Original article

Effectiveness of an educational intervention in improving standard precautions knowledge among nursing students at Hue University of Medicine and Pharmacy

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Abstract

Background: Healthcare-associated infections pose a significant threat to patient safety and increase the burden of healthcare. Standard precautions are essential measures for preventing the transmission of infectious agents. Nursing students are at increased risk of occupational exposure due to frequent contact with patients, while their knowledge of standard precautions remains variable. This study aimed to assess nursing students' knowledge of standard precautions and evaluate the effectiveness of an educational intervention at Hue University of Medicine and Pharmacy.

Methods: A quasi-experimental study was conducted among 260 second-year nursing students from May to July 2026. Knowledge of standard precautions was assessed before and after the intervention using a 50-item questionnaire. Data were analyzed using SPSS version 26.0 with descriptive statistics, Chi-square test, McNemar test, and Wilcoxon signed-rank test.

Results: Before the intervention, 28.5% of students demonstrated adequate knowledge of standard precautions. Following the educational intervention, this proportion increased to 56.5% ($p < 0.001$). Significant improvements were observed in most knowledge domains, except for hand hygiene ($p = 0.71$).

Conclusion: Standard precautions knowledge scores were significantly higher among second-year nursing students immediately after the educational intervention, although a substantial proportion remained below the adequacy threshold. These findings suggest a need for early and ongoing education on standard precautions throughout nursing curricula. However, the one-group pretest-posttest quasi-experimental study design limits causal inference, and controlled studies with longer follow-up are needed to evaluate the intervention's effectiveness and the retention of knowledge over time.

Keywords: *standard precautions; nursing students; knowledge; educational intervention.*

1. INTRODUCTION

Healthcare-associated infections (HAIs) remain a major challenge to patient and occupational safety, highlighting the importance of effective infection prevention and control (IPC) practices in healthcare settings. Standard precautions (SPs) constitute the foundation of IPC and should be applied to all patients, regardless of their known or suspected infection status [1–3]. For nursing students, appropriate knowledge of SPs is particularly important because clinical education involves direct patient contact and exposure to procedures associated with potential occupational hazards.

However, evidence from Vietnam indicates substantial gaps in nursing students' knowledge of SPs. A recent study among nursing students at Duy Tan University found that the overall knowledge score was only 60.3%, with important gaps in personal protective equipment, medical instrument handling, and environmental sanitation [4]. Similarly, only 26.9% of nursing students at Nguyen Tat Thanh University demonstrated adequate knowledge of SPs [5]. These findings are consistent with international evidence showing that nursing students generally have moderate knowledge and compliance with SPs, with considerable variation across studies and domains of practice [6]. Importantly, knowledge gaps may be particularly relevant during the transition from classroom-based learning to clinical practice, when students begin to apply infection prevention principles in real patient-care situations.

The second year of nursing education represents a critical stage for SP education because students are developing foundational clinical knowledge and skills while preparing for or beginning their initial clinical exposure. Evidence suggests that clinical

experience and academic year are associated with students' knowledge and adherence to SPs. In a recent Vietnamese study, fourth-year students demonstrated higher SP knowledge than second- and third-year students, while previous clinical experience and participation in SP-related educational activities were associated with knowledge levels [4]. Therefore, providing structured SP education before or at the beginning of clinical placement may help establish essential infection prevention knowledge before students encounter higher-risk clinical situations.

Although educational interventions using lectures, simulation, videos, online learning, and other interactive approaches have been investigated, evidence regarding the most effective approaches for teaching SPs to nursing students remains heterogeneous. A literature review identified considerable variation in both students' SP knowledge and compliance and in the pedagogical approaches used for SP education, supporting the use of combined or multimodal educational strategies rather than reliance on a single teaching method [6]. A blended educational approach that integrates complementary instructional methods may therefore provide a practical strategy for strengthening students' understanding of SPs before clinical practice.

Despite increasing attention to SP education, evidence remains limited regarding the effectiveness of structured, blended educational interventions specifically targeting nursing students at the early stage of clinical preparation. Most available studies in Vietnam have focused on describing knowledge, attitudes, or practices rather than evaluating changes following an educational intervention [1, 2, 4, 5]. Therefore, an intervention study addressing SP knowledge before substantial clinical exposure may help clarify whether targeted education can improve students' preparedness for clinical training.

