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Effectiveness of Educational Interventions to Develop Patient Safety Competencies in Undergraduate Nursing Students

A Systematic Review

Helena De Rezende, PhD, RN; Alexandre Souza Morais, PhD, RN; Aline Mirema Ferreira Vitorio, MSc, RN; Ellen Regina Sevilla Quadrado, PhD, RN; Ana Claudia Alcântara Garzin, PhD, RN; Maristela Santini Martins, PhD, RN; Daniela Campos de Andrade Lourenção, PhD, RN; Roberto Chrispim Modesto, RN; and Andressa Garcia Nicole, PhD, RN

ABSTRACT

Background: Nursing professionals are key to providing safe care that improves patient outcomes. Hence, it is essential to focus on developing nurses' patient safety competencies and principles.

Purpose: This review examined the effectiveness of educational interventions in developing patient safety knowledge, skills, behaviors, and attitudes in undergraduate nursing students.

Methods: The search strategy aimed to identify published and unpublished studies in databases and grey literature. Studies were assessed using the Joanna Briggs Institute critical appraisal tools.

Results: A total of 36 studies met the inclusion criteria. The teaching methods employed single or combined interventions and the educational interventions suggested either improvements in outcomes or no impact.

Conclusion: The effectiveness of educational interventions to develop patient safety competencies in undergraduate nursing students, either as a single or combined strategy, was mixed. Further research is needed to provide more robust evidence on which teaching method for patient safety is most effective.

Keywords: curriculum, errors, medication safety, patient safety education, systematic review, teaching methods

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Patient safety is defined as a framework of activities that create cultures, processes, procedures, behaviors, technologies, and environments in health care that consistently minimize risks, prevent avoidable harm, and reduce the impact of errors.[1] Despite worldwide efforts to reduce harm, patient safety incidents remain the leading cause of death and disability globally[2] and incur significant financial and economic costs, reducing trillions of dollars in global economic output annually.[3]

Nurses play a pivotal role in the provision of safe care. A significant portion of the nursing workforce is responsible for delivering and coordinating care and contributing to the development of organizational structures that aim to enhance patient outcomes.[4] Nurses are also essential for addressing the health care system's challenges with their comprehensive and specialized skills, participation in leadership and management, and quality and safety measures.[5] Therefore, undergraduate nursing edu-

Author Affiliations: Department of Nursing Sciences (Dr De Rezende), Bournemouth University, Bournemouth, UK; Health and Nursing Management Research Group (Drs Morais and Nicole), UFES, Federal University of Espírito Santo, São Mateus, Espírito Santo, Brazil; Seção de Auditoria em Goiás, Ministério da Saúde, Auditoria Geral do Sistema Único de Saúde (Ms Vitorio), Goiás, Goiânia, Brazil; Nursing School (Drs Quadrado, Dr Lourenção, and Modesto), Quality and Safety in Nursing and Health Services Research Group, USP, University of São Paulo, São Paulo, São Paulo State, Brazil; Quality and Safety in Nursing and Health Services Research Group (Dr Garzin), Centro Universitario São Camilo, São Paulo, São Paulo State, Brazil; and Nursing School (Dr Martins), The Brazilian Centre for Evidence-based Healthcare: A JBI Centre of Excellence, Quality and Safety in Nursing and Health Services Research Group USP, University of São Paulo, São Paulo, São Paulo State, Brazil.

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Correspondence: Dr De Rezende, Principal Academic in Adult Nursing, Bournemouth University, Room BGB-410, Lansdowne Campus 12 St Paul's Ln, Bournemouth BH8 8GP, UK (hderezende@bournemouth.ac.uk).

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cation should be designed to develop nurses' knowledge, skills, behaviors, and attitudes that align with patient safety principles and improve the quality of health care systems.[6,7]

Despite the indication that patient safety education is a key priority, it is yet to be fully implemented, and there exist several inconsistencies in patient safety education across nursing programs.[8,9] Additionally, there is a necessity for greater agreement and understanding of the best approaches for teaching patient safety to prelicensure nursing students and to identify the most effective teaching methods.[10-12]

A preliminary search of PROSPERO and MEDLINE identified 2 published systematic reviews on this topic. A rapid review[13] investigated only clinical learning environments that facilitate nursing students' development of patient safety competencies. The other explored only the core concepts of patient safety, resulting in few articles investigating nursing students.[14] Thereafter, students from other disciplines were included.

