

Assessment of Nursing Students' Knowledge Levels and Determinants Related to Pressure Injury Classification and Staging

Abstract

Background: Pressure injuries (PIs) are a major patient safety concern associated with increased morbidity, mortality, and healthcare costs. Accurate diagnosis and classification of PIs are crucial for effective prevention and management. However, both nurses and nursing students frequently demonstrate insufficient knowledge and make errors in this area.

Aim: This study aimed to assess nursing students' competence in the classification of PI categories and staging by examining their level of knowledge and the factors influencing it.

Methods: This cross-sectional descriptive study was conducted between December 2022 and July 2023 and included 300 undergraduate nursing students. Data were collected online using the Student Information Form and the 20-item multiple-choice Pressure Injury Test (PI-TEST). Descriptive statistics and independent samples t-tests were performed, and receiver operating characteristic (ROC) analysis was used to determine the optimal cut-off score.

Results: Among the participants, 88.3% were female, 61.3% were nursing students at foundation universities, 55.3% were fourth-year students, and 71.0% had received undergraduate education on PIs. The mean PI-TEST score was 56.36±19.05 out of 100. The highest correct response rates were observed for Stage 1, Stage 4, and Mucosal Membrane PIs, whereas Stage 3 and Deep Tissue PIs had the highest rates of incorrect responses. Participants who had received education on PIs and who had provided care to patients with PIs and at risk for PIs during clinical practice had significantly higher knowledge scores.

Conclusion: These findings suggest that nursing students' knowledge regarding PI is insufficient. The results highlight the need to incorporate both theoretical and practical content on pressure injury-related topics into undergraduate nursing curricula.

Keywords: Classification, nursing students, pressure injury, staging

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Introduction

Pressure injuries (PIs), one of the most common problems affecting skin integrity in clinical settings, are recognized as a significant health concern and a global threat to patient safety.¹ The adverse consequences of PIs, including increased mortality and morbidity rates, prolonged hospitalization, and reduced quality of life for patients and their families, place a substantial burden on healthcare systems worldwide.² The prevention and effective management of PIs are considered fundamental quality improvement priorities in healthcare systems and nursing practice. PI prevention is a patient outcome highly sensitive to nursing care.³ Preventive efforts require interdisciplinary team collaboration within a holistic care approach. A nurse-centered approach enables nurses to enhance their expertise and competencies in providing nursing care, encompassing the assessment, prevention, and management of PIs.⁴ Therefore, nurses should possess adequate knowledge, maintain positive attitudes, and adhere to evidence-based practices to improve the quality of patient care and uphold professional standards among healthcare providers.⁵

PIs may present as intact skin or open wounds. Differentiating PIs from other types of wounds is the first step in establishing an appropriate wound treatment plan. This process requires accurate diagnosis, classification, and staging. The National Pressure Injury Advisory Panel (NPIAP) has developed a classification system to standardize diagnostic criteria and promote a common language among healthcare professionals.⁶ The NPIAP system was updated in 2016 and describes the extent of skin and tissue damage manifested as a PI.⁷ Anatomical knowledge of the skin, subcutaneous, fat, fascia, muscle layers, and supporting structures such as tendons, ligaments, and bones is essential for accurate staging. According to the NPIAP classification system, PIs are categorized as Stage 1 PI, Stage 2 PI, Stage 3 PI, Stage 4 PI, Unstageable PI, Deep Tissue PI, Medical Device-Related PI (MDRPI), and Mucosal Membrane PI.^{6,7}

Once a PI has developed, it must be classified according to its category and stage, taking into account the type and depth of the affected tissues.^{6,7} In this regard, enhancing nurses' knowledge and skills in classification is critically important for providing appropriate care to patients with PIs.³ Therefore, nurses should acquire learning experiences related to PI classification skills from the early stages of their education. Current literature indicates that both nurses⁸ and nursing students^{9,10} demonstrate insufficient knowledge and skills in this area, and errors are frequently reported.¹¹ Findings from previous studies, along with clinical observations

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and experiences, suggest that nursing students, as well as practicing nurses, often encounter difficulties in diagnosing, assessing, classifying, and staging PIs during routine care. Accurate staging of PIs, however, is recognized as essential for appropriate local wound care and effective treatment management.¹²