This study aimed to evaluate the effectiveness of a blended educational intervention in improving knowledge of standard precautions among second-year nursing students. By focusing on students at an early stage of clinical preparation, the study sought to provide evidence for strengthening SP education within undergraduate nursing curricula. To address these gaps in the existing literature, this study aimed to evaluate the effectiveness of an educational intervention in improving nursing students' knowledge of standard precautions at Hue University of Medicine and Pharmacy, Hue University. Specifically, the study had two objectives: (1) to assess nursing students' baseline knowledge of standard precautions and (2) to evaluate the effectiveness of the educational intervention in improving their knowledge following the intervention.

2. METHODS

2.1. Study participants

The study participants were second-year full-time undergraduate nursing students enrolled in the 2025 – 2026 academic year at Hue University of Medicine and Pharmacy, Hue University. Eligible participants were those who provided informed consent, were preparing for or undergoing clinical placements, and were present at the university during the study period. Students were excluded if they had physical health problems requiring hospitalization, did not complete the educational intervention, or failed to complete the study questionnaire.

Sample size and sampling method: Sample size was calculated using G*Power for a two-tailed paired t-test, assuming $\alpha = 0.05$, 85% power, and an effect size of 0.2. Allowing for a 15% dropout rate, the required sample size was 260 eligible second-year nursing students. Students were randomly selected for participation.

2.2. Study design

A one-group pretest-posttest quasi-experimental study design was employed. Data collection and implementation of the educational intervention were conducted from May 2026 to July 2026 at Hue University of Medicine and Pharmacy, Hue University.

2.3. Research instrument

2.3.1. Development of the instrument for assessing nursing students' knowledge of standard precautions

The research team developed the questionnaire based on relevant decisions, circulars, training materials, and guidelines issued by the Vietnamese Ministry of Health and the World Health Organization, as well as instruments used in previous studies assessing nursing students' knowledge of standard precautions. The content covered key components of standard precautions and was informed by documents on infection prevention and control training, guidelines for standard precautions in healthcare facilities, infection prevention and control guidelines for healthcare facilities, regulations on infection prevention and control in healthcare settings, and regulations on healthcare waste management within healthcare facilities [7-11]. In addition, several items were adapted from the questionnaire developed by Nguyen Thi Minh Hue in the study entitled "Knowledge and Attitudes Regarding Standard Precautions among Nurses at

the National Hospital of Endocrinology in 2022" [12, 13].

The questionnaire used to assess knowledge of standard precautions consisted of two sections: Part 1: General characteristics of the study participants. This section collected information on age, sex, clinical placement status, history of occupational exposure, previous participation in standard precautions training, and grade point average. Part 2: Knowledge of standard precautions. The knowledge questionnaire consisted of 50 items divided into 10 domains, with five items in each domain. The domains included: general knowledge of standard precautions; hand hygiene; use of personal protective equipment (PPE); respiratory hygiene and cough etiquette; patient placement; injection safety and prevention of sharps injuries; reprocessing of medical equipment; linen management; environmental cleaning; and healthcare waste management.

Content validity: The questionnaire was reviewed by a panel of experts comprising three physicians working in the Department of Infection Control, the Head of the Nursing Department, the head nurse of the Department of Infection Control, and one nursing lecturer responsible for teaching the Infection Control course. The experts evaluated the questionnaire and provided recommendations for revision. The item-level content validity index (I-CVI) ranged from 0.87 to 1.00. The scale-level content validity index (S-CVI) values were 0.95 for relevance, 0.94 for simplicity, 0.95 for acceptability, and 0.96 for appropriateness. These findings indicated a high level of content validity, confirming that the questionnaire was appropriate for use in the study [14]. The research team subsequently synthesized the experts' comments and revised the questionnaire to produce the final version.

