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# Intensive care nurses' knowledge of pressure injury prevention

Ntombifikile Klaas[1*] and Ricki-Lee Serebro[1]

## Abstract

**Background** Pressure injuries (PIs) remain a significant public health concern due to their high prevalence among critically ill patients admitted to intensive care units (ICUs). Despite advancements in science and technology related to PI prevention, the prevalence continues to rise. A key factor contributing to this rise is inadequate knowledge and limited use of evidence-based practices by nurses, resulting in prolonged hospital stays and poor patient outcomes. This study aimed to determine the knowledge of intensive care nurses regarding pressure injury prevention.

**Methods** A descriptive cross-sectional design was used to collect data from 101 nurses working in four ICUs at an academic hospital in Gauteng Province, South Africa. The revised Pressure Ulcer Knowledge Assessment Tool (PUKAT 2.0) was utilized to gather data from a convenience sample of intensive care nurses. Descriptive and inferential statistics were employed to analyze the data, with statistical tests including the Shapiro-Wilk test, univariate and multivariate linear regression, and Cronbach's alpha coefficient tests. A ***p***-value of less than 0.05 was considered statistically significant.

**Results** The mean knowledge score of the nurses (***N*** = 101) was 42.16% (SD 12.09), indicating poor knowledge of PI prevention. The lowest scores were observed in the areas of "prevention of pressure injuries" (25%) and "classification and observation" (39.5%). Higher levels of education (14.00; 95% CI 2.90–25.11; ***p*** = 0.014), seniority (15.58; 95% CI 2.92–28.24; ***p*** = 0.016), and years of experience (6.38; 95% CI 9.70–5.45; ***p*** = 0.039) were statistically significant predictors of better prevention and management of PI.

**Conclusion** The findings of this study demonstrate that intensive care nurses have poor knowledge of prevention measures, classification, and observation of stages. This may hinder their ability to effectively utilize risk assessment tools in clinical practice. Improving training and providing intensive care nurses with adequate information about evidence-based practices to prevent PI could strengthen their contribution to patient safety. These findings underscore the need for continuous, mandatory training programs for intensive care nurses to stay updated with the latest evidence and practices in PI prevention.

**Keywords** Pressure injury, Prevention, Knowledge, Intensive care unit, Nursing

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## Background

Pressure injuries (PIs) continue to be a major public health concern due to their high prevalence in critically ill patients admitted in the intensive care units (ICUs). There has been an increase in the prevalence of PIs internationally despite the current scientific and technological advancements in PI prevention. The international incidence rates for patients with PIs range from 8 to 40% for acute care settings [1, 2]. A meta-analysis on the global prevalence of PI suggested 12.8%, with a hospital-acquired pressure injury incidence of 8.4% [3]. This makes PIs a major difficult-to-treat health problem, which is often expensive and complex.

Critically ill patients in the ICU have a higher likelihood of developing PIs compared to those in other healthcare settings [4, 5]. According to the findings of an Australian study, ICU patients are 3.8 times more likely to develop a PI than patients in general wards [6]. Factors such as severe illness, comorbidities, limited mobility, prolonged bed rest are among the factors that increase the risk of PIs in this patient group [7].

Intensive care nurses play a vital role in implementing PI prevention practices in ICU settings, as these practices are a fundamental nursing responsibility. However, various factors make prevention in ICUs challenging. Findings of a systematic review on nursing interventions for PI prevention among critically ill patients highlighted that access to highly skilled nurses with expertise in PIs is linked to increased implementation of preventive measures and the development of best practices [8].

Despite the National Pressure Ulcer Advisory Panel (NPUAP) providing numerous protocols, guidelines, and educational materials on PI prevention, pressure injuries remain a persistent issue in hospitals [9]. Although these guidelines were developed to promote consistent, evidence-based care using the latest knowledge, they have not been widely implemented in ICUs globally [10–12]. International literature indicates that nurses' knowledge of PI prevention is generally poor [13–16].

The findings of a Sweden study on nurses' knowledge and practice of existing guidelines on prevention of PIs found that most nurses lacked sufficient knowledge and practice in implementing PI prevention guidelines [17]. Similarly, research from Belgium revealed inadequate knowledge among nurses about PI prevention [18]. Similarly, a South African study reported unsatisfactory knowledge and practices [19].

A systematic review on nurses' knowledge of PI prevention echoed these findings, showing consistently poor knowledge regardless of geographic location [20]. Key barriers to implementing PI prevention guidelines include knowledge deficits, negative attitudes, poor staffing, time and resource constraints [21].

Comprehensive knowledge of pressure injuries, including risk factors, prevention strategies, staging, and treatment, is crucial to prevent PIs and their associated complications [22]. Nurses need updated knowledge to identify at-risk patients, apply effective preventative methods, and evaluate gaps in their knowledge and practices related to PI prevention [23, 24].

