *Lotfi et al. (2019),* reported no statistically significant relationship in practice scores among nurses based on their years of experience. Additionally, *Li et al. (2017)* in China posited that longer service experience could lead to nurse burnout, negatively impacting their behaviors and overlooking issues related to nurses' empathy and psychological well-being.

Regarding the statistically significant positive correlation observed between participants' knowledge and their self-reported practices in pressure injury (PI) prevention, it becomes evident that as participants' knowledge about PI prevention increases, their engagement in preventive practices for PI also increases.

This finding highlights the importance of conducting a continuous education program regarding PI prevention. This finding was similar and in agreement with a study conducted by *Tesfa Mengist et al. (2022).* Nurses with inadequate knowledge of pressure injury (PI) prevention were 51% less likely to exhibit proficient PI prevention practices than nurses with a strong knowledge base in this area.

On the other hand, most of the nurses who participated in this study cited that the first and top barriers are staff shortages (lack of aids). In contrast, inadequate facilities and equipment were ranked second barriers. Shortage of staff and facilities results in work overloads, difficulty in carrying out unaided, and barriers to implementing effective care practices related to PI prevention. These findings agree with *Etafa et al. (2018)* study's findings that a lack of staff and equipment was the main barrier to PI prevention.

Lastly, forgetting to implement the practice of prevention of PI and lack of support and monitoring from head nurses and managers were the lowest barriers cited. Based on that, it is clear that nurses who participated in this study feel the importance of applying PI prevention. They are working towards achieving their goal and can integrate various roles with the help and support of team structures as head nurses and managers. These findings agree with those of *Lavallée et al. (2018),* who found the same result.

7. Conclusion

In conclusion, the study's findings reveal that approximately two-thirds of the participating nurses

demonstrated moderate knowledge regarding pressure injury (PI) prevention. However, these nurses were highly committed to implementing effective PI prevention practices. Given the significant correlation between knowledge and practice, nursing administrators must establish ongoing PI prevention and management training initiatives to enhance nurses' knowledge, subsequently translating into improved practices.

Staff shortages (lack of aides) and inadequate facilities and equipment were the most frequently cited barriers to effective PI prevention. These findings offer valuable insights to decision-makers and authorities, suggesting the need to formulate strategies for mitigating and addressing these barriers effectively.

Ultimately, diligent monitoring and follow-up procedures are essential to ensure nurses' adherence to PI prevention protocols.

8. Recommendations

The results of this study contribute to several recommendations, including:

Recommendations for administration

- Provide administrative support and enhance nurses' development level in preventing PI and wound management through creating a positive work environment, encouraging staff to participate in education and training courses related to PI prevention and management.
- Develop multidisciplinary forms related to the PI management team, including P: physicians, A: assistance of patient care (social workers and health education), N: nurses, D: dietitians, and P: physiotherapists (PANDP team).
- Motivate and orient all PANDP team to know the roles expected to play with PI and high-risk patients.
- Listening to the staff nurses and providing material and supplies needed for PI management.
- Review and revise the policy in the light of the research outcomes.
- Boosting more funds and resources for PI to facilitate the prevention and management.
- Establishing PI committee and counseling unit per month.

Recommendations for education and training:

- Provide effective and updated continuous education programs for nursing staff.
- Integrate PI management and prevention in the quality talk and unit-based lectures.
- Distribute brochures and electronic links through barcodes to access PI prevention information easily.
- Regular staff monitoring by managers and the head nurses ensures the quality of conducting PI assessment and management in each department.
- Conducting periodic lectures and workshops by the wound management unit in cooperation with the educational department.
- Create a specific link in the KAASH policy to add all needed information, latest research, and evidence, including video lectures, and the link will be accessible to all departments to benefit from it.
- Create videos targeting relatives and nurses for educational purposes.

Recommendations for practice and skills:

- Develop and incorporate core PI prevention and management competency to ensure nurses acquire standardized knowledge and skills.
- Using advanced dressing is recommended by the wound management team instead of traditional dressing.

Recommendations for future research:

- Future research needs to examine the effect of PI prevention education programs in increasing knowledge and practice regarding PI prevention.

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