

# Medical Student's Knowledge on Patient Safety: A Systematic Review

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## ABSTRACT

**Introduction:** The Ordinance MS/GM No. 529 of 2013 of the Ministry of Health established the National Program for Patient Safety (PNSP), seeking to contribute to the qualification of health care. Neste sentido, um dos objectives do PNSP é a inclusion do tema no ensino técnico e de graduação e pós-graduação na área da saúde, entretanto incluir a segurança do paciente temática e seus pressupostos em um currículo tem se constituída um desafio.

**Methodology:** Systematic review conducted according to the recommendations of PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis Statement), registered in the PROSPERO platform under number CRD42020193693, with the aim of synthesizing evidence on the inclusion of the patient safety theme in the teaching-learning process in undergraduate medicine. The U.S. National Library of Medicine (PubMed) and Portal CAPES databases were used, using the following descriptors: "patient safety" "knowledge" and "medical student", joined by the Boolean operator "AND". After applying the inclusion and exclusion criteria, 21 articles were selected, for which the QUADAS-2 tool was applied to analyze the risk of bias and methodological quality. Results and discussion: The studies were categorized into two groups, namely: articles that used a methodological resource to develop the subject with the participants, such as the application of courses or workshops on patient safety and articles that did not use any type of methodological resource, only quantifying the students' knowledge on patient safety.

**Conclusion:** The evidence points to a broad view of the teaching-learning process on the theme, and the inclusion happens in several ways, without curricular systematization. Embora esta diversidade de metodologias continuam de maneira significativa para o aprendizado, permanece uma lacuna em relação à atitudes dos estudantes, os quais reconhecem a necessidade de qualificação nesta área.

## INTRODUCTION

The World Health Organization (WHO), in 2004, created the World Alliance for Patient Safety. Among the objectives of this program were the organization of concepts and definitions on patient safety and the proposition of measures to reduce risks and mitigate adverse events. Since then, the concept of patient safety aims to reduce to an acceptable minimum, the risk of unnecessary damage associated with health care [1].

Subsequently, the Ministry of Health established the National Program for Patient Safety (PNSP), through the Ordinance MS/GM No. 529 of April 1, 2013, in order to contribute to the qualification of care in all health facilities in the national territory. One of the objectives of the PNSP is to produce, systematize and disseminate knowledge about patient safety, encouraging the inclusion of the subject in technical education and undergraduate and graduate education in health care [2].

### Quick Response Code:



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The importance of structuring programs to improve patient safety is remarkable and, in this context, appropriate teaching, with relevant teaching methodologies, is suggested as the best strategy capable of qualifying the appropriate attitude of the professional with a view to quality care. It is essential to include the topic in the reflections, debates, and curricula of medical schools and establish learning objectives that encompass concepts of patient safety and quality of health care, in order to promote the development of a safety culture. It is reiterated that the inclusion of the patient safety theme in the educational curriculum of students is still a challenge that requires a joint action of all levels of education [3].

Patient safety is still addressed in a diffuse manner among undergraduate medical courses, and there is no conceptual and methodological standard of teaching in all institutions. Ferguson [4] points out that although there are still some challenges to implement the topic in the curricula of students, given its relevance, there should be a broad approach to the subject, both didactically and experimentally. He also suggests longitudinal actions, integrating the content in the subjects seen in the pre-clinical and clinical years, parallel to the content already provided [5]. Thus, due to the importance of the topic in professional practice and the lack of relevant literature that shows how the subject is treated in teaching institutions in medical courses, this systematic review aims to synthesize evidence on the insertion of the topic of patient safety in the teaching-learning process in undergraduate medicine.

## METHODS

This is a systematic literature review, type of research that provides a summary of the evidences related to a specific intervention strategy, by applying explicit and systematized methods of search, critical appreciation and synthesis of the selected information [6]. Before the search, it was verified in the

Cochrane Library if there were other ongoing systematic reviews on this topic. No work in progress or published for this purpose was found.

To write this review, the steps of methodology were followed, starting with the elaboration of the research question based on the acronym PICO, which is configured as Patient, Intervention, Comparison and Outcomes, resulting in the question: is patient safety a theme that is part of the teaching-learning process of medical students during graduation? Sequentially, it was registered in PROSPERO - International prospective register of systematic review and is registered under number CRD42020193693. A literature search was conducted in the Portal da CAPES and PubMed (U.S. National Library of Medicine) databases, and the selection of studies was performed by three independent researchers, using the following descriptors: "patient safety" "knowledge" and "medical student", which were previously consulted in the Descriptors in Health Sciences (DeCS) and Medical Subject Headings (MeSH).

Concomitantly, the inclusion criteria were defined: articles in Portuguese, English and Spanish, in humans and published in the last 5 years and as exclusion criteria: articles related to knowledge about patient safety by doctors in training or residents. The search resulted in 269 articles, summing the two databases used. An independent review was then performed by the authors, with the initial intention of excluding articles that did not meet inclusion criteria. Consequently, the repeated articles were disregarded and the remaining articles were analyzed in full. Finally, the final selection was based on the content analysis of 21 articles, which were read and analyzed in depth. During the entire process of search and selection of articles was used the PRISMA checklist [7] composed of 27 items for the data to be presented in this review. In addition, a flow chart demonstrating the decisions made by the reviewer team was prepared. This flowchart is shown in Figure 1.