Reliability: After finalizing the questionnaire, a pilot study was conducted among 30 nursing students to assess its internal consistency. The questionnaire consisted of 50 multiple-choice knowledge items, with one correct answer for each item. For scoring, each item was coded dichotomously as 1 for a correct answer and 0 for an incorrect answer. The questionnaire demonstrated good internal consistency, with a Cronbach's alpha coefficient of 0.89. Because the knowledge items were dichotomously scored, Cronbach's alpha is mathematically equivalent to the Kuder–Richardson Formula 20 (KR-20) under this scoring scheme.

2.3.2. Criteria for assessing nursing students' knowledge of standard precautions

A cutoff of ≥ 70%, corresponding to at least 35 correct answers out of the 50-item questionnaire, was used to categorize participants as having adequate knowledge, based on previously published studies using the same or comparable knowledge assessment approaches [12, 13]. This threshold was used as a categorical indicator for descriptive and supplementary analyses and should not be interpreted as a formally validated clinical or psychometric cutoff for this instrument. To minimize potential information loss associated with dichotomization, the total knowledge score was also analyzed as a continuous outcome, including the pre–post change, 95% confidence interval, and effect size.

Table 1. Criteria for assessing nursing students' knowledge of standard precautions

Content	Adequate knowledge	Inadequate knowledge
Knowledge by domain (Maximum score: 5 points per domain)	≥ 70% of the total score	< 70% of the total score
Overall Knowledge of Standard Precautions (Maximum score: 50 points)	≥ 70% of the total score	< 70% of the total score

2.4. Data collection procedures

Following approval from the Institutional Review Board/Ethics Committee for Biomedical Research, the research team collaborated with the Faculty of Nursing to identify eligible students and provide them with information regarding the study objectives, procedures, and participants' rights. Students who agreed to participate were asked to provide written informed consent and were assigned a unique study identification code to ensure confidentiality.

Prior to the intervention, participants completed a questionnaire assessing their knowledge of standard precautions. They then attended the educational program in accordance with the planned intervention protocol. Immediately after completion of the program, participants were reassessed using a questionnaire with content equivalent to that of the baseline assessment. To minimize recall bias, the order of the questions and response options could be rearranged in the post-intervention assessment.

2.5. Educational intervention program

Table 2. Educational intervention program

Component	Description
Training program title	The Educational Intervention on Standard Precautions for Nursing Students
Participants	Second-year full-time undergraduate nursing students enrolled in the 2025 – 2026 academic year at Hue University of Medicine and Pharmacy, Hue University.
Program objective	To enhance students' knowledge of standard precautions and improve their understanding of infection prevention practices before clinical placement.
Intervention providers	The theoretical session was delivered by one nursing faculty member with expertise in infection prevention and control (IPC) and nursing education. The practical and simulation-based sessions were facilitated by multiple instructors, including physicians and nurses from the Infection Prevention and Control Department and nursing faculty members. These instructors supervised students' practice, provided demonstrations, and gave immediate feedback.
Organization of the intervention	The intervention consisted of two sequential components: (1) a theoretical session conducted for all participating students in a single classroom setting, followed by (2) a small-group practical and simulation-based session. During the practical component, students were divided into smaller groups of approximately 20 participants, with each group supervised by one instructor to ensure adequate guidance and interaction.
Program content	The educational intervention was developed based on standard precautions guidelines issued by the Vietnamese Ministry of Health, the World Health Organization (WHO), and relevant infection prevention and control materials. The program covered the fundamental principles of standard precautions; hand hygiene; use of personal protective equipment; respiratory hygiene; appropriate patient placement; injection safety and prevention of sharps injuries; reprocessing of medical equipment; linen management; environmental cleaning; and healthcare waste management.
Teaching methods	A blended teaching approach was used, incorporating interactive lectures, instructional videos, case-based discussions, technique demonstrations, simulation-based practice, and direct feedback from instructors to reinforce knowledge and enhance students' ability to apply standard precautions in practice.
Practical and simulation activities	During the practical sessions, students participated in instructor-guided demonstrations and simulation activities related to SP implementation. These activities included hand hygiene techniques, appropriate selection and use of PPE, safe injection procedures and sharps injury prevention, patient placement decisions, healthcare waste segregation, handling of contaminated materials, and environmental cleaning procedures. Students practiced each procedure under supervision and received feedback from instructors to correct errors and reinforce appropriate techniques.
Duration and session structure	The intervention was completed in a single session lasting 120 minutes. The session included: introduction (2 minutes), theoretical instruction (approximately 50 minutes), practical and simulation-based training (approximately 60 minutes), post-intervention knowledge assessment (5 minutes), and summary/discussion (3 minutes).
Teaching materials and equipment	Teaching materials included PowerPoint presentations, instructional videos, handouts, WHO and Ministry of Health IPC resources, and equipment required for SP practice, including personal protective equipment, hand hygiene supplies, sharps containers, and waste segregation materials.
Evaluation	Participants' knowledge was assessed before and after the educational intervention using the study questionnaire.