This study contributes new insights into pressure injury prevention by examining it from the unique perspective of the South African intensive care nurses. Although global studies recognize the importance of PI prevention and have identified knowledge gaps and training challenges, this study highlights specific factors within the South African context. South Africa has unique patient demographics, resource constraints, and access disparities in specialized training for PI prevention. By revealing how these variables influence nurses' knowledge and practices, the study provides critical guidance for designing targeted interventions tailored to resource-constrained healthcare settings and emphasizing the need for development of context-specific strategies in PI prevention.

### Aim

This study aimed to determine the knowledge of intensive care nurses regarding PI prevention.

### Research question

What is the knowledge of intensive care nurses regarding PI prevention?

## Methods

### Design

A descriptive cross-sectional design was used in this study [25].

### Study setting

Data were collected from four ICUs of an academic hospital in Gauteng province, South Africa. These ICUs included multidisciplinary, trauma, neurosurgical and cardiothoracic ICU. The severity of illness and length of stay of the critically ill patients are similar in these four units. On average, six to seven patients in the multidisciplinary and neurosurgical ICUs develop pressure injuries every month compared to two to four patients in the trauma and cardiothoracic ICUs. The Waterlow scale is the risk assessment tool used at the study setting.

### Population, sample and sampling

The accessible population comprised all registered nurses working in ICU at the study setting. At the time of the study, there were approximately 135 nurses practising in these units. We included registered nurses who provided direct care for adult patients and have worked for a

minimum of six months in ICU. A convenience sample of 101 was calculated by using Raosoft sample size calculator, [26] after setting the indicator percentage at 0.50, the margin of error at 5%, and the confidence interval at 95%.

### Instrument

A modified version of the Pressure Ulcer Knowledge Assessment Tool (PUKAT) version 2.0 was used to achieve the study objectives. The PUKAT version 2.0 is a self-administered questionnaire developed initially in 2010 [18] and revised in 2017 [23]. It is the most up-to-date knowledge assessment tool on PI prevention. All items of the tool were formulated according to the most recent evidence-based guidelines. Cases and pictures were added to evaluate theoretical knowledge and practical knowledge [23].

The questionnaire consists of two sections. The first section contained six questions assessing the demographic data: gender, age, the highest level of education, ICU experience, current position and type of ICU. The second section consists of 25 multiple choice questions divided into six themes. The themes include "aetiology", "classification and observation", "risk assessment", "nutrition", "prevention of pressure ulcers" and "specific patient groups". The correct answer was scored one while the wrong answer and "I do not know" answers were scored zero, with a possible range between 0 and 25. A score of 15/25 (60%) indicates adequate knowledge of PI prevention [27].

For each of the themes in the questionnaire, a Cronbach alpha coefficient was calculated to measure the internal consistency of each of the items that make up each theme. The Cronbach alpha coefficients show that there was very poor (Cronbach alpha coefficient < 0.50) consistency in any of the themes in the PUKAT 2.0 questionnaire responses by the respondents [28]. Table 1 summarizes this information.

The PUKAT 2.0 has been reported to have valid and reliable psychometric properties with an intraclass correlation coefficient of 0.69 and an average item difficulty of 0.56 [23]. The questionnaire was subjected to face and content validity by five experts who had more than ten years of experience in the field (3) and were critical care educators (2) and members of the Critical Care Society of South Africa (CCSSA). The wording of three items was modified based on feedback from the expert panel. No items were added or removed. A pilot test was conducted on 5 participants, no challenges were encountered and no changes needed to be made. The results of the pilot test were included in the main study.

**Table 1** Internal consistency of the items in the PUKAT

| Themes | Cronbach alpha coefficient |
|---|---|
| Theme One: Etiology and development | 0.26 |
| Theme Two: Classification and observation | 0.31 |
| Theme Three: Risk assessment | 0.24 |
| Theme Four: Nutrition | 0.11 |
| Theme Five: Preventative measures to reduce the amount of pressure | 0.27 |
| Theme Six: Specific patient groups | 0.14 |

### Ethical considerations

Ethical clearance from the University of Witwatersrand's Human Research Ethics Committee (**M200364**) and permission to conduct the study was obtained from the provincial health directorate, hospital management and the respective operational managers. Written informed consent was obtained from all participants prior to their involvement in the study. The participants were provided with detailed information regarding the purpose of the study, procedures involved, potential risks and benefits, and their right to withdraw at any time without consequence. This information was communicated both verbally and in writing. No form of personal identification was incorporated into the study; therefore, confidentiality and anonymity of the respondents were guaranteed.