Prevention and management of PIs, a critical aspect of nursing care practice, is expected to be an integral component of undergraduate nursing education, with the anticipation that students will graduate with enhanced knowledge and assessment skills.¹³ Given the important role of nurses in evaluating etiological factors and preventing PIs, it is essential for nursing students to acquire comprehensive knowledge in this area. Accordingly, nursing students should enhance their knowledge of all aspects of PIs, including etiological factors, the mechanisms of PI formation, assessment, diagnosis, classification, and staging, to effectively prevent and manage PIs in their future professional practice.^{14,15}

The relevant literature indicates a need for data identifying the factors that influence nursing students' level of knowledge regarding PI classification.⁹ Although several studies have assessed nursing students' general knowledge of PIs,¹⁴⁻¹⁸ most have not specifically examined competence in classification, which is a critical skill for accurate diagnosis and appropriate management. These findings suggest that existing research predominantly evaluates overall PI knowledge rather than the more complex and error-prone process of classification.

A limited number of emerging studies in Türkiye have begun to address this issue; however, their methodological and contextual scope remains restricted. One moulage-based simulation study evaluated nursing students' PI staging performance and satisfaction; however, it did not use the updated NPIAP criteria for accurate benchmarking.¹⁸ Similarly, a descriptive study reported low levels of knowledge and positive attitudes among senior nursing students but did not directly assess staging competence.¹⁰ A recent randomized controlled trial comparing standardized patient and medium-fidelity simulation practices demonstrated improvements in staging performance; however, it focused on short-term performance outcomes rather than criterion-based diagnostic accuracy.¹⁸ Therefore, despite these contributions, there remains no comprehensive, multicenter study aligned with current NPIAP criteria that evaluates Turkish nursing students' true competence in PI classification and staging.

The existing gap underscores the need for strengthened curricula and targeted educational strategies that explicitly address classification proficiency. To this end, raising awareness by analyzing the current situation and identifying training needs will support this process.¹⁹ In this context, the present study focused on nursing students' skills in the classification and staging of PIs. The study aimed to assess nursing students' competence in classifying PI categories and staging by examining their level of knowledge and the factors influencing it. It is anticipated that the findings obtained from this study will contribute to the enhancement of undergraduate nursing curricula at both national and international levels. Additionally, the study may help clarify the level of awareness among future nurses during their undergraduate education regarding the recognition and differentiation of PIs.

Research Questions

The study sought to answer the following questions:

1. What is the level of nursing students' knowledge regarding the classification of PI categories and staging?
2. What factors influence nursing students' level of knowledge regarding the classification of PI categories and staging?

Materials and Methods

Study Design

This study employed a descriptive cross-sectional design.

Study Sample

Purposive sampling was used in this study.²⁰ The target population comprised third- and fourth-year undergraduate nursing students in Türkiye. Based on data from the Turkish Council of Higher Education for the 2022-2023 academic year (N=68,152),²¹ the required sample size was calculated as 382 using the Qualtrics Sample Calculator ($\alpha=0.05$; margin of error=5%). Preparatory, first-, and second-year students were excluded because they may not yet have completed compulsory nursing courses related to PI.

To reach the target sample, representatives of the Student Nurses Association and the Turkish Nurses Association Student Commission were contacted. Following approval, member students were invited to participate via email. Participation was voluntary, and 300 eligible students were enrolled in the study. The sampling access rate was 78.5% (300/382).

A post hoc power analysis was performed to evaluate the adequacy of the achieved sample size using G*Power 3.1 for a one-sample t-test (two-tailed, $\alpha=0.05$), based on the observed mean total PI-TEST score and the predefined reference cut-off value. The effect size was calculated as 0.45, and the achieved power was approximately 1.00, indicating that the sample size was more than sufficient to detect this difference.

Data Collection Tools

Data were collected using the Student Information Form and the Pressure Injury Test. The *Student Information Form*, developed by the researchers, consisted of nine questions that gathered descriptive information about the students, including age, gender, type of university, year of study, whether they had received education related to PIs (including classification and staging), and whether they had provided care to patients at risk of and with PIs during clinical practice within the undergraduate curriculum.