2.6. Data analysis

Data were coded, entered, cleaned, and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics, including frequencies and percentages, were used to summarize the general characteristics of the study participants and to describe baseline knowledge of standard precautions among second-year nursing students at Hue University of Medicine and Pharmacy, Hue University. The effectiveness of the educational intervention was evaluated using a McNemar test and Wilcoxon signed-rank test to compare changes in students' knowledge of standard precautions before and after the intervention.

2.7. Ethical considerations

The study was approved by the Ethics Committee of Hue University of Medicine and Pharmacy, Hue University (Approval No. H2026/133, dated April 14, 2026). Before participation, all eligible nursing students were provided with clear information regarding the study objectives, procedures, and relevant study information by the research team. Participation was entirely voluntary, and students were free to decide whether or not to participate. All information collected from participants was used solely for research purposes and was kept strictly confidential. Participants had the right to discontinue their participation or withdraw from the study at any time without any adverse consequences or loss of benefits to which they were otherwise entitled.

3. RESULTS

3.1. General characteristics of the study participants

Table 3. General characteristics of the study participants (n = 260)

Content		Frequency, %
Age (Mean (±SD)) **(19.85 (± 0.51)**)		
Gender	Male	31 (11.9)
	Female	229 (88.1)
Clinical practice	Completed	84 (32.2)
	Not yet completed	176 (67.7)
History of occupational exposure	Yes	32 (12.3)
	No	228 (87.7)
Participation in a standard precautions training course	Yes	14 (5.4)
	No	246 (94.6)
Grade Point Average (GPA) (Mean (±SD)) **(2.22 ± 0.47)**)		

Among the 260 nursing students who participated in the study, the majority were female (88.1%), with a mean age of 19.85 ± 0.51 years. Most participants had not yet undertaken clinical placements (67.7%), had no previous history of occupational exposure (87.7%), and had not attended any training course on standard precautions (94.6%). The mean grade point average of the study participants was 2.22 ± 0.47.

3.2. Knowledge of standard precautions and effectiveness of the educational intervention on nursing students' knowledge of standard precautions

Table 4. Changes in knowledge of standard precautions by content domain before and after the educational intervention (n=260)

Knowledge content	Pre-training (Mean, SD)	Post-training (Mean, SD)	Mean change (post-pre)	CI 95%	Z (pre-post)	p	Effect size (r)
Overview of standard precautions	3.55 (1.05)	4.15 (1.05)	0.60	0.44 to 0.77	-6.59	< 0.01	0.48
Hand hygiene	3.62 (1.02)	3.65 (1.00)	0.03	−0.13 to 0.18	-0.39	0.70	0.03

