ORIGINALES

The perceptions of nursing students regarding the safe administration of medications

Percepciones de los estudiantes de enfermería sobre la administración segura de medicamentos

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ABSTRACT:
Objective: The purpose of this review was to identify the perceptions of nursing students about the safe administration of medications.
Method: Original empirical research that describes a method to incorporate concepts of safety in the administration of medicines in nursing education and examine the perceptions of nursing students for review. A search of four electronic databases (Scopus, Cumulative Index to Nursing and Allied Health Literature, MedLine / PubMed and Google Scholar), as well as a manual search to identify original research published between 2017 and 2021. Analysis guidelines were adopted (PRISMA) as the preferred reporting element for systematic reviews and meta-analyzes.
Results: Twelve original research articles were included for review. Two methods were identified for incorporating safety in the administration of medications in nursing education: process factors or systems in the clinical setting and educational factors in the academic setting. The use of interventions varied, but all focused on analyzing students' experiences to promote skills and knowledge in different settings (academic and clinical).
Conclusion: Nursing educators must promote theory and clinical experiences in a comprehensive way so that the student learns and internalizes the attitudes, behaviors and values of the profession with a focus of responsibility in all aspects. The perception and training of students could lead to changes in the way drugs are administered, as well as decrease the rate of adverse events in the future.

Keywords: Medication Administration; Patient Safety; Nursing Education; Medication Safety.

RESUMEN:
Objetivo: El propósito de esta revisión fue identificar las percepciones de los estudiantes de enfermería sobre la administración segura de medicamentos.
Método: Investigación empírica original que describe un método para incorporar conceptos de seguridad en la administración de medicamentos en la educación de enfermería y examinar las percepciones de los estudiantes de enfermería para su revisión. Una búsqueda en cuatro bases de datos electrónicas (Scopus, Cumulative Index to Nursing and Allied Health Literature, MedLine / PubMed y Google Scholar), así como una búsqueda manual para identificar investigaciones originales publicadas entre 2017 y 2021. Se adoptaron las directrices de análisis (PRISMA) como elemento de informe preferido para revisiones sistemáticas y metaanálisis.

Resultados: Se incluyeron doce artículos de investigación originales para su revisión. Se identificaron dos métodos para incorporar la seguridad en la administración de medicamentos en la educación de enfermería: factores de proceso o sistemas en el entorno clínico y factores de educación en el entorno académico. El uso de intervenciones varió, pero todas se enfocaron en analizar las experiencias de los estudiantes para promover habilidades y conocimientos en los diferentes entornos (académico y clínico).
Conclusión: Los educadores de enfermería deben promover la teoría y las experiencias clínicas de manera integral para que el alumno aprenda e interiorice las actitudes, comportamientos y valores de la profesión con un enfoque de responsabilidad en todos los aspectos. La percepción y formación de los estudiantes podría generar cambios en la forma en que se administran los medicamentos, así como disminuir la tasa de eventos adversos en el futuro.

Palabras clave: Administración de medicamentos; seguridad del paciente; educación en enfermería; seguridad de los medicamentos.

INTRODUCTION

Medication errors are one of the leading causes of preventable injuries and damage to health care systems [1]. In fact, the worldwide cost associated with medication errors is estimated at $42 billion annually [2]. The administration of medications is a task performed by nurses [3]. Medication administration errors are sometimes difficult to prevent before reaching patients, thereby potentially triggering adverse implications in terms of patient morbidity and mortality [4,5]. Hence, some initiatives to educate future nurses about safety have been trialed. Some support changing the design of the job or the use of information technologies aimed at reducing errors, such as barcodes or smart bombs [6,7]. Other strategies try to improve the knowledge, skills, and attitudes of health professionals in relation to the medication administration process [8,9].

The administration of medications is undoubtedly an area of nursing practice in which safety skills must be employed. In this regard, several initiatives have been put in place at the international level regarding the skills that nursing students must acquire during their studies. These education plans generally focus on patient safety, quality of care, teamwork, communication, and evidence-based information and practice [9]. However, regardless of the possible reforms or changes made to different nursing curricula at the international level, we consider the opinion of the students to be especially important once they have acquired their basic theoretical and practical skills.