The *Pressure Injury Test (PI-TEST)* was used to evaluate students' knowledge regarding the identification, classification, and staging of PIs. The PI-TEST was developed based on the researchers' clinical experience and current literature.^{6,7} Currently, there is no measurement tool specifically designed to assess students' competence in the classification and staging of PI categories. Existing assessment tools primarily evaluate general knowledge about PIs and include only a limited number of questions related to classification and staging. Moreover, these tools were developed prior to the most recent NPIAP 2016 classification system.^{22,23} Given the need for a comprehensive assessment tool containing target group-specific questions to evaluate competence in PI classification, the PI-TEST was developed. The PI-TEST covers all PI categories. The PI-TEST includes realistic case scenarios and photo-based questions that numerically assess staging. Thus, it provides an alternative tool for evaluating nursing students' competence. During its development, potential confounding factors in measurement and assessment were controlled.²⁴ Correct answers were evenly distributed across response options, and consecutive correct or incorrect answers were avoided. Questions and case scenarios were structured to ensure that no item revealed the answer to another. The PI-TEST begins with general questions addressing the NPIAP classification system criteria.^{6,7} It then proceeds with case scenarios describing different PI categories and severity levels and concludes with photo-based questions assessing PI staging.

The PI-TEST consists of 20 multiple-choice questions, each with five options, designed to assess knowledge and provide characteristic information regarding PI categories and stages in accordance with the NPIAP classification system.^{6,7} Participants were instructed to answer the questions based on the information provided in the questions, case descriptions, characteristics, and visuals. The test comprises questions related to identification, classification, and staging as follows: general classification and staging information (2 questions), Stage 1 PI (2 questions), Stage 2 PI (2 questions), Stage 3 PI (3 questions), Stage 4 PI (3 questions), Unstageable PI (3 questions), Deep Tissue PI (3 questions), and Mucosal Membrane PI (2 questions). Two of the items address the identification and staging of MDRPIs. In these questions, participants are expected first to recognize the injury as an MDRPI and then determine its appropriate stage.

Although the primary aim of this study was not to develop a measurement tool, a content validity study was conducted to evaluate the adequacy and suitability of the PI-TEST for the target population. Expert opinions were obtained from five nursing academics specializing in PIs (one professor, two associate professors, and two assistant professors) within the scope of the content validity study. The selection criteria for experts were: 1) holding a doctoral degree in nursing and 2) having educational and publication experience in the field of PIs. Expert evaluations were conducted using the Davis method. Accordingly, a 4-point Likert-type scale (1=inappropriate, 2=somewhat appropriate, 3=appropriate, 4=very appropriate) was used to assess the relevance and clarity of each item. Subsequently, the proportion of experts who rated each item as 3 or 4 was divided by the total number of experts to calculate the Content Validity Index (CVI) for each item. An item was considered to have acceptable content validity if its CVI was at least