Use of personal protective equipment (PPE)	2.89 (1.38)	3.37 (1.44)	0.48	0.26 to 0.70	-4.27	< 0.01	0.31
Respiratory hygiene and cough etiquette	3.56 (1.34)	4.13 (1.19)	0.57	0.40 to 0.75	-5.90	< 0.01	0.45
Patient placement	2.93 (1.28)	3.42 (1.34)	0.50	0.30 to 0.70	-4.75	< 0.01	0.36
Handling of medical equipment	2.13 (1.37)	2.77 (1.37)	0.64	0.44 to 0.83	-5.90	< 0.01	0.42
Safe injection practices and prevention of sharps injuries	2.93 (1.44)	3.62 (1.31)	0.69	0.49 to 0.89	-6.34	< 0.01	0.45
Linen handling	3.00 (1.45)	3.66 (1.38)	0.66	0.45 to 0.86	-6.10	< 0.01	0.44
Environmental cleaning	2.64 (1.35)	3.28 (1.30)	0.64	0.44 to 0.84	-5.79	< 0.01	0.42
Waste management	2.17 (1.66)	2.73 (1.75)	0.56	0.32 to 0.81	-4.46	< 0.01	0.32
Current level of knowledge of standard precautions	29.41 (9.81)	34.78 (9.91)	5.37	4.04 to 6.70	-7.41	< 0.01	0.47

Before the intervention, the overall knowledge score was 29.41 ± 9.81. After the intervention, knowledge improved significantly in all domains except hand hygiene (Z = −0.39, p = 0.70, r = 0.03). The overall score increased to 34.78 ± 9.91, with a mean improvement of 5.37 points (95% CI: 4.04 – 6.70; Z = −7.41, p < 0.001, r = 0.47).

Table 5. Changes in the proportion of students with adequate knowledge of standard precautions before and after the educational intervention (n = 260)

Knowledge content	Assessment	Pre-training		Post-training		McNemar's χ^2	p
		n	%	n	%		
Overview of standard precautions	Adequate	134	51.5	205	78.8	46.67	0.01
	Inadequate	126	48.5	55	21.2		
Hand hygiene	Adequate	154	59.2	159	61.2	0.14	0.71
	Inadequate	106	40.8	101	38.8		
Use of personal protective equipment (PPE)	Adequate	95	36.5	134	51.5	13.75	0.01
	Inadequate	165	63,5	126	48.5		
Respiratory hygiene and cough etiquette	Adequate	153	58.8	201	77.3	20.84	0.01
	Inadequate	107	41.2	59	22.7		
Patient placement	Adequate	75	28.8	121	46.5	20.66	0.01
	Inadequate	185	71.2	139	53.5		
Handling of medical equipment	Adequate	67	25.8	95	36.5	8.1	0.01
	Inadequate	193	74.2	165	63.5		
Safe injection practices and prevention of sharps injuries	Adequate	111	42.7	162	62.3	21.74	0.01
	Inadequate	149	57.3	98	37.7		

Knowledge content	Assessment	Pre-training		Post-training		McNemar's χ^2	p
		n	%	n	%		
Linen handling	Adequate	106	40.8	153	58.8	20.15	0.01
	Inadequate	154	59.2	107	41.2		
Environmental cleaning	Adequate	92	35.4	133	51.2	14.41	0.01
	Inadequate	168	64.6	127	48.8		
Waste management	Adequate	100	38.5	139	53.5	12.34	0.01
	Inadequate	160	61.5	121	46.5		
Current level of knowledge of standard precautions	Adequate	74	28.5	147	56.5	51.33	0.01
	Inadequate	186	71.5	113	43.5		

Before the intervention, only 28.5% of nursing students demonstrated adequate knowledge of standard precautions. Adequate knowledge was highest for hand hygiene (59.2%) and lowest for medical equipment reprocessing (25.8%) and patient placement (28.8%). Following the intervention, the proportion with adequate overall knowledge increased significantly to 56.5% ($p < 0.01$). Significant improvements were observed across most knowledge domains, except for hand hygiene ($p = 0.71$).

4. DISCUSSION

4.1. Baseline knowledge of standard precautions

Before the intervention, second-year nursing students demonstrated suboptimal baseline knowledge of standard precautions, with only 28.5% achieving adequate knowledge and a mean score of 29.41 ± 9.81. The cohort had a mean age of 19.85 years; 67.7% had not yet undertaken clinical rotations, and 94.6% had received no formal infection prevention and control (IPC) training. Limited clinical exposure may therefore have restricted students' opportunities to apply theoretical IPC principles to clinical situations.