Given these limitations, this systematic review sought to contribute to the evidence on this topic and aimed to evaluate the effectiveness of educational interventions in developing patient safety knowledge, skills, behaviors, and attitudes in undergraduate nursing students.

Methods

This review was conducted using the Joanna Briggs Institute (JBI) methodology for systematic reviews of effectiveness[15] and reported according to the Preferred Reporting Items for Systematic Review and Meta-analysis Protocol guidelines (PRISMA).[16] A review protocol was published previously[17] and registered in PROSPERO (CRD42021254965).

Inclusion and Exclusion Criteria

A review question was developed to support the inclusion criteria: How effective are educational interventions in developing patient safety knowledge, skills, behaviors, and attitudes among undergraduate nursing students? Inclusion criteria were: (1) participants were fully composed of undergraduate nursing students; (2) evaluated any educational intervention aimed at teaching patient safety within the existing topic areas of the WHO Multiprofessional Patient Safety Curriculum Guide: Multiprofessional edition[18]; and (3) considered studies that described and evaluated at least one of the subsequent outcomes: nursing students' knowledge, skills, behaviors, and attitudes related to patient safety. Furthermore, this review considered experimental and quasi-experimental study designs, including non-randomized and randomized controlled trials (RCTs), before-and-after studies, and interrupted time series studies. Additionally, analytical observational studies, including prospective and retrospective cohort, case-control, and analytical cross-sectional studies, were considered for inclusion. Excluded studies included non-nursing subjects and studies that did not assess an educational intervention and did not address the outcomes stated above.

Search Strategy

An initial search was performed in MEDLINE and the Cumulative Index to Nursing and Allied Health Literature (CINAHL), in consultation with a university librarian, to identify articles on this topic. The index terms and keywords in the titles and abstracts were used to develop a full search strategy. A second search was conducted across 7 databases: MEDLINE (PubMed), CINAHL (EBSCOhost), Scopus (Elsevier), Education Research Complete (EBSCOhost), Cochrane Central Register of Controlled Trials (CENTRAL), Latin American and Caribbean Health Sciences Literature (LILACS), Medes (Spain), and ClinicalTrials.gov for registers. Sources of unpublished studies and grey literature searches were Google Scholar, DART-Europe, ProQuest Dissertations and Theses, Coordination for the Improvement of Higher Education Personnel, Brazil (CAPES thesis and dissertations), The Virginia Henderson Global e-Repository, Mednar, and Thesis Canada. The third search included screening the reference lists of all studies selected for critical appraisal to identify additional studies.

Studies published in English, Spanish, and Portuguese were included. The timeframe for searching the literature was from July 2011, reflecting when the WHO National Patient Safety Curriculum Guide: Multi-professional Edition[18] was published, to May 31, 2024 (see the search strategies in Supplemental Digital Content Table 1, available at: http://links.lww.com/NE/B686).

Study Selection

Following the search, all identified citations were collated and uploaded to EndNote online (Clarivate Analytics, Pennsylvania, USA), and duplicates were removed. After a pilot test, titles and abstracts were screened by 2 independent reviewers. Furthermore, potentially relevant studies were retrieved and their citation details were imported to Ryyan.[19] The full texts of the selected citations were assessed in detail against the inclusion criteria. The reasons for excluding full-text studies that did not meet the inclusion criteria were recorded and reported. Any disagreements between the reviewers at each stage of the study selection process were resolved through discussion or by consultation with a third reviewer.

Assessment of Methodological Quality

Two independent reviewers critically appraised the eligible studies using standardized critical appraisal instruments from the JBI for experimental, quasi-experimental, and observational studies.[15] Disagreements were resolved through discussion or by a third reviewer. The authors of the papers were contacted to request missing

or additional data for clarification. Regardless of the methodological quality, all studies were included in the data extraction and synthesis.