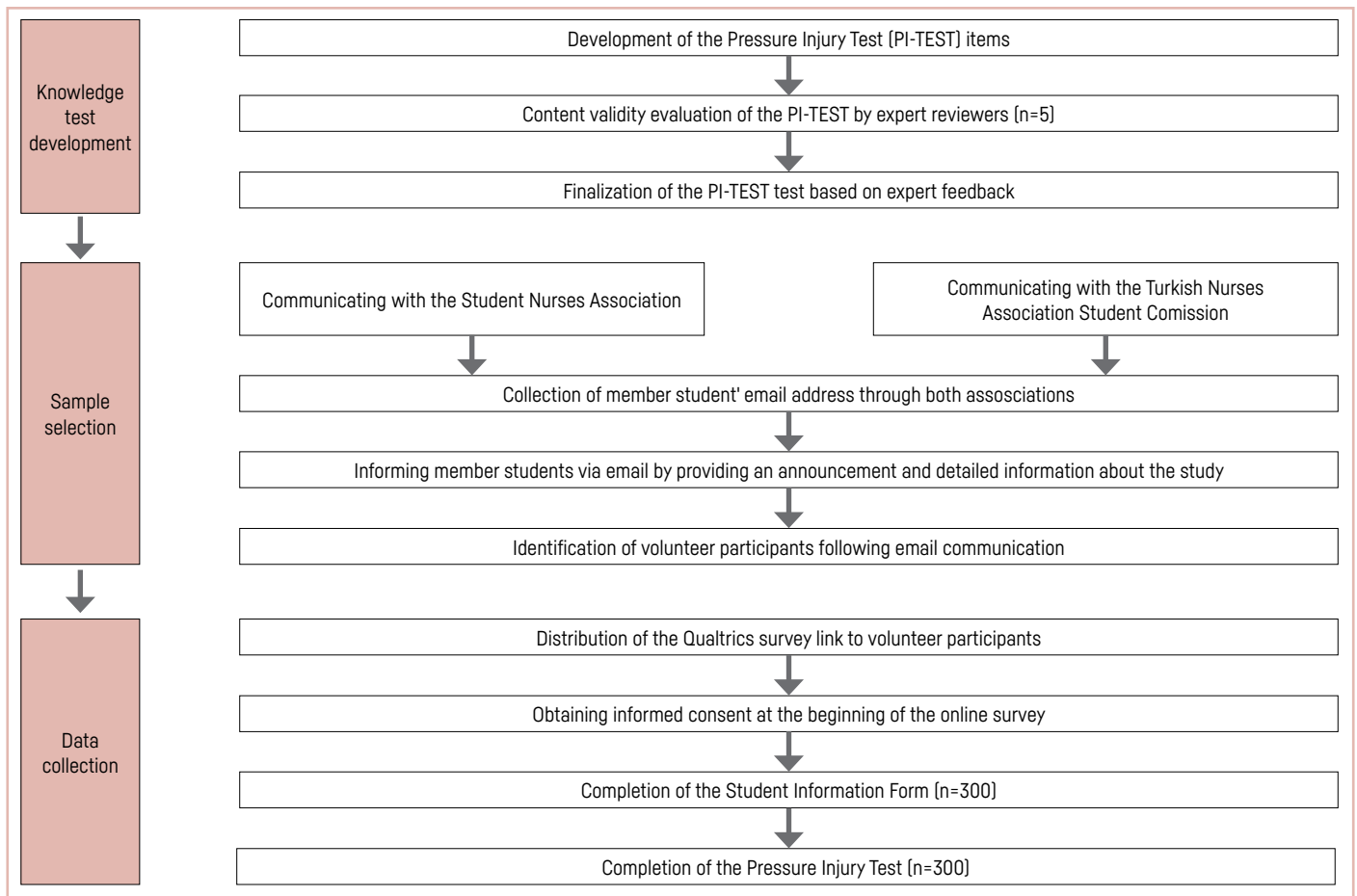


Figure 1. Flow diagram of the study process.

0.80. Accordingly, to ensure consensus, a test item was deemed valid if it received a rating of 3 or 4 at least 80% of the time.²⁵ The overall CVI for the PI-TEST was calculated as 0.96, indicating an acceptable level of content validity.²⁵

The draft PI-TEST items were sent to the experts via email, and they were asked to evaluate each question in terms of suitability, adequacy, and clarity, as well as to provide suggestions. Based on expert feedback, minor revisions were made to enhance clarity and ensure alignment with the NPIAP classification system criteria. These revisions included refining item wording for greater precision in line with expert opinions, ensuring consistency in question stems, and arranging response options to better reflect clinically essential differences among the PI categories. Based on expert opinions, 5 points were awarded for each correct answer and 0 points for each incorrect answer. The maximum total score for the 20 questions was 100. The clarity of the questions was tested with five students from the researchers' network who were not included in the study.

Data Collection

The study was conducted between December 1, 2022 and July 31, 2023. The methodological flow of the study is presented stepwise, including test development, participant recruitment, and data collection procedures (Fig. 1). The research data were collected online. The questions in the Student Information Form and the PI-TEST were transferred to a Qualtrics survey link. This link was shared with student members of the Student Nurses Association and the Turkish Nurses Association Student Commission through electronic communication networks to reach the study sample. The survey link, accompanied by an informed consent form, was distributed to volunteer participants. Students were asked to register with their email address via the link and complete the questions on the Qualtrics platform. Completion of the questionnaire required a maximum of 20 minutes.