The baseline adequacy rate was comparable to findings from Nguyen Tat Thanh University (26.9%) [5], but higher than those reported at Vinh Medical University (5.9%) [15] and Can Tho University of Medicine and Pharmacy (11.1% – 14.7%) [2, 16]. Conversely, higher rates have been reported at Hai Duong Medical Technical University (47.66%) [17], Duy Tan University (60.3%) [18], Pham Ngoc Thach University of Medicine (84.2%) [18], and Hanoi Medical University (64.2% – 84.2%) [19, 20]. Differences across studies may reflect variations in students' academic year, previous clinical exposure, timing and content of IPC education, and the instruments and thresholds used to assess adequate knowledge. Nevertheless, these findings are consistent with previous evidence suggesting that greater academic seniority and clinical exposure may be associated with higher SP knowledge and compliance [6, 21].

At baseline, students performed best in Hand Hygiene (59.2%) and Respiratory Hygiene/Cough Etiquette (58.8%), whereas the largest knowledge gaps were observed in Medical Equipment Reprocessing (25.8%), Patient Placement (28.8%), Environmental Cleaning (35.4%), PPE Use (36.5%), Healthcare Waste Management (38.5%), and Linen Handling (40.8%). This pattern is consistent with findings from Duy Tan University and Hai Duong Medical Technical University, where equipment reprocessing, linen handling, and environmental sanitation were among the weakest domains [17]. The lower scores in these areas may reflect students' limited exposure to hospital-based IPC procedures, as equipment reprocessing, patient placement, environmental cleaning, and waste management are often more directly encountered and reinforced during clinical training than in classroom-based instruction.

4.2. Effectiveness of the educational intervention

Following the blended educational intervention, the proportion of students achieving adequate overall SP knowledge increased from 28.5% to 56.5% (McNemar's $\chi^2 = 51.33$, $p = 0.01$), while the mean knowledge score increased from 29.41 ± 9.81 to 34.78 ± 9.91 ($p < 0.01$). Significant improvements ($p < 0.01$) were also observed in several domains, including Safe Injection Practices & Sharps Injury Prevention (42.7% to 62.3%), Linen Handling (40.8% to 58.8%), Patient Placement (28.8% to 46.5%), Overview of Standard Precautions (51.5% to 78.8%), and Respiratory Hygiene & Cough Etiquette (58.8% to 77.3%). These findings indicate that participation in

the blended educational intervention was associated with improved SP knowledge among second-year nursing students.

The observed improvement may be related to the integration of multiple learning strategies, including theoretical instruction, instructional videos, and simulation-based case scenarios. Compared with lecture-based instruction alone, multimodal learning provides opportunities for students to visualize IPC procedures and apply theoretical knowledge to simulated clinical situations. In the present study, case-based simulation may have been particularly relevant to improvements in domains requiring practical decision-making, such as safe injection practices and patient placement. Previous experimental and quasi-experimental studies have similarly reported improvements in SP knowledge and related learning outcomes following blended or simulation-based educational approaches [3, 6, 22, 23].

Hand Hygiene was the only domain in which no statistically significant improvement was observed (59.2% vs. 61.2%, p = 0.71). This finding may partly reflect students' relatively greater baseline familiarity with hand hygiene principles, leaving less room for short-term improvement. Nevertheless, nearly two-fifths of students remained below the adequacy threshold after the intervention, indicating persistent gaps in detailed technical knowledge, including specific indications and appropriate hand hygiene methods. Previous studies suggest that developing hand hygiene competency may require repeated practice, simulation, reinforcement, and direct clinical supervision rather than a single educational exposure [3, 6].

Although the proportion of students achieving adequate overall knowledge increased to 56.5% after the intervention, 43.5% remained below the predefined adequacy threshold. This finding suggests that a single educational intervention may be insufficient to ensure comprehensive and sustained SP knowledge. Furthermore, improved knowledge should not be assumed to translate directly into appropriate clinical practice. For example, senior students at Pham Ngoc Thach University demonstrated 84.2% adequate knowledge but only 52.7% correct practice [18]. Strengthening SP knowledge before clinical placement may therefore provide an important foundation for subsequent competency development, particularly given previously reported associations between SP knowledge and compliance behaviors [16, 18]. IPC education could be integrated longitudinally throughout nursing curricula through repeated simulation, hands-on training, and competency-based assessment. Coordination between nursing schools and affiliated hospitals may also facilitate consistent IPC instruction, standardized clinical procedures, access to appropriate PPE, and continuous feedback during clinical training.