Thus, it would be advisable to study new measures or barriers to help avoid adverse events, implement standardized reporting systems and new information technologies (e.g., for dose calculation or infusion pumps, etc.), and even address aspects of communication and therapeutic or psychological relationships. Therefore, the objective of this current review was to identify the perceptions of nursing students regarding the safe administration of medications to see how this can be applied to the invention of new measures or tweaking of existing ones to help avoid medical errors.

METHODS

Search procedure

To implement the review process, we followed the proposals for improving the publication of systematic reviews and meta-analyses [10] and the preferred reporting

items for systematic reviews PRISMA-ScR extension for scoping reviews (see the supplementary file for a checklist and explanation) [11]. The following academic databases were consulted to identify articles for inclusion: the Cumulative Index to Nursing and Allied Health Literature (CINAHL), SCOPUS, Medline/PubMed, and the Cochrane library. The search terms "nurs*" "educ*", "students", "safety", "medication", and "medication error*" were used.

Inclusion and exclusion criteria

Articles describing and evaluating the perceptions of nursing students regarding the safe administration of medications were considered to be of interest. Thus, articles that met the following criteria were included: available in English, published in peer-reviewed academic journals, and printed between 2017 and 2021. This search window was used so as to follow best literature review practices [11] and to use at least a 5-year search frame that would capture relevant and timely publications. Articles describing the perceptions of safe medication administration among health professionals other than nursing students or during graduate programs were excluded.

Data extraction and analysis

Following selection of the articles for inclusion in the review, data was extracted from each one and was organized into a matrix. The extracted data included the year of publication, journal, country of origin, sample size, description of the safety activity, perception or intervention, and results. The accuracy of the data extracted from each article was confirmed and we performed content analysis to identify themes from among the extracted data [12] that would incorporate the perceptions of the nursing students regarding the safe administration of medications.

RESULTS
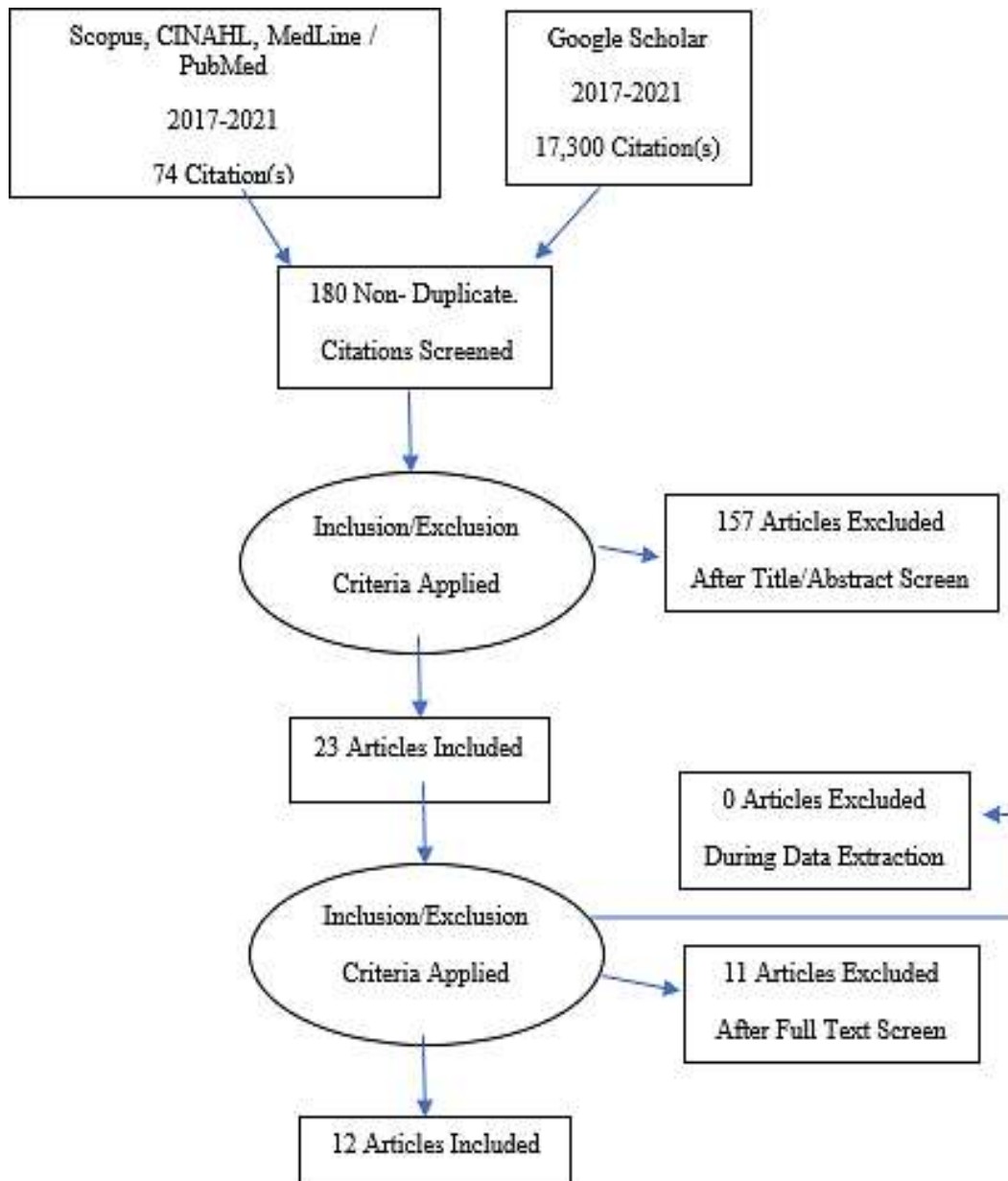
Scopus, CINAHL, and Medline/PubMed