Data Analysis

SPSS Statistics, version 27.0 [Armonk, NY: IBM Corp., 2021], was used to analyze the data. Participant responses collected via Qualtrics were transferred to SPSS for analysis. Descriptive statistics included frequencies and percentages for categorical variables and means and standard deviations for continuous numerical data. A normality test was performed to determine whether the study data followed a normal distribution. The Kolmogorov-Smirnov test was used to assess normality. As the data were normally distributed, the independent samples t-test was conducted to compare participants' total PI-TEST scores.

Furthermore, receiver operating characteristic [ROC] analysis was performed to determine the cut-off value, and the area under the curve was calculated for the PI-TEST. Determining this threshold is a common approach in knowledge-based assessment tools, as it helps distinguish participants with adequate competence from those with lower performance in a statistically supported manner.²⁰ Different threshold values were examined using the ROC curve, and a new cut-off value was established by considering the balance between sensitivity, true positive rate, and false positive rate. Based on the distribution of threshold values, the PI-TEST cut-off point was determined to be 65%.²⁰

Ethical Considerations

Ethics committee approval was obtained from the Ethics Committee of Koç University [Approval Number: 2023.114.IRB3.056, Date: 27.03.2023]. The online data collection form included study information in its initial section, where participants were asked to confirm their voluntary participation. Written informed consent was obtained from all participants before data collection. The study was conducted in accordance with the Declaration of Helsinki.

Results

The mean age of the participants was 22.33±1.74 years, and the majority were female (88.3%, n=265). Among the participants, 71.0% (n=213) reported that they had received education related to PIs at the undergraduate level; 65.3% (n=139) stated that this education included classification of PI categories and staging; 83.3% (n=250) indicated that they had provided care to a patient at risk of PI; and 74.7% (n=224) reported providing care to a patient with PI during their clinical practice within the curriculum (Table 1).

The percentage of participants who scored above the 65% cut-off point was low (33.0%, n=99) for the overall sample (Table 2). The mean total PI-TEST knowledge score was 56.36±19.05 out of 100 (Table 3). The most correctly answered PI categories and stages were Stage 1 PI (Question 3, n=275, 89.3%) Stage 4 PI (Question 9, n=193, 64.3%), Unstageable PI (n=185, 61.7%), and Mucosal Membrane PI (Question 16, n=18, 60.3%). In contrast, the most incorrectly answered categories and stages were Stage 3 PI (Question 8, n=189, 63.0%) and Deep Tissue PI (Question 20, n=168, 56.0%) (Table 2).

Statistically significant differences were observed in PI-TEST total knowledge scores according to three variables: receiving PI-related education within the undergraduate curriculum (p=0.019), providing care to patients at risk of PIs (p=0.042), and providing care to patients with PIs (p=0.018). Participants who had received PI-related education had higher knowledge scores compared to those who had not (61.15±20.28 vs. 55.00±20.06; Cohen's d=0.30; 95% confidence interval [CI] [1.08, 11.22]). Similarly, participants who had provided care to patients at risk of PI demonstrated higher scores than those without such experience (60.70±19.96 vs. 54.30±21.50; Cohen's d=0.32; 95% CI [-0.05, 12.85]). In addition, participants who had cared for patients with PI scored higher than those who had not (61.04±20.23 vs. 54.67±20.17; Cohen's d=0.32; 95% CI [1.12, 11.62]).

Discussion

The findings of this study indicate that third- and fourth-year nursing students require improved knowledge to accurately classify PI categories and stages. Using a 65% cut-off value for acceptable performance, only one-third of the students scored above the threshold. Participants most accurately identified Stage 1 PI but had difficulty classifying Stage 3 PI and Deep Tissue PI. Consistent with previous studies,^{26,27} the results of this study revealed that nursing students' knowledge levels regarding PI categories and staging were very low.