This study has several limitations. First, the single-group pre–post design without a control group limits causal inference; therefore, the observed improvement cannot be attributed solely to the educational intervention. Second, knowledge was assessed immediately after the intervention, and the study did not evaluate long-term knowledge retention or changes in actual clinical practice. Third, repeated administration of the same or similar questionnaire may have introduced a testing effect, whereby familiarity with the assessment contributed to post-intervention performance. Finally, the study was conducted at a single university, which may limit the generalizability of the findings to nursing students in other educational and clinical settings. Future research should employ controlled, multicenter, and longitudinal designs to assess the sustainability of knowledge gains and determine whether educational interventions lead to measurable improvements in observed SP practices and clinical competency over time.

5. CONCLUSION

Second-year nursing students demonstrated suboptimal baseline knowledge of standard precautions, with adequate knowledge increasing from 28.5% to 56.5% immediately after the educational intervention. These findings support the early and systematic integration of SP education into nursing curricula through theoretical instruction, simulation, and practical training. Future controlled, multicenter, and longitudinal studies should assess long-term knowledge retention and its translation into clinical practice.

Conflict of interest

The authors declare no conflicts of interest.

REFERENCES

1. Trần TTL, Võ TX. Đánh giá sự tuân thủ các biện pháp phòng ngừa chuẩn của sinh viên điều dưỡng và các yếu tố liên quan. Tạp chí Y Dược Huế. 2022;12(6):119-127. doi:10.34071/jmp.2022.6.16.

2. Nguyễn LKA, Nguyễn VT, Nguyễn TKT, Trần NN, Nguyễn TTM, Trần TMT và cộng sự. Kiến thức và thái độ về phòng ngừa chuẩn của sinh viên điều dưỡng Trường Đại học Y Dược Cần Thơ. Tạp chí Y Dược học Cần Thơ. 2024;(80):168-174. doi:10.58490/ctump.2024i80.3026.

3. de Almeida Lima AB, Gusmão CMP, do Espirito Santo Lima L, Rocha DM, Menegueti MG, de Oliveira E Silva AC, et al. Effect of an educational intervention on nursing students' knowledge about COVID-19 and compliance with standard and transmission-based precautions: a quasi-experimental study. BMC Nurs. 2025;24(1):1071. doi:10.1186/s12912-025-03672-y.

4. Nguyen TL, Tran TTH, Dang TTT, Le TH. Standard precautions knowledge among nursing students at Duy Tan University in 2024. JNS. 2025;8(1):47-58. doi:10.54436/jns.2025.01.903.

5. Tô TL, Lê TBN, Lê TQP, Phạm DQ. Kiến thức, thái độ về phòng ngừa chuẩn của sinh viên điều dưỡng Trường Đại học Nguyễn Tất Thành. Tạp chí Khoa học và Công nghệ - Đại học Nguyễn Tất Thành. 2024;7(4):88-92. doi:10.55401/m39wtm57.

6. Bouget Mohammedi S, Landelle C. Review of literature: Knowledge and practice of standard precautions by nursing student and teaching techniques used in training. Am J Infect Control. 2023;51(5):574-581. doi:10.1016/j.ajic.2022.08.032.

7. Bộ Y tế. Quyết định số 3671/QĐ-BYT về Hướng dẫn phòng ngừa chuẩn trong các cơ sở khám chữa bệnh, Hà Nội. 2012.

8. Bộ Y tế. Tài liệu đào tạo phòng và kiểm soát nhiễm khuẩn, Hà Nội. 2012.

9. Bộ Y tế. Quyết định số 3916/QĐ-BYT về Phê duyệt các hướng dẫn kiểm soát nhiễm khuẩn trong các cơ sở khám bệnh, chữa bệnh, Hà Nội. 2017.

10. Bộ Y tế. Thông tư 16/2018/TT- BYT Quy định về kiểm soát nhiễm khuẩn trong các cơ sở khám bệnh, chữa bệnh, Hà Nội. 2018.