A total of 74 articles were found by searching the leading medical databases and selected journals. Four articles were duplicated, leaving 70 articles for review for potential inclusion according to their titles and abstracts, which led to the exclusion of 50 more manuscripts. Of the remaining 20 sources, 7 articles were excluded after reviewing their full texts.

Google Scholar

Using the same search terms and search limiters, 17,300 articles were found through Google Scholar. Of these, a total of 100 articles were listed, selected, and reviewed for inclusion, in order of relevance. Articles listed after the first 100 hits were not consistently relevant to this present study. Reasons for exclusion included, but were not limited to, the use of samples of nurse practitioners, non-students, other health professionals, and articles on medication errors by students with no report of curricular interventions.

Hence, a final sample of 12 original research articles was finally included in this current review. Figure 1 shows the PRISMA diagram for this entire article selection process.

Figure 1. PRISMA diagram.


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┌─────────────────────────┐        ┌─────────────────────────┐
│ Scopus, CINAHL, MedLine/│        │    Google Scholar       │
│        PubMed           │        │      2017-2021          │
│       2017-2021         │        │   17,300 Citation(s)    │
│     74 Citation(s)      │        │                         │
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              ↘                              ↙
              ┌──────────────────────────────┐
              │   180 Non- Duplicate.         │
              │   Citations Screened          │
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              ┌──────────────────────────────┐    ┌──────────────────────────┐
              │  Inclusion/Exclusion          │ →  │  157 Articles Excluded    │
              │  Criteria Applied             │    │  After Title/Abstract     │
              │                               │    │  Screen                   │
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              ┌──────────────────────────────┐
              │   23 Articles Included        │
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              │   12 Articles Included        │
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Item features

The 12 studies that met the inclusion criteria were reviewed in full. Most of the studies we analyzed had been conducted in the United States. The publication dates of the included studies ranged from 2017 to 2021 and the sample cohorts examined in the articles ranged from 20 to 4,284 nursing students. The characteristics of each article are summarized below in table 1.

Table 1. Characteristics of the articles included in this review.

First author and year	Country	Journal	Sample	Study type	Program
	United States	Nurse Education Today	83 students	Quasi-experimental I	Third year BSN
	Iran	Pediatric Quality and Safety	80 students	Quasi-experimental I	ADN
	Indonesia	Journal of Medical Sciences	26 students	Descriptive and qualitative	BSN
	Canada	The Training Of Nurses in Practice	106 students	Non-experimental descriptive and qualitative	BSN
	United States	Nurse Education Today	99 students	Descriptive and qualitative	BSN
	Chile	Nurse Education Today	53 students	Quantitative transversal description	BSN
	Taiwan	Nurse Education Today	93 students	Quasi-experimental I	ADN and BSN
	Spain	Nurse Education Today	4,284 students	Retrospective longitudinal and observational	BSN
	United States	Nurse Education Today	147 students	Cross-sectional and correlational	BSN
	United States	Nurse Education Today	34 students	Pretest–post-test intervention	BSN
	Qatar	The Training Of Nurses in Practice	20 students	Descriptive and qualitative	BNRT
	Israel	Nurse Education Today	128 students	Quasi-experimental comparison	BSN

Abbreviations: BNRT, Bachelor of Nursing, Regular Track; BSN, Bachelor of Science in Nursing; ADN, Associate Degree in Nursing.