### Data collection

Data collection commenced after receiving ethical clearance and permissions from the study settings. The researcher visited the four ICUs, and nurses with characteristics incorporated in the inclusion criteria were chosen. Permission to give a brief presentation about the study at the beginning of each shift was obtained from the operational managers. The potential participants were assured that the study is voluntary, and they must not feel obligated to participate. The nurses, once verbally consented, were given the survey. The researcher remained in the vicinity while the survey was being completed to assist in any questions from the participants.

Data collection commenced from September to December 2020. The ICUs were visited two to three times a week. The questionnaires were handed out in the mornings and collected from the participants in the late afternoons for day shifts, and for night shifts, the surveys were handed out in the early evening and were collected the following day. More time was given to those who needed it. Once the surveys were collected, the researcher coded the questionnaires to maintain anonymity. The questionnaires were then put in a sealed box and kept under lock and key.

### Data analysis

Data was analysed using descriptive and inferential statistical using the Shapiro Wilk test, univariate and multivariate linear regression and Cronbach alpha coefficient

tests. Percentages: categorical variables were described as frequencies and percentages; continuous variables, such as years of experience, were assessed for normality using the Shapiro Wilk test.

Normally distributed continuous variables were described as means and standard deviations (SD), and skewed variables were described as medians and interquartile ranges (IQR). A total score on knowledge of pressure injury prevention was calculated by adding the number of correct responses of the 25 questions asked and calculating a percentage. For each of the themes in the questionnaire, a Cronbach alpha coefficient was calculated to measure the internal consistency of each of the items that make up each theme. For each of the scores in each theme, a Shapiro Wilk test was used to determine the distribution of the scores. A Shapiro Wilk $p$-value of above 0.05 indicated that the scores were normally distributed; hence, the score's distribution was presented as a mean and standard deviation. A Shapiro Wilk $p$-value of less than 0.05 indicated that the scores were skewed; hence, the score's distribution was presented as a median and interquartile range.

**Table 2** Demographic characteristics of the respondents ($N=101$)

| Variable | Frequency | Percentage |
|---|---|---|
| Gender | | |
| Male | 11 | 10.89% |
| Female | 90 | **89.11%** |
| Age | | |
| 20 to 29yrs | 15 | 14.85% |
| 30 to 39yrs | 27 | **26.73%** |
| 40 to 49yrs | 26 | 25.74% |
| 50 to 59yrs | 26 | 25.74% |
| 60 to 65yrs | 7 | 6.93% |
| Highest level of education | | |
| Undergraduate diploma/degree | 45 | 44.55% |
| Postgraduate diploma/degree | 52 | **51.49%** |
| Master's degree | 4 | 3.96% |
| Intensive care experience | | |
| 6 months to 1 year | 17 | 16.83% |
| 2 to 5 years | 24 | 23.76% |
| 6 to 10 years | 32 | **31.68%** |
| 11 to 15 years | 12 | 11.88% |
| 16 to 20 years | 9 | 8.91% |
| >20 years | 7 | 6.93% |
| Current position | | |
| Professional nurse | 36 | 35.64% |
| Trauma trained/experienced | 10 | 9.90% |
| ICU trained/experienced | 52 | **51.49%** |
| Unit manager | 3 | 2.97% |
| Type of ICU | | |
| Trauma | 36 | **35.64%** |
| Neurosurgery | 14 | 13.86% |
| Cardio-thoracic | 17 | 16.83% |
| Multidisciplinary | 34 | **33.66%** |

A linear regression model was fitted to determine how each demographic factor predicted knowledge of pressure injury prevention and management independently. Multiple linear regression was then fitted to determine how the demographic factors (adjusted for each other) predicted pressure injury prevention and management knowledge. STATISTICA™ version 13.2 was the statistical software used to analyse the data.

## Results

### Demographic characteristics

In total, 101 surveys were distributed, and the response rate was 100%. Most of the participants (26.73%, $n=27$) were between the ages of 30 and 39 years and the majority were female (89.1%, $n=90$). Just over half (51.49%, $n=52$) held postgraduate qualifications and 31.68% ($n=32$) had 6 to 10 years of ICU experience. Trauma ICU had majority of the respondents (35.64%, $n=36$). Table 2 summarizes these results.

### Knowledge of pressure injury prevention and management

Knowledge of intensive care nurses was measured using the PUKAT 2.0. Table 3 presents the percentage of correct answers on the PUKAT 2.0 for the total group, and for each theme. The mean knowledge score for the sample was 42.16% (SD 12.09). Only six (5.9%) out of 101 respondents achieved 60% or more. No respondent answered all questions correctly. The theme "Prevention of pressure injuries" had the lowest percentage of correct answers (25%) followed by "Classification and observation" (39.5%), respectively. Risk assessment" and "Nutrition" were the themes in which respondents had the highest scores, 100% and 50% respectively.