In the most recent systematic review and meta-analysis conducted by Wu et al.,⁸ which included 20 publications, the knowledge levels of nurses and nursing students regarding PI prevention were examined using the Pressure Ulcer Knowledge Assessment Tool (PUKAT). The study reported that nursing students had low scores in the classification and observation domain of the PUKAT. In a literature review by Bruce et al.,²⁸ which included 10 publications, difficulties were identified in distinguishing Stage 2 PI from Unstageable PI and Deep Tissue PI, as well as differences in assessment between ward nurses and Wound, Ostomy, and Continence Nurses (WOCNs). Similarly, in a descriptive study by Aydin and Karadag (n=237), majority of nurses experienced difficulty distinguishing Deep Tissue PI.²⁹ In a non-experimental study by Jesada et al.,³⁰ 100 digital PI photographs were assessed and staged by four WOCNs. The highest percentage of agreement was observed for Deep Tissue PI. The same study reported that partial- and full-thickness wounds, such as Stage 3 PI and Stage 4 PI, may be easier to identify than superficial injuries, such as Stage 1 PI and Stage 2 PI.

However, the findings of that study are inconsistent with the present results. Nursing students' difficulty in classifying Stage 3 PI and Deep Tissue PI may reflect limited clinical exposure, the complexity of wound assessment, and insufficient theoretical preparation. Although the literature on PI classification and staging remains limited,³¹ findings from related studies²⁸⁻³⁰ are consistent with the present study. Overall, the results suggest that students who received PI-focused education and gained clinical experience in PI care during undergraduate training demonstrated better knowledge of classification and staging, as well as higher total scores, than those without such training. Bobbink et al.¹⁶ conducted a quasi-experimental pre-test/post-test study to assess first-year nursing students' (n=21) knowledge of PIs using a blended learning approach. The PUKAT was used to measure PI knowledge at baseline (T₀), after blended learning (T₁), and following clinical practice (T₂). The results showed an increase in correct responses in the "Classification and Observation" domain and in

Table 1. Descriptive characteristics of the participants (n=300)

| Descriptive characteristics | n | % |
|---|----------------|----------------|
| Gender | | |
| Male | 35 | 11.7 |
| Female | 265 | 88.3 |
| Type of university | | |
| Public university | 116 | 38.7 |
| Foundation university | 184 | 61.3 |
| Year of study | | |
| Third year | 134 | 44.7 |
| Fourth year | 166 | 55.3 |
| Receipt of PI-related education | | |
| Yes | 213 | 71.0 |
| No | 87 | 29.0 |
| Type of PI education received (n=213) | | |
| Required course | 156 | 73.2 |
| Elective course | 57 | 26.8 |
| Inclusion of PI classification in education (n=213) | | |
| Yes | 139 | 65.3 |
| No | 74 | 34.7 |
| Provided care to patients at risk of PI | | |
| Yes | 250 | 83.3 |
| No | 50 | 16.7 |
| Provided care to patients with PI | | |
| Yes | 224 | 74.7 |
| No | 76 | 25.3 |
| | Mean±SD | Min-Max |
| Age (years) | 22.33±1.74 | 19-36 |

n: Number, %: Percentage, PI: Pressure injury, SD: Standard deviation, Min: Minimum, Max: Maximum.

overall scores from T₀ to T₂. Similarly, in a quasi-experimental study by Sezgunsay and Basak³² evaluating the effect of the moulage simulation method on nursing students' PI assessment skills, fourth-year students (n=73) were included. The study found that PI assessment scores increased significantly in both the intervention and control groups, with higher correct staging percentages observed in the intervention group. It was concluded that this method may contribute to improving nursing students' PI assessment skills and facilitate the transfer of knowledge to the clinical setting.