Evidence summary

After analyzing the content of the 12 articles we included, two relevant themes were identified that incorporated the perceptions of nursing students regarding the safe administration of medications. These topics represented factors associated with drug safety concepts in nursing education: clinical settings (clinical systems or processes) and academic settings (academic training). Table 2 shows the results related to these two themes from each included study.

Table 2. Results and evidence from the publications included in this review related to the issues under study.

Theme	First author and year	Instrument	Intervention	Results
Clinical setting. Clinical systems or processes.		Interviews.	Express the perceptions and experiences of students.	Three topics emerged from the data analysis: the vital role nurses play in relation to medication safety; the types of medication errors made by nursing students; and the causes of medication errors during clinical rotations.
		Forms.	Identify areas of instruction associated with patient safety that may be deficient and address these deficiencies in a timely manner.	The largest number of errors reported was made by fifth-year students (73.5%) and the most common type of error was associated with medication administration (94.2%).
		Online notification systems. Questionnaire.	Analyze the characteristics of the adverse events (AEs) reported by nursing students during their clinical practice in different care settings.	The most frequently reported clinical adverse events were medication administration errors (n = 212, 18.2%). There were significant differences between the course years, with second years reporting the most errors.
Academic environment. Academic training.		Simulation with integrated technology.	Examine the effect of an educational strategy incorporating enhanced drug safety simulations on the levels of student knowledge, skills, and confidence.	Students who participated in the intervention group performed significantly better in the medication administration process compared to the control group.
		Telegram messenger application.	Help educators improve student motivation and learning outcomes and help nurses improve their knowledge and skills.	The error frequency was higher in the control groups, suggesting that e-learning with the Telegram messaging application had a significant effect on the performance of students in the intervention groups.
		Questionnaire.	Understand the perceptions of nursing students regarding the feedback provided after medication errors and determine how this feedback affects medication error reporting.	The group sizes were too small to determine whether variables related to teacher feedback were significant. Students indicated their intention to report errors based on professional attitudes, behaviors, and/or values.

Surveys.	Describe the perceptions of students about the relationship between pharmacological education and clinical safety.	Positive responses were characterized by knowledge of how medications work, improvements to the nursing process, and building a foundation of clinical knowledge. The negative responses were based on the inability to move from didactic to clinical practice.
Questionnaire.	To estimate the risk of error among undergraduate nursing students based on their scores on the pharmacology knowledge questionnaire and their self-rated level of certainty.	Drug calculation was the subject area in which students had the lowest mean score. A considerable risk of error was observed in 14% of the students who scored incorrect answers associated with a high degree of certainty.
Simulation.	Examine the effects of simulation training and problem-based scenarios when discussing medication errors among graduating nursing students.	The number of times that participants talked about medication errors improved significantly in both the experimental group (pre-test = 2.05 ± 1.12 and post-test = 6.14 ± 1.25, t = 22.85, $p < 0.01$) and in the control group (pre-test = 2.04 ± 1.16 and post-test = 4.26 ± 1.63, t = 6.33, $p < 0.01$).
Simulation and survey.	To examine the effects on students of an online synchronous active nursing pharmacology learning classroom design with simulated clinical immersion experiences.	The results showed that students believed that simulated clinical immersions promoted authentic learning and confidence.
Focus groups (interpretive description).	Explore the perception of learning mathematical calculations to safely administer medications.	In group 1: fear of mathematics, student success depends on good instructors overcoming student resentment of topics perceived as being 'complicated'. In group 2: lack of confidence among nursing students to calculate medication doses in clinical settings and inconsistency among clinical instructors in terms of the implementation of applied mathematics in clinical settings.
Questionnaire and simulation.	Examine the influence of simulation-based learning of the medication administration process on the satisfaction, self-perceived readiness, and clinical	The simulation experience increased participant readiness when designed both for individual students and groups of students.

performance of students practicing in the simulated environment.