### Factors associated with knowledge of prevention and prevention of pressure injuries

An analysis of the relationship between the demographic characteristics of intensive care nurses and their knowledge showed that the level of education and years of experience likely influenced the mean scores. Nurses with an undergraduate degree or diploma were less likely to score higher on the PUKAT 2.0 questionnaire compared to those with post-basic qualifications (-5.41, 95% CI -10.08 to -0.74; $p=0.024$). It was further noted that nurses with a Master's degree scored significantly higher on the PUKAT questionnaire (14.00, 95% CI 2.90 to 25.11; $p=0.014$) compared to those with only a postgraduate qualification.

Nurses with 2–5 years of experience were more likely to achieve higher scores on the PUKAT questionnaire (6.38, 95% CI 5.45 to 9.70; $p=0.039$) compared to those with 6–10 years of experience.

**Table 3** Association between nurses' demographics and knowledge of pressure injury prevention

| | Unadjusted Odds Ratio | | Adjusted Odds Ratio | |
|---|---|---|---|---|
| | **OR (95% CI)** | ***p*-value** | **OR (95% CI)** | ***p*-value** |
| Gender | | | | |
| Male | 7.39 (-0.16- 14.95) | 0.014* | 1.55 (1.22–1.97) | 0.014* |
| Female | 1 | 1 | 1 | 1 |
| Age | | | | |
| 20–29 | 5.90 (-1.84- 13.63) | 0.133 | 9.69 (2.61–16.77) | 0.008* |
| 30–39 | 1 | 1 | 1 | 1 |
| 40–49 | -1.34 (-7.94-5.25) | 0.687 | -1.42 (7.27–4.43) | 0.630 |
| 50–59 | 2.04 (-4.56-8.64) | 0.541 | 3.02 (-4.20–10.24) | 0.407 |
| 60–65 | 0.68 (-9.51- 10.86) | 0.895 | 3.58 (-7.14–14.32) | 0.508 |
| Education | | | | |
| Undergraduate diploma/degree | -5.4(-10.08-0.74) | 0.024* | -2.40 (-8.03-3.24) | 0.400 |
| Postgraduate diploma/degree | 1 | 1 | 1 | 1 |
| Master's degree | 11.92 (0.02–23.83) | 0.050 | 14.00 (2.90-25.11) | 0.014* |
| Experience | | | | |
| 6 months-1 year | -9.18(-15.90-2.47) | 0.008* | -10.71(-18.53--2.89) | 0.008* |
| 2–5 years | 6.38 (0.33–12.41) | 0.039* | 2.89 (-3.41–9.18) | 0.365 |
| 6–10 years | 1 | 1 | 1 | 1 |
| 11–15 years | -2.13 (-9.70-5.45) | 0.579 | -1.85 (-9.25-5.54) | 0.620 |
| 16–20 years | 2.76 (-5.68-11.21) | 0.517 | -0.79 (-9.64-8.06) | 0.860 |
| ≥20 years | 0.73 (-8.61-10.07) | 0.877 | -0.97 (-10.65-8.71) | 0.843 |
| Position | | | | |
| Professional Nurse | -7.44 (-12.25- -2.64) | 0.003* | -1.44 (-8.03-5.15) | 0.665 |
| Unit manager | 16 (2.84–29.16) | 0.018* | 15.58 (2.92–28.24) | 0.016* |

Key: * = statistically significant

**Table 4** Intensive care nurses' knowledge of pressure Injury Prevention

| Variable | Mean (SD) | Median (IQR) | Percentage |
|---|---|---|---|
| Total score (%) | 12.06 | | 42.16% |
| **Themes** | | | |
| Aetiology and development (items = 6) | 2.81(1.25) | | 46.8% |
| Classification and observation (items = 4) | 1.58 (1.06) | | 39.5% |
| Risk assessment (items = 2) | | 2 (1–2) | 100% |
| Nutrition (items = 3) | 1.51 (0.84) | | 50% |
| Preventative measures to reduce the amount of pressure (items = 8) | | 2 (11 – 3) | 25% |
| Specific patient groups (items = 8) | 0.96 (0.56) | | 48% |
| | ***n*** | | **%** |
| Equal to or more than 60% | 6 | | 5.94 |
| Equal to or lower than 59% | 95 | | 94.06 |

According to the adjusted multiple linear regression models, nurses aged 20–29 years were more likely to score higher on the PUKAT questionnaire (9.69, 95% CI 2.61 to 16.77) than those aged 30–39 years, potentially due to the shorter time between graduation and entering the workforce.