Data Extraction

Data were extracted from the included studies by 2 independent reviewers and verified by other authors. The data extraction tool included specific details about the study author(s), country, setting of the intervention, characteristics of participants, study design, and description of the intervention (including the type of educational method and duration of the intervention). Outcomes of significance to the review question assessed (knowledge, skills, behaviors, and attitudes), follow-up time, main results, limitations, and additional data, when required, were also extracted.

Data Synthesis

The literature suggests that synthesizing data from educational interventions is challenging due to heterogeneities in interventions and study methodologies.[20,21] In line with this evidence, the studies included in this review were heterogeneous in their interventions, designs and outcome measures; therefore, statistical pooling of results was not possible. Owing to these heterogeneities, the findings were presented in the narrative form following the synthesis without meta-analysis[22] in systematic reviews. A direction of effect plot was used to help visualize the effectiveness of the interventions.[23]

Results

Thirty-six studies met the inclusion criteria and were included in the review. Search results and screening are summarized in the PRISMA[16] flow diagram (see Supplemental Digital Content Figure 1, available at: http://links.lww.com/NE/B685).

Characteristics of Included Studies

The detailed characteristics of all included studies were presented in the Supplemental Digital Content Table 2, available at: http://links.lww.com/NE/B687 and are summarized. The studies were published in 14 countries between 2012 and 2024. There were 3,534 students, and the number of participants ranged from 23 to 373.

Various teaching methods were used in the interventions. Sixteen studies applied single interventions, with simulation being the most common. Other single interventions included problem-based learning (PBL), traditional lectures, lectures using video demonstrations, group work, individual tutorials, flipped classrooms, and mobile web-based training.

A range of combined interventions were employed in 20 studies. Lectures were the most common teaching method presented and were combined with several other approaches, such as group discussions, skills laboratories, clinical placements, flipped classrooms, simulation, online activities (synchronous and asynchronous), PBL, and virtual reality. Other combined interventions included group and individual discussions during placements, skills and simulation, video presentation and group discussions, online modules followed by seminars using a flipped classroom, online workshop, videos and PBL, a lecture, skill laboratory, and 2 clinical days in placement, design thinking and case-based learning and finally, online seminar and simulation. The content within the existing topic areas of the WHO Patient Safety Curriculum Guide[18] varied between studies. Some included multiple topics, whereas others focused on only one topic.

Across the studies, most of the outcomes were measured immediately after the conclusion of the educational intervention, with some studies measuring outcomes in a short time and another 6 months later. Of the 25 assessment tools identified in our 36 studies, the issue of content validity was raised in the descriptions of 6 tools (24%). According to the response process, rater training was described for 3 tools (12%). The matter of internal structure was mentioned in 18 tools (72%). Most of the tools had acceptable reliability, and in 11 studies (44%), information regarding validity and reliability was not provided (see Supplemental Digital Content Table 3, available at: http://links.lww.com/NE/B688).

Critical Appraisal

The studies were graded as low (70% score "yes"), moderate (50-69% score "yes"), or high (≤49% score "yes") risk of bias.[24] Among the 36 studies included in this review, 58.3% were found to have a moderate risk of bias. Of the 33 before-and-after studies, most (60.6%) were graded as having a moderate risk of bias. The critical appraisal showed that 19 studies (57.6%) had a control group, none of the studies had multiple measurements of the outcome both before and after the intervention, and only 6 studies (18%) had outcomes measured in a reliable way (see Supplemental Digital Content Table 4, available at: http://links.lww.com/NE/B689). The RCTs (n = 2) were graded as having a low risk of bias. Owing to the nature of the educational interventions, it was not possible to blind the participants and instructors (see Supplemental Digital Content Table 5, available at: http://links.lww.com/NE/B690). The prospective cohort study was rated as having a moderate risk of bias. The method of exposure measurement was not clearly described, the study had a short follow-up time, and strategies to address incomplete follow-up were not utilized. Finally, the analytical techniques used were not clearly described and it was not clear how specific confounders were measured (see Supplemental Digital Content Table 6, available at: http://links.lww.com/NE/B691).