Clinical setting: clinical systems or processes

Three studies [13–15] used questionnaires and interviews about factors associated with systems or processes in clinical settings designed to help students express their perceptions related to the safe administration of medications. Musharyanti et al. [13] recruited 26 undergraduate nursing students to participate in an interview designed to explore their perceptions and experiences of times when medication errors had been made. The student coordinator divided the participants into 4 groups of 6–7 students each. The results indicated that the students were aware of the importance of nurses in patient and medication safety.

Other researchers analyzed adverse events and factors associated with errors that had been reported by students during their clinical nursing rotations [14]. A total of 68 adverse events committed by a total of 53 students over a 6-year period were reported. Among the factors that contributed to the occurrence of errors, the most common cause was failure to review the '10 rights of medication administration' (85.3%).

Another group analyzed the characteristics of the reporting of adverse events by nursing students during their clinical practice in different care settings [15]. The study population comprised 4,284 students enrolled in the nursing undergraduate degree at the University of Malaga (Spain) over 7 consecutive years. There were significant differences in medication administration errors between the course years, with second-year students reporting higher levels of clinical adverse events than third and fourth-year students ($n = 23$; 10.8%; $n = 12$, 5.7%; and $n = 177$, 83.5%, respectively; $\chi^2 = 88.8$, $p < 0.01$).

Academic environment: academic training

Nine studies reported upon factors associated with nursing student academic training for the safe administration of medications. Four of the 9 studies used simulations to examine the influence of simulation-based learning on the process of safe medication administration. Firstly, Craig et al. [16] examined the effect of an educational strategy that incorporated enhanced medication safety simulations on the levels of knowledge, skills, and confidence in nursing students learning the medication administration process. Eighty-three third-year nursing students participated and were randomly assigned to an intervention group ($n = 45$) or a control group ($n = 35$). There were higher levels of confidence in the intervention group than in the control group.

Kuo et al. [17] also examined the effects of simulation and problem-based training scenarios on nursing students in terms of the number of medication errors. Students in the experimental ($n = 66$) and control ($n = 27$) groups were evaluated for their performance in identifying medication errors. Students in the experimental group received 2 hours of medication administration simulation training in addition to the pre- and post-test problem-based scenarios, while the control group students received only

the pre- and post-tests. The performance of the students in the experimental group improved regarding talking about incorrect medications (their talking rate increased from 28.2% to 98.5%, $p < 0.01$).

Also using simulations, Thelen et al. [18] analyzed the effects on students of an online synchronous active nursing pharmacology learning classroom design with simulated clinical immersion experiences. The researchers set up a simulation environment to present a hospital room with a large bedside monitor that actually displayed the patient physiology. To provide synchronous learning, the lectures were delivered through Microsoft® Teams using a webcam and laptop. Results from simulated clinical immersions showed improvement in self-efficacy scores.

Abraham et al. [19] also examined the influence of simulation-based learning of the medication administration process on the satisfaction, self-perceived readiness, and clinical performance of students practicing in the simulated environment, either individually or as a group. Third-year nursing students participated in two consecutive academic courses (78 in the individual sample and 50 in the group sample). The simulation experience increased participant readiness when designed both for individual students and groups of students. Simulation performance was the main contributor to participant preparation among the individual sample ($β = 0.51$, $p < 0.01$), while prior preparation was the main contributor among the group sample ($β = 0.42$, $p < 0.01$).

In contrast, Pourteimou et al. [20] determined the effect of a smartphone messaging application on learning about medication error prevention among nursing students. They conducted a quasi-experimental study with 80 nursing students who were randomly divided into intervention and control groups and collected data using a checklist developed by researchers. The learning was conducted for 3 weeks via the Telegram messaging application. The error frequency was higher in the control groups, suggesting that e-learning with the Telegram messaging application had a significant effect on the performance of students in the intervention groups.

Walsh et al. [21] determined which factors increase the likelihood of nursing students reporting medication errors. This quantitative study used a non-experimental descriptive approach to assess student perceptions of faculty feedback following medication errors. A convenience sample of 106 second, third, and fourth-year nursing students was surveyed. Students indicated that they would be more likely to report an error if given the opportunity to explain the reason for the error (95.2%). Similarly, Preston et al. [22] described the perceptions of students about the relationship between pharmacological education and clinical safety. Twenty-eight RN-BSN students and 71 traditional BSN students participated. The data was analyzed using conventional content analysis and students described the impact of pharmacology education as a positive or negative effect.