The adjusted multiple linear regression models also indicated that male nurses were more likely to score higher on the PUKAT questionnaire (8.52, 95% CI 1.80 to 15.26; $p=0.014$) compared to their female counterparts, though the small number of male participants suggests caution in interpreting this finding. Likewise, unit managers scored higher on the PUKAT questionnaire (15.58, 95% CI 2.92 to 28.24; $p=0.016$) compared to nurses with additional Critical Care qualifications or experience, but the small sample size of unit managers limits the generalizability of this result. Table 4 summarises these results.

## Discussion

This study aimed to determine the intensive care nurses' knowledge of PI prevention in a South African context, revealing an overall mean score of 42.16% on the PUKAT 2.0 scale. This low score suggests that many intensive care nurses lack sufficient knowledge of PI prevention, which is essential for delivering evidence-based care and minimizing PI risks for patients. Insufficient knowledge in this area has been associated with inadequate implementation of prevention practices, as observed in previous studies from various countries, which consistently report suboptimal knowledge levels among nurses over the past two decades [14, 15, 17–19, 29–31]. This international pattern highlights a critical need for improvement in PI prevention education and training.

Although the mean knowledge score in this study was higher than those reported in Turkey (38.2%) [14] and

Belgium (28.9%) [30], it remains below the accepted threshold of 60% for adequate PI prevention knowledge. This finding aligns with global patterns; for example, studies in Iran, Australia, Jordan, Belgium, and Sweden [27, 31–33] report similar knowledge deficiencies, with only a few countries (e.g., China, scoring 65.8% and 73.9%) surpassing the threshold [11, 35]. The observed disparities could reflect differences in the structure and quality of nursing education, the emphasis placed on PI prevention in the curriculum, and the availability of ongoing professional development in various healthcare settings.

In this study, only 5.9% of the 101 respondents scored 60% or higher, and none answered all questions correctly. A recent systematic review and meta-analysis by Dalvand et al. [20] involving 4,766 nurses and nursing students found an average knowledge score of 53.1%, highlighting that many nurses fall short of the 59% knowledge threshold.

This study also identified specific themes where knowledge was particularly lacking, with nurses scoring lowest in "classification and observation" (39.5%) and "prevention of pressure injuries" (25%). The low scores in prevention of PI may be associated with the fact that the core curriculum in nursing schools still focuses on development, classification and assessment but rarely on how to prevent PIs. Another possible reason could be the fact that most of the respondents in this study were diploma holders. Diploma programs typically focus more on the practical aspects of nursing, with less emphasis on theory, research, and advanced clinical knowledge. These findings suggest that more focus on these specific areas during training could improve overall PI prevention effectiveness. Consistent with studies from Belgium and Jordan [11, 31], knowledge deficits in these themes suggest that targeted training in core areas of PI prevention (such as early recognition and preventive interventions) is a global need.

The highest scores in this study were observed in "risk assessment" (100%) and "nutrition" (50%), suggesting that while nurses may understand how to identify at-risk patients, they may lack comprehensive knowledge on preventing PI once risks are identified. This underscores the necessity of comprehensive PI training that covers both risk assessment and effective prevention strategies. The higher score in nutrition may be due to the small number of questions in this dimension or the simplicity of these questions compared to other questions.

Analysis of the relationship between nurses' characteristics and their PI prevention knowledge revealed that education and years of experience influenced the mean scores. Intensive care nurses with a higher level of education, particularly those with post-basic qualifications, scored significantly higher in PI prevention knowledge. This finding aligns with studies from Ethiopia and China, which demonstrated that nurses with a bachelor's degree were more likely to have better PI prevention knowledge compared to those with diplomas [13, 36]. Similar correlations between educational background and knowledge were found in studies from Belgium and Italy [18, 36]. This may be due to the fact that diploma programs typically focus more on the practical aspects of nursing, with less emphasis on theory, research, and advanced clinical knowledge. In contrast, degree programs provide a more comprehensive education that includes in-depth studies of nursing theory, evidence-based practices, and specialized topics like PI prevention.

Intensive care nurses with 2–5 years of experience scored higher than those with 6–10 years. This is consistent with findings from Spain [38], where nurses with recent experience scored higher, possibly due to more current training and recent exposure to evidence-based practices. In contrast, findings from Ethiopia and Nigeria [13, 39] suggest that nurses with 11–20 years of experience tend to have higher knowledge, possibly because of increased experiential learning. The variance in these findings may reflect differences in access to continuing education and the retention of up-to-date knowledge across different countries. For South Africa, these findings highlight the importance of bridging the gap between theoretical education and practical experience, suggesting that mid-career nurses may benefit from additional refresher courses in PI prevention.