Effectiveness of the Interventions

Mixed results were observed regarding the effects of educational interventions on the various outcomes measured. Most studies (67.6%) assessed more than 1 outcome.

Patient safety knowledge was assessed in 30 studies, including all 11 topics in the WHO multi-professional curriculum guide.[18] Of these, 11 studies reported a significant increase in all dimensions of patient safety knowledge after the educational interventions, while 6 reported a significant increase in only some dimensions.

Sixteen studies evaluated patient safety skills, covering all topics in the WHO multi-professional curriculum guide[18] except patient safety during invasive procedures (Topic 10). Of these, 9 reported a significant improvement in all dimensions of patient safety skills post-intervention, and 1 demonstrated a significant increase in only some dimensions of patient safety skills post-intervention.

Only 2 studies addressed patient safety behaviors, focusing on improving medication safety (Topic 11).[18] One study reported a significant increase in patient safety behaviors, whereas another showed no changes after the intervention.

Patient safety attitudes were addressed in 25 studies, which followed the contents of all topics of the WHO Patient Safety Curriculum Guide: Multi-professional Edition.[18] Eight studies reported a significant increase in all dimensions of patient safety attitudes after the intervention, while 5 studies only reported a significant increase in some dimensions. The Supplemental Digital Content Table 7, available at: http://links.lww.com/NE/B692 presents the visual summaries of the effect direction of all outcomes.

Discussion

To the best of our knowledge, this is the first systematic review to use a comprehensive search strategy and retrieve all relevant studies from databases and grey literature to assess undergraduate nursing students' patient safety knowledge, skills, behaviors, and attitudes.

The educational interventions varied and included single and combined strategies. They applied traditional methods such as lectures, seminars, group work, discussions, skills laboratories, simulation sessions, and clinical placements, as well as more innovative approaches such as flipped classrooms, online activities, PBL, quizzes, design-thinking, virtual reality and mobile web-based training. These findings are in line with those of a previous systematic review,[14] which demonstrates several types of teaching modalities that may be effective in engaging students to enhance patient safety learning and competencies.[6]

The most frequently included concepts were patient safety principles and theories, a systemic approach to errors, clinical risk management, and improving medication safety. This evidence shows that essential components of teaching patient safety that are often missing were covered in pre-licensure nursing education.[1,25] Conversely, the topic of engaging with patients and carers was the least common and highlights the necessity to focus more on teaching nursing students the importance of patient engagement to enhance safety. Treating patients as partners is essential for improving patient safety by fostering collaborative relationships between patients and health care providers, promoting effective communication, and enabling patients to play an active role in their care.[26,27]

The instruments used to assess the effectiveness of the interventions were numerous, and information regarding their validity and reliability was not consistent. According to previous research, creating trustworthy and accurate tools for measuring safety competencies is difficult,[28] and previous reviews have identified the absence of a reliable and valid tool that covers all patient safety domains.[29,30]

Most of the studies were graded as having a moderate risk of bias and denoting a lack of a control group and multiple assessments before and after the intervention. Additionally, significant heterogeneity was presented across the studies and was related to variations in course design, teaching methods and contents, and outcomes assessment, which made the meta-analysis unfeasible. These results are similar to those of previous systematic reviews conducted among medical students and trainee physicians.[31,32]

The findings highlighted have contributed to the inconsistent and mixed results about the effectiveness of educational interventions in the 36 studies reviewed. It also reflects the variability and complexity of educational interventions and their impact on patient safety competencies in undergraduate nursing students. Moreover, it has raised concerns about patient safety education in nursing and the necessity for more effective approaches. This is in accordance with other studies showing that patient safety education for undergraduate nursing students is inconsistent,[9,33] and more evidence is required regarding the most effective practices for educating pre-registration nursing students and the methods that should be utilized for optimal results.[11,34]

High-quality research is needed to identify effective strategies for developing nursing students' patient safety competencies. Studies with control groups can better assess changes before and after interventions, while longitudinal studies can track their impact over time. Additionally, validated instruments that can reliably evaluate these competencies should be employed.