A group of researchers estimated the risk of error among undergraduate nursing students based on their scores on the pharmacology knowledge questionnaire and their self-rated certainty [23]. They conducted a cross-sectional correlational study with a sample of 147 nursing students. Drug calculation was the subject area in which students had the lowest mean score. Positive correlations were observed between age and pharmacology score and between the last time the pharmacology course was taken and the risk of error.

Finally, another group of researchers [8] explored the perceptions of nursing students regarding the process of learning mathematical calculations to safely administer medications. Four focus groups were conducted, two with participants who were in the first year of the nursing program and two with participants in the second year. Each focus group comprised 4 to 6 students and lasted between 20 and 40 minutes. The questions were designed to explore the experience and understanding of learning mathematics for medication administration.

DISCUSSION

It is important to consider how nursing students perceive the safe administration of medications, as well as to use a global curriculum that promotes safety in medication administration practices across all its courses. In addition, the curriculum must ensure that students acquire the skills required to allow them to implement the safe administration of medications from the time they are studying at the academy (theory/simulated environments) to their clinical practice (real environment). The studies included in this review, which were related to factors associated with systems or processes in clinical settings, invite us to explore the experiences and opinions of nursing students regarding the errors found in medical practice and their underlying causes.

During most of their working day, nurses prepare and administer medications [24] as part of what could be considered one of their most important healthcare roles. Therefore, medication errors are also the most frequent type of error made by nurses [24], making the culture of error an important part of undergraduate training. This helps ensure that future health professionals are trained and educated on this subject in order to promote the safety and quality of patient health. However, recent research [25] has shown that nursing students enrolled in clinical rotations have not been optimally prepared to fulfill their roles in terms of medication safety. This gap was highlighted by the existence of errors related to a lack of adequate knowledge, skills, supervision, and role models during clinical rotations, which led to medication errors by nursing students [13].

Other factors related to medication errors in the clinical setting can be attributed to inadequate computational skills among students, leading to inaccurate dose calculation, incorrect medication preparation, or the wrong conversion of measurement units [14]. In addition, environmental factors such as the presence of noises and distractions, make it harder for students to concentrate and carefully review instructions [14]. At some point in their clinical practice, almost all nursing students experience situations in which adverse events compromise patient or student safety. Some reviews [26] even state that 28–30% of students make medication errors during their clinical practice. Therefore, attention to medication management and the characteristics of adverse event reporting must be prioritized in accordance with the different nursing academic courses or rotations in different clinical practice settings [15].

Regarding factors related to the academic environment, the students perceived training with simulations and scenarios to promote the safe administration of medications as positive experiences. Among the reviews we included in this present work, it is worth highlighting four quasi-experimental studies that used simulation as the study instrument [16–19]. They all suggested that nursing educators should consider

simulation as a teaching strategy to engage students in the implementation of medication safety practices in clinical settings. Simulation scenarios can be designed to allow students to practice their technical skills while also experiencing clinical reasoning, critical thinking, and decision making in practice [22, 27].

Questionnaires were another instrument often used in the studies included in this review [19,21,28]. Although distinct types of surveys and outcome measures were used, their results all suggest that it would be beneficial to reassess how safety and quality of care is provided in nursing schools, placing emphasis on understanding the varying learning styles of students and teaching strategies of instructors. Other highlights include the fact that learning environments in which students feel supported and feedback from teachers is focused on patient safety [21], adequate knowledge of pharmacology [28], and the teaching of evaluation, critical thinking, and safe administration of medications [19] all seem to reduce the risk of error.

The use of information and communication technologies in nursing education via smartphones could also help educators to improve motivation and learning outcomes while also helping nurses to improve their knowledge and skills [29]. Among the reviews we surveyed, the academic study by Pourteimou et al. [20] indicated that learning through smartphones by using the Telegram messaging application helped improve the knowledge of student nurses about the prevention of medication errors. Telegram is an immensely popular and free social network application in Iran and so nursing students use this application to read and discuss educational content provided by researchers, helping them to reduce the occurrence of medication errors and improve how they prepare and administer medications.