The study also found that younger nurses (aged 20–29) scored higher than their older counterparts. Similar findings in Saudi Arabia and Iran [40, 41] suggest that younger nurses may retain more current knowledge, likely because of the shorter time since they completed their formal education. This is in contrast to findings in a systematic review by Wu et al. [22] where older nurses generally had higher knowledge levels due to their accumulated experience. This discrepancy suggests that knowledge retention and relevance may vary depending on access to continuing education and professional development resources.

### Study contributions and recommendations

The findings from this study contribute valuable knowledge to the literature on PI prevention by providing insights specific to the South African ICU nursing context. The findings underscore the need for targeted educational interventions and the need for continuous, mandatory training programs that address identified knowledge gaps in classification, observation, and specific preventive strategies. Furthermore, the study suggests a need for ongoing professional development to keep mid- and late-career nurses up to date with best practices,

as well as a curriculum review to enhance early-career nurses' knowledge retention in PI prevention.

Given that intensive care nurses in South Africa and in other low- and middle-income countries often face resource constraints, tailored approaches to PI prevention training, emphasizing practical strategies that can be implemented in resource-limited settings, could enhance their ability to provide high-quality, preventive care.

### Limitations and strengths

Several limitations must be considered when interpreting the findings of this study:

Sample and generalizability: The study was conducted within a single province in South Africa, and the sample consisted of intensive care nurses from a limited number of ICUs. Thus, the findings may not be fully generalizable to intensive care nurses in other regions or to those working in non-ICU settings. Future studies involving a broader and more diverse sample are recommended to enhance generalizability.

Cross-Sectional Design: As a cross-sectional study, the data provide a snapshot of knowledge levels at one point in time but cannot determine causality or long-term knowledge retention. Longitudinal studies would be valuable to assess whether knowledge levels change over time and to evaluate the impact of continuous education on knowledge retention and clinical practice.

Reliability of the PUKAT 2.0 Tool: The study utilized the PUKAT 2.0 questionnaire to assess knowledge, but the low Cronbach alpha coefficients across themes indicate poor internal consistency, which may limit the reliability of the knowledge scores in this context. PUKAT 2.0 has been validated in previous studies with acceptable reliability scores, supporting its use in assessing knowledge of PI prevention. However, we acknowledge that the tool's performance in our context indicates the need for further adaptation and validation in similar settings. Adapting or developing a tool specific to the South African nursing context might yield more accurate assessments of knowledge.

Potential Response Bias: Although the study achieved a 100% response rate, the self-reported nature of the questionnaire could introduce response bias, with participants possibly overestimating or underestimating their knowledge levels. Future studies could consider using a mixed-methods approach, combining quantitative assessments with qualitative interviews, to gain a more comprehensive understanding of nurses' knowledge and attitudes toward PI prevention.

Influence of Unmeasured Factors: The study primarily focused on demographic characteristics and did not account for other factors that might influence knowledge, such as access to continuing education programs, institutional support, or differences in training curricula. Including these factors in future research could provide a more holistic view of what influences PI prevention knowledge.

## Conclusion

This study sheds light on the knowledge gaps in PI prevention among intensive care nurses in a South African context, highlighting areas for improvement in both foundational knowledge and specific PI prevention strategies. While the findings align with global trends of knowledge deficits in PI prevention, they emphasize unique demographic and educational factors influencing knowledge levels within the South African ICU setting. However, further research is needed to evaluate whether addressing these knowledge gaps leads to measurable improvements in patient outcomes and to identify the most effective educational interventions tailored to resource-limited healthcare environments.

### Abbreviations

| | |
|---|---|
| CCSSA | Critical Care Society of South Africa |
| ICU | Intensive care unit |
| NPUAP | National Pressure Ulcer Advisory Panel |
| PI | Pressure injuries |
| PIP | Pressure injury Prevention |
| PUKAT | Pressure Ulcer Knowledge Assessment Tool |

## Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12912-024-02533-4.

Supplementary Material 1

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### Author contributions

RS: Conceptualization, Methodology, Data collection, Data analysis and interpretation. Manuscript original draft preparation. NK: Conceptualization, Supervision, Methodology, Formal Analysis - Original draft preparation, reviewing and editing. All authors have read and approved the manuscript.

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### Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on request.

## Declarations

### Ethics approval and consent to participate

This research was approved by the Human Research Ethics Committee of the University of the Witwatersrand (M200364). Permissions were obtained from the study setting and informed consent forms were received from all participants. The study was performed in accordance with the general ethical principles.

### Consent for publication

The article does not contain any individual details, and therefore, consent for publication is not applicable.