Nevertheless, although the literature suggests that various learning methods may positively influence nursing students' knowledge and skills related to PI identification, classification, and staging, PI education in undergraduate nursing programs is generally inadequate and varies in content.²⁷ Possessing fundamental evidence-based knowledge and skills to prevent the occurrence of PIs and to appropriately diagnose, assess, and manage them is among the Nursing Education Program Learning Outcomes of undergraduate nursing programs. This necessitates that nursing educators and academic administrators revise curricula to ensure the development of students' knowledge, skills, and attitudes regarding the prevention and assessment of PIs, thereby facilitating new graduates' adaptation to the clinical environment.³³ In addition, nursing curricula and clinical internships should be structured with appropriate emphasis on the accurate etiological classification of PIs.²⁶

Providing education on PIs within undergraduate curricula significantly influences nursing students' knowledge of PI classification and their ability to stage them accurately. The Nursing National Core Education Program in Türkiye, which all nursing programs are required to follow, includes content on tissue damage, healing processes, complications, and injury care.³⁴ However, the inclusion of wound-related topics varies across institutions. In some schools, PIs are addressed within specific courses, whereas in others, they are covered as part of an elective wound management

Table 2. Knowledge levels regarding classification of pressure injury categories and stages (n=300)

| Pressure injury test item | Correct responses | | Incorrect responses | |
|---|-------------------|------|---------------------|------|
| | n | % | n | % |
| Question 1. Name of the pressure injury classification system | 70 | 23.3 | 230 | 76.7 |
| Question 2. Criteria used for staging a PI | 268 | 91.7 | 32 | 8.3 |
| Question 3. Case scenario reflecting MDRPI, Stage 1 PI | 275 | 89.3 | 25 | 10.7 |
| Question 4. Case scenario reflecting Stage 1 PI | 187 | 62.3 | 113 | 37.7 |
| Question 5. Case scenario reflecting Stage 2 PI | 144 | 48.0 | 156 | 52.0 |
| Question 6. Case scenario reflecting MDRPI, Stage 2 PI | 165 | 55.0 | 135 | 45.0 |
| Question 7. Case scenario reflecting MDRPI, Stage 3 PI | 178 | 59.3 | 122 | 40.7 |
| Question 8. Case scenario reflecting Stage 3 PI | 111 | 37.0 | 189 | 63.0 |
| Question 9. Case scenario reflecting Stage 4 PI | 193 | 64.3 | 107 | 35.7 |
| Question 10. Case scenario reflecting Stage 4 PI | 186 | 62.0 | 114 | 38.0 |
| Question 11. Case scenario reflecting Deep Tissue PI | 167 | 55.7 | 133 | 44.3 |
| Question 12. Case scenario reflecting Deep Tissue PI | 139 | 46.3 | 161 | 53.7 |
| Question 13. Case scenario reflecting Unstageable PI | 134 | 44.7 | 166 | 55.3 |
| Question 14. Case scenario reflecting Unstageable PI | 163 | 54.3 | 137 | 45.7 |
| Question 15. Case scenario reflecting Mucosal Membrane PI | 180 | 60.0 | 120 | 40.0 |
| Question 16. Case scenario reflecting Mucosal Membrane PI | 181 | 60.3 | 119 | 39.7 |
| Question 17. Image-based case addressing Stage 3 PI | 138 | 46.0 | 162 | 54.0 |
| Question 18. Image-based case addressing Stage 4 PI | 162 | 54.0 | 138 | 46.0 |
| Question 19. Image-based case addressing Unstageable PI | 185 | 61.7 | 115 | 38.3 |
| Question 20. Image-based case addressing Deep Tissue PI | 132 | 44.0 | 168 | 56.0 |
| Proportion of correct responses above the 65% cut-off point | 99 | 33.0 | - | - |

n: Number, %: Percentage, PI: Pressure injury, MDRPI: Medical-device related pressure injury.

Table 3. Factors influencing knowledge levels regarding classification of pressure injury categories and stages (n=300)