Limitations

The studies showed significant heterogeneity in methodology, interventions, outcome measures, and reporting, which precluded meta-analysis and did not allow the calculation of standardized effect sizes. Additionally, owing to the time and limitations of translation services,

excluding languages other than English, Spanish, and Portuguese may have omitted otherwise eligible studies.

Conclusion

This systematic review found significant differences in how patient safety education is delivered to undergraduate nursing students in terms of course design, content, the stage at which it is introduced into the curriculum, the evaluation process, and the assessment tools and outcomes in the included studies. Educational frameworks for patient safety can support nursing education, providing evidence-based materials to help in curriculum development.

The interventions described in this review may help to guide new strategies for enhancing patient safety knowledge, skills, behaviors, and attitudes in undergraduate nursing students. It is paramount for researchers and educators to continue developing patient safety curricula and examine the effects of educational interventions using more robust research methodologies.

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TEACHING TIPS

New Nurse Journal Club: 5 Tips for Success!

New and seasoned nurses may feel intimidated when it comes to evidence-based practice. Our accredited, 1-year, systemwide residency program is for any new nurse hired with less than 6 months of experience. A journal club was created as a safe space for nurse residents to gain peer support and confidence while reviewing the latest research. We realized that new nurses are interested in learning more about research and even presenting. Here is how we get 100 or more attendees, lessons learned, and how you can help your journal club take off! **(1) Go virtual. . .but set ground rules.** The camera must be on, and participation is required for credit. **(2) Get the residents involved.** Let the residents select the topic and article and create the presentation. **(3) Select a convenient time, stick to it, and send frequent reminders.** A 4 p.m. meeting is not convenient when most new nurses work nights. Meeting the first Wednesday of every month at 8 p.m. has gained us the highest consistent attendance. **(4) Offer many opportunities.** Meeting once per month has allowed more people to present and more people to join to meet their requirements, compared to initial bimonthly meetings. **(5) Keep the meetings closed.** Aside from the 2 journal program moderators (managers), by restricting meetings to peers only, the nurse residents engage in lengthy and in-depth discussions during meetings.

By **Jocelyn Marx Townes**, MSN, RN-BC, HNB-BC, Manager Clinical Programs-Nurse Residency, Hackensack Meridian Health, Neptune, New Jersey and Georgian Court University, Lakewood, New Jersey, jocelyn.marx@hmhn.org, and **Sara Scheller Humeny**, MS, BSN, RN, NBC-HWC, HNB-BC, Manager Clinical Programs-Holistic Nursing, Hackensack Meridian Health, Neptune, New Jersey and Drexel University, Philadelphia, Pennsylvania, sara.humeny@hmhn.org.

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TEACHING TIPS

Creating a Room of Errors in the Postpartum Setting

Nursing faculty need to promote critical thinking and an understanding of patient safety protocols in the postpartum clinical setting for prelicensure nursing students. A simulation can address these needs through the development of a Postpartum Room of Errors. Students participated in a simulation that recreated a postpartum patient care area where errors related to medications, documentation, patient safety, infection control, and assessment were present. Assigned prework included completion of templates related to intravenous magnesium sulfate and assessment and care of the newborn. Students watched a video on the care of the postpartum client prior to the simulation. They were provided verbally with the delivery summary and given a blank chart to document erroneous findings related to the birthing parent, newborn, and environment. Students have 10 minutes to identify and analyze these errors. They were directed into the postpartum client room in a small group and did not discuss their findings with their peers during the simulated experience. Debriefing with the maternity and pediatric faculty was completed immediately following the experience. Some of the errors included incorrect patient identifiers, wrong intravenous rate of magnesium sulfate, at home prescriptions on the bedside table, bleeding at the incisional area, and the newborn lying prone with a stuffed animal in the crib (Supplemental Digital Content Implementation Plan, available at: http://links.lww.com/NE/B625).

By **Michelle Kaulback**, EdD, RN, **Michelle O'Connor Kensey**, DNP, RN, and **Adrienne Wharry**, DNP, RN, Department of Nursing, West Chester University of Pennsylvania, West Chester, PA, mkaulback@wcupa.edu.

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