**Competing interests**
The authors declare no competing interests.

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**References**

1. de Sousa RC, Faustino AM. Nurses' understanding about the pressure injury prevention and care/Conhecimento de enfermeiros sobre prevenção e cuidados de lesão por pressão. Revista De Pesquisa Cuidado é Fundamental Online. 2019;11(4):992–7.
2. Becker D, Tozo TC, Batista SS, Mattos AL, Silva MC, Rigon S, Laynes RL, Salomão EC, Hubner KD, Sorbara SG, Duarte PA. Pressure ulcers in ICU patients: incidence and clinical and epidemiological features: a multicenter study in southern Brazil. Intensive Crit Care Nurs. 2017;42:55–61.
3. Li Z, Lin F, Thalib L, Chaboyer W. Global prevalence and incidence of pressure injuries in hospitalised adult patients: a systematic review and meta-analysis. Int J Nurs Stud. 2020;105:103546.
4. Nowicki JL, Mullany D, Spooner A, Nowicki TA, Mckay PM, Corley A, Fulbrook P, Fraser JF. Are pressure injuries related to skin failure in critically ill patients? Australian Crit Care. 2018;31(5):257–63.
5. Chaboyer WP, Thalib L, Harbeck EL, Coyer FM, Blot S, Bull CF, Nogueira PC, Lin FF. Incidence and prevalence of pressure injuries in adult intensive care patients: a systematic review and meta-analysis. Crit Care Med. 2018;46(11):e1074–81.
6. Coyer F, Miles S, Gosley S, Fulbrook P, Sketcher-Baker K, Cook JL, Whitmore J. Pressure injury prevalence in intensive care versus non-intensive care patients: a state-wide comparison. Australian Crit Care. 2017;30(5):244–50.
7. Jacq G, Valera S, Muller G, Decormeille G, Youssoufa A, Poiroux L, Allaert F, Barrois B, Rigaudier F, Ferreira P, Huard D. Prevalence of pressure injuries among critically ill patients and factors associated with their occurrence in the intensive care unit: the PRESSURE study. Australian Crit Care. 2021;34(5):411–8.
8. Alshahrani B, Sim J, Middleton R. Nursing interventions for pressure injury prevention among critically ill patients: a systematic review. J Clin Nurs. 2021;30(15–16):2151–68.
9. Haesler E. National pressure ulcer advisory panel, European pressure ulcer advisory panel and pan pacific pressure injury alliance. Prev Treat Press Ulcers: Quick Ref Guide. 2014:14–32.
10. Tayyib N, Coyer F, Lewis PA. Implementing a pressure ulcer prevention bundle in an adult intensive care. Intensive Crit Care Nurs. 2016;37:27–36.
11. De Meyer D, Verhaeghe S, Van Hecke A, Beeckman D. Knowledge of nurses and nursing assistants about pressure ulcer prevention: a survey in 16 Belgian hospitals using the PUKAT 2.0 tool. J Tissue Viability. 2019;28(2):59–69.
12. Fulbrook P, Lawrence P, Miles S. Australian nurses' knowledge of pressure injury prevention and management: a cross-sectional survey. J Wound Ostomy Cont Nurs. 2019;46(2):106–12.
13. Nuru N, Zewdu F, Amsalu S, Mehretie Y. Knowledge and practice of nurses towards prevention of pressure u8lcer and associated factors in Gondar University Hospital, Northwest Ethiopia. BMC Nurs. 2015;14:1–8.
14. Kısacık ÖG, Sönmez M. Pressure ulcers prevention: Turkish nursing students' knowledge and attitudes and influencing factors. J Tissue Viability. 2020;29(1):24–31.
15. Hu L, Sae-Sia W, Kitrungrote L. Intensive care nurses' knowledge, attitude, and practice of pressure injury prevention in China: a cross-sectional study. Risk Manage Healthc Policy. 2021 Oct;11:4257–67.
16. Alshahrani B, Middleton R, Rolls K, Sim J. Critical care nurses' knowledge and attitudes toward pressure injury prevention: A pre and post intervention study. Intensive Crit Care Nurs. 2023;79:103528.
17. Clark M, Bours G, Delfoor T. Summary report on the prevalence of pressure ulcer EPUAP review [Internet]. 2002; 4(-): 49–57. https://sid.ir/paper/575544/en
18. Beeckman D, Vanderwee K, Demarré L, Paquay L, Van Hecke A, Defloor T. Pressure ulcer prevention: development and psychometric validation of a knowledge assessment instrument. Int J Nurs Stud. 2010;47(4):399–410.
19. Malinga S, Dlungwane T. Nurses' Knowledge, Attitudes and Practices regarding Pressure Ulcer Prevention in the Umgungundlovu District, South Africa. Afr J Nurs Midwifery. 2020;22(2).