| Descriptive variables | n | Mean±SD | Test | | Cohen's d | 95% CI |
|---|-----|-------------|-------|--------|-----------|---------------|
| | | | t | p | | |
| Mean total PI-TEST knowledge score | 300 | 56.36±19.05 | - | - | - | [54.21-58.52] |
| Gender | | | 1.616 | 0.107 | -0.29 | [-14.04-2.24] |
| Male | 35 | 54.42±23.50 | | | | |
| Female | 265 | 60.32±19.82 | | | | |
| Type of University | | | 1.416 | 0.158 | -0.17 | [-8.18-1.36] |
| Public University | 116 | 57.54±20.92 | | | | |
| Foundation University | 184 | 60.95±19.89 | | | | |
| Year of study | | | 0.081 | 0.936 | 0.01 | [-4.43-4.81] |
| Third year | 134 | 59.73±20.21 | | | | |
| Fourth year | 166 | 59.54±20.45 | | | | |
| Receipt of PI-related education | | | 2.368 | 0.019* | 0.30 | [1.08-11.22] |
| Yes | 216 | 61.15±20.28 | | | | |
| No | 84 | 55.00±20.06 | | | | |
| Provided care to patients at risk of PI | | | 2.043 | 0.042* | 0.32 | [-0.05-12.85] |
| Yes | 250 | 60.70±19.96 | | | | |
| No | 50 | 54.30±21.50 | | | | |
| Provided care to patients with PI | | | 2.376 | 0.018* | 0.32 | [1.12-11.62] |
| Yes | 224 | 61.04±20.23 | | | | |
| No | 76 | 54.67±20.17 | | | | |

*p<0.05, n: Number, SD: Standard deviation, PI: Pressure injury, t: Student's t-test, CI: Confidence interval.

course or through more comprehensive wound management programs comprising up to four courses totaling 12 credits.³⁵ Furthermore, accurate identification of PIs is highly dependent on observation and clinical judgment, as is effective education on the topic. Therefore, to enhance nursing students' PI assessment skills, nurse educators should provide sufficient clinical experience.^{19,34} The finding that nursing students who cared for patients with PIs during clinical practice had higher total knowledge scores than those who did not highlights the importance of clinical experience.

Nursing students should be familiar with PI categories and staging to improve the quality of patient care and establish and promote standardized care among health-care providers.⁵ Accurate staging is essential for implementing appropriate preventive and therapeutic interventions. In this context, innovative educational strategies, enhanced teaching methods, and curricular improvements are necessary to address existing gaps in nursing education related to PI prevention and management. Incorporating innovative approaches such as simulation-based training, case-based learning, and hands-on clinical experiences can significantly contribute to nursing students' acquisition of comprehensive knowledge and skills.

Limitations

This study has certain limitations. Participation was voluntary, not all eligible individuals were included. Additionally, the sample consisted of nursing students from a single country, which may limit generalizability. The PI-TEST included multiple-choice items without an "I do not know" option. Although PI categories and stages were presented in a case-based and non-consecutive format, the inclusion of numerical stage options may have encouraged guessing and influenced response accuracy. Online data collection made it impossible to fully prevent the use of external resources; however, anonymity and instructions emphasizing honest and independent responses were employed to enhance reliability. Furthermore, only CVI was evaluated for the PI-TEST, which should be considered when interpreting the knowledge outcomes. Although multivariable analyses might have identified independent predictors, they were not conducted because the study was descriptive rather than predictive, and the dichotomous, conceptually overlapping independent variables posed a high risk of multicollinearity. Therefore, analyses were limited to descriptive statistics and bivariate comparisons. Although the required sample size was 382, the study was completed with 300 nursing students, likely due to voluntary participation. The smaller-than-planned sample may limit generalizability and should be considered when interpreting the findings.

Conclusion

This study provides updated and comprehensive evidence regarding undergraduate nursing students' competence in the current PI classification system. Knowledge levels were generally low, whereas prior PI-related coursework and clinical experience were associated with higher scores. These findings support the integration of structured PI classification and prevention content into undergraduate curricula using technology-enhanced, multimodal teaching strategies (e.g., simulations, educational games, didactic materials, leaflets, and pocket guides).

A key strength of this study is the development of a topic-specific instrument to assess competency in PI classification and staging, which may serve as a prototype for future assessment tools in this field. Further research should evaluate the PI-TEST's psychometric properties and cross-cultural validity. Although this study included a large and geographically diverse sample from Türkiye, larger multinational studies and randomized controlled trials evaluating structured educational interventions are needed to generate higher-level evidence and further strengthen nursing students' competencies.

Ethics Committee Approval: The study was approved by the Koç University Ethics Committee [Approval Number: 2023.114.IRB3.056, Date: 27.03.2023].

Informed Consent: Written informed consent was obtained from the participants.

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