Johnson et al. [8] used focus groups to explore the perception of nursing students about learning the mathematical calculations required to safely administer medications. Thus, the potential for medication errors became a way for instructors to motivate students to take mathematics more seriously. Therefore, it seems that to successfully transition to mastery of dose calculations, the mathematics taught must be contextual so that the concept itself has meaning to the students. To promote this idea, other studies [30] propose eliminating student resentment towards the notion of complicated mathematics which they perceive as unnecessary.

Different interventions and outcome measures were used in the 12 studies we reviewed and so it is difficult to reach a conclusion about which intervention was more effective in improving the safe administration of medications in nursing students. Thus, future researchers studying this topic should consider conducting multi-site studies using the same measurement tools to determine the relative effectiveness of their interventions in relation to specific outcomes.

The studies included in this work lacked information regarding the psychometric properties of the measures used. Most of the instruments used had been developed by the same authors or were extracted from secondary databases or reporting systems. For example, Walsh et al. (2018) developed a new questionnaire for their work which mainly used quantitative measures. Furthermore, only 6 studies [13,16,18,19,20,28] provided information on the reliability or validity of the metrics they had used. For example, Musharyanti et al. [13] conducted interviews with 5 professors and 4 clinical instructors as part of the triangulation method they employed to compare and confirm the validity of the study findings.

Thelen et al. [18] used measures of self-efficacy from the *Motivated Strategies for Learning Self-Efficacy Questionnaire* subscale [31] and measures of student perceptions from the *Survey for the Acquisition and Application of Knowledge* [32]. They showed acceptable levels of reliability and validity using these instruments, with a Cronbach alpha of 0.85 among the population of accelerated nursing students [32]. In turn, Abraham et al. [19] used a validated and reliable 18-item instrument [33] to assess the level of participant satisfaction with the simulation they used. This tool consisted of a 5-point Likert scale and the definitive version was adapted and approved by a committee of experts. The Cronbach alpha for the total score and for the 3 subscales ranged from 0.73 to 0.88 for the individual sample and from 0.80 to 0.90 for the group sample.

Craig et al. [16] based their work on methods developed by Mariani et al. [34] and designed and implemented high-fidelity medication administration simulations enhanced by information technology which were integrated into their undergraduate nursing curriculum. Finally, Pourteimou et al. [20] used a survey that included 50 items on a binary scale (observed = 0 and not observed = 1) and 5 nursing professors and 2 pharmacists confirmed the apparent validity of the checklist. The content validity ratio was 0.80 and they measured the correlation coefficient ($r = 0.89$) to verify the interrater reliability of the checklist after 10 nursing students completed it.

In conclusion, it will be important to continue analyzing the global perceptions of students regarding the safe administration of medications given that medication errors are the result of many factors, including human error as well as some characteristics related to the healthcare and academic systems. These include the availability of resources, the working/learning environment, care overload, presence of distractions, anxiety, and lack of adequate knowledge, skills, and supervision [9,35,36].

Limitations

There are several limitations to this review. First, despite international representativeness among the studies included in this review, most of them had been conducted in the United States and so our findings may not be generalizable to nursing schools at the international level. Furthermore, this review included only studies published in English and so this approach may have excluded relevant evidence published in other languages. Finally, although we conducted extensive database and manual searches, some relevant studies may have been inadvertently excluded from this work.

CONCLUSIONS

This review provides information about the perceptions of nursing students regarding the safe administration of medications. In the 12 original research studies we reviewed, we analyzed the reported experience of nursing students while building their skills and knowledge in different settings (academic and clinical). Between these studies, different outcomes were measured for similar interventions, which limited our ability to reach a consensus on the effectiveness of each intervention type. Furthermore, we found that discussion of the psychometric properties of the instruments were limited and that reliable and valid instruments to measure the outcome variables had not been employed. Thus, there is a clear need to develop psychometrically sound tools in future research.

The literature suggests that the perception and training of nursing students in safety practices can generate changes in the way medications are administered and can reduce the rate of adverse events in the future. Training and practice in different environments (academic and clinical) could favor the progressive and repetitive application of different tasks until a certain level of skill is achieved, also helping students to reflect upon and avoid mistakes in the administration of medicines.

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