11. Bộ Y tế. Thông tư 20/2021/TT-BYT Quy định về quản lý chất thải y tế trong phạm vi khuôn viên cơ sở y tế, Hà Nội. 2021.

12. Nguyễn TMH, Trần NN, Đinh TKD, Trần THP. Kiến thức, thái độ về phòng ngừa chuẩn của điều dưỡng viên Bệnh viện Nội tiết Trung ương năm 2022. Tạp chí Khoa học Điều dưỡng. 2023;6(3):6-14. doi:10.54436/jns.2023.03.633.

13. Nguyễn TP, Trần TKN, Phạm NN. Khảo sát kiến thức và thái độ về phòng ngừa chuẩn của nhân viên y tế trong phòng chống dịch COVID-19 tại Bệnh viện Đà Nẵng. Tạp chí Y Dược Huế. 2022;12(6):142-148. doi:10.34071/jmp.2022.6.19.

14. Lynn MR. Determination and quantification of content validity. Nurs Res. 1986;35(6):382-385. doi:10.1097/00006199-198611000-00017.

15. Vũ TTT, Trương TA. Thực trạng và một số yếu tố liên quan đến kiến thức, thái độ về phòng ngừa chuẩn của sinh viên điều dưỡng Trường Đại học Y khoa Vinh năm 2018. Tạp chí Khoa học Điều dưỡng. 2018;1(2):84-89.

16. Trần VN, Nguyễn VH, Lê BM. Kiến thức, thực hành phòng ngừa chuẩn và các yếu tố liên quan ở nhân viên y tế tại Trung tâm y tế huyện An Biên tỉnh Kiên Giang năm 2024. Tạp chí Nghiên cứu Y học. 2025;194(9):315-356. doi:10.52852/tcncyh.v194i9.3866.

17. Đỗ TTH, Nguyễn TH. Kiến thức và thái độ về các biện pháp phòng ngừa chuẩn của sinh viên điều dưỡng Trường Đại học Kỹ thuật Y tế Hải Dương. Tạp chí Y học Việt Nam. 2023;530(2):105-108. doi:10.51298/vmj.v530i2.6807.

18. Nguyễn HY, Nguyễn HKL. Kiến thức và thực hành về phòng ngừa chuẩn của sinh viên Điều dưỡng năm 3 và 4 Trường Đại học Y khoa Phạm Ngọc Thạch. Tạp chí Y Dược học Phạm Ngọc Thạch. 2023;2(2):191-198. doi:10.59715/pntjmp.2.2.24.

19. Trần TT, Nguyễn ĐV, Nguyễn TTH. Kiến thức về phòng ngừa chuẩn của sinh viên cử nhân điều dưỡng năm cuối Trường Đại học Y Hà Nội năm 2019 [Luận văn thạc sĩ]. 2020. http://dulieuso.hmu.edu.vn/handle/hmu/2275.

20. Bùi VT, Bùi VB, Phạm TS, Bùi TDH, Lê TH. Kiến thức về phòng ngừa chuẩn của sinh viên năm cuối Trường Đại học Y Hà Nội năm 2021. Tạp chí Y học Việt Nam. 2021;507(1):122-126. doi:10.51298/vmj.v507i1.1337.

21. Cheung K, Chan CK, Chang MY, Chu PH, Fung WF, Kwan KC, et al. Predictors for compliance of standard precautions among nursing students. Am J Infect Control. 2015;43(7):729-734. doi:10.1016/j.ajic.2015.03.007.

22. Xiong P, Zhang J, Wang X, Wu TL, Hall BJ. Effects of a mixed media education intervention program on increasing knowledge, attitude, and compliance with standard precautions among nursing students: A randomized controlled trial. Am J Infect Control. 2017;45(4):389-395. doi:10.1016/j.ajic.2016.11.006.

23. Hassan ZM. Improving knowledge and compliance with infection control Standard Precautions among undergraduate nursing students in Jordan. Am J Infect Control. 2018;46(3):297-302. doi:10.1016/j.ajic.2017.09.010.