20. Dalvand S, Ebadi A, Gheshlagh RG. Nurses' knowledge on pressure injury prevention: a systematic review and meta-analysis based on the Pressure Ulcer Knowledge Assessment Tool. Clinical, cosmetic and investigational dermatology. Nov. 2018;23:613–20.
21. Wong AL, Walia GS, Bello R, Aquino CS, Sacks JM. Pressure ulcer prevalence and perceptions on prevention: a hospital-wide survey of health professionals. J Wound Care. 2018;27(Sup4):S29–35.
22. Wu Z, Song B, Liu Y, Zhai Y, Chen S, Lin F. Barriers and facilitators to pressure injury prevention in hospitals: a mixed methods systematic review. J Tissue Viability. 2023;32(3):355–64.
23. Manderlier B, Van Damme N, Vanderwee K, Verhaeghe S, Van Hecke A, Beeckman D. Development and psychometric validation of PUKAT 2· 0, a knowledge assessment tool for pressure ulcer prevention. Int Wound J. 2017;14(6):1041–51.
24. Wound O. WOCN 2016 guideline for prevention and management of pressure injuries (ulcers): an executive summary. J Wound Ostomy Cont Nurs. 2017;44(3):241–6.
25. Polit D, Beck C. Essentials of nursing research: Appraising evidence for nursing practice. Lippincott Williams & Wilkins; 2020 Dec 30.
26. Raosoft. Raosoft Sample Size Calculator. Raosoft, Inc., Seattle. http://www.raosoft.com/samplesize.html. Accessed 09 August 2024. 2004.
27. Tirgari B, Mirshekari L, Forouzi MA. Pressure injury prevention: knowledge and attitudes of Iranian intensive care nurses. Adv Skin Wound Care. 2018;31(4):1–8.
28. Tavakol M, Dennick R. Making sense of Cronbach's alpha. Int J Med Educ. 2011;2:53.
29. Gunningberg L, Lindholm C, Carlsson M, Sjödén PO. Risk, prevention and treatment of pressure ulcers–nursing staff knowledge and documentation. Scand J Caring Sci. 2001;15(3):257–63.
30. Demarré L, Vanderwee K, Defloor T, Verhaeghe S, Schoonhoven L, Beeckman D. Pressure ulcers: knowledge and attitude of nurses and nursing assistants in Belgian nursing homes. J Clin Nurs. 2012;21(9–10):1425–34.
31. Batiha AM. Critical care nurses' knowledge, attitudes, and perceived barriers towards pressure injuries prevention. Int J Adv Nurs Stud. 2018;7(2):117.
32. Li Z, Marshall AP, Lin F, Ding Y, Chaboyer W. Knowledge of pressure injury in medical and surgical nurses in a tertiary level hospital: a cross-sectional study. J Tissue Viability. 2022;31(1):24–9.
33. Gunningberg L, Mårtensson G, Mamhidir AG, Florin J, Muntlin Athlin Å, Bååth C. Pressure ulcer knowledge of registered nurses, assistant nurses and student nurses: a descriptive, comparative multicentre study in Sweden. Int Wound J. 2015;12(4):462–8.
34. Sengul T, Karadag A. Determination of nurses' level of knowledge on the prevention of pressure ulcers: the case of Turkey. J Tissue Viability. 2020;29(4):337–41.
35. Liu M, Yuan HB, Chen WJ, Poon C, Hsu M, Zhang B. Translation, modification and validation of the Chinese version of a knowledge assessment instrument regarding pressure ulcer prevention. Chin Nurs Res. 2016;3(1):16–23.
36. Jiang L, Li L, Lommel L. Nurses' knowledge, attitudes, and behaviours related to pressure injury prevention: a large-scale cross-sectional survey in mainland China. J Clin Nurs. 2020;29(17–18):3311–24.
37. Simonetti V, Comparcini D, Flacco ME, Di Giovanni P, Cicolini G. Nursing students' knowledge and attitude on pressure ulcer prevention evidence-based guidelines: a multicenter cross-sectional study. Nurse Educ Today. 2015;35(4):573–9.
38. Pancorbo-Hidalgo PL, García-Fernández FP, López-Medina IM, López-Ortega J. Pressure ulcer care in Spain: nurses' knowledge and clinical practice. J Adv Nurs. 2007;58(4):327–38.
39. Ilesanmi RE, Olabisi P. Assessment of common interventions and perceived barriers to pressure ulcer prevention in southwest Nigeria. J Wound Ostomy Cont Nurs. 2014;41(3):242–6.
40. Kaddourah B, Abu-Shaheen AK, Al-Tannir M. Knowledge and attitudes of health professionals towards pressure ulcers at a rehabilitation hospital: a cross-sectional study. BMC Nurs. 2016;15:1–6.
41. Khojastehfar S, Ghezeljeh TN, Haghani S. Factors related to knowledge, attitude, and practice of nurses in intensive care unit in the area of pressure ulcer prevention: a multicenter study. J Tissue Viability. 2020;29(2):76–8.

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