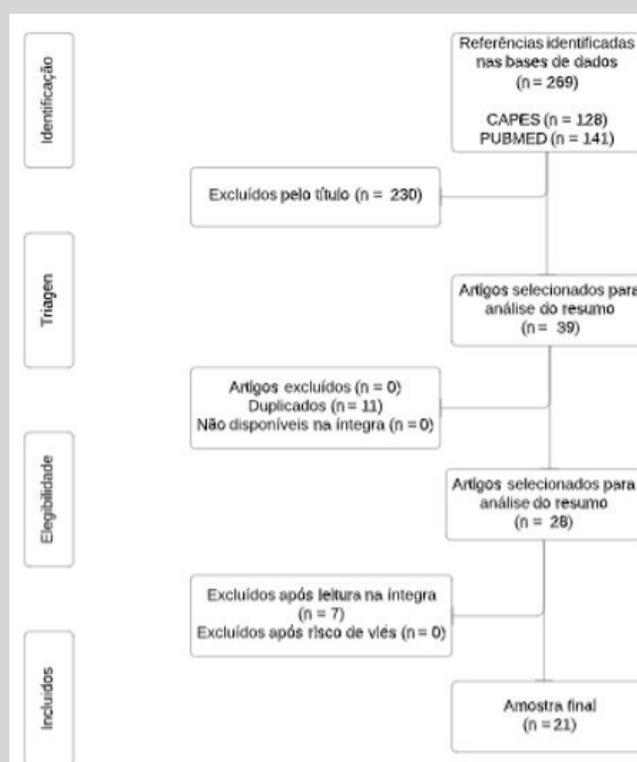


Figure 1: Flowchart of the article selection.

The QUADAS-2 tool, which comprises 4 domains: patient selection, index test, reference standard, and flow and time, was applied to the final sample in order to improve the quality of this review. Each domain is assessed in terms of risk of bias and the first

three domains are also assessed in terms of concerns regarding applicability. In addition, signaling questions are included for further support of the assessment process [8-10].

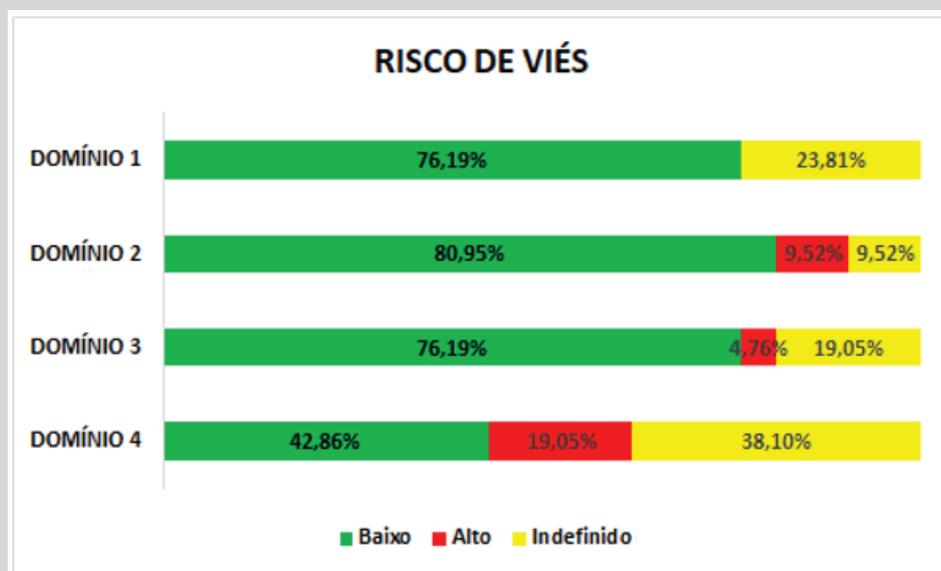


Figure 2: Evaluation of the risk of bias of the selected articles.

The evaluation of risk of bias resulted in a sample with 76.19% of articles with a low risk in domain 1, with low risk in domain 2 were 80.95% of studies, 76.19% of research with low risk in domain 3 and 42.86% of papers with low risk in domain 4. Figure 2 represents the percentages found in each domain.

## RESULTS

After the systematic search and selection of studies, a final sample of 21 articles was selected. Such studies were published as follows regarding the year: four in 2015 (19%), 4 in 2016 (19%), 3 in 2017 (14.3%), 6 in 2018 (28.6%), 3 in 2019 (14.3%) and 1 in 2020 (4.8%). From the methodological point of view, there were 14 experimental studies (66.6%), 3 cross-sectional studies (14.3%), 2 prospective cohort studies (9.5%), 1 non-randomized, non-controlled observational study (4.8%) and 1 controlled longitudinal study (4.8%). Table 1 encompasses the general characteristics of the selected articles.

## DISCUSSION

Due to the methodological variety of the articles found and for a better understanding of the results obtained, the findings were categorized into two groups. The first group included those studies that used a methodological resource with the participants, such as the application of courses or workshops on patient safety. The second group includes the studies that did not use any type of methodological resource, only quantifying the students' knowledge about patient safety.

### Category 1: Studies with Application of Methodological Resource

Among the studies that applied some type of teaching intervention to teach and evaluate medical students about patient safety, they were divided into sub-categories according to the method used among those that used face-to-face courses, those that

applied e-learning or distance learning courses, and those whose chosen methodology was workshops and simulations.

**Sub-category 1: On-site courses:** Following the face-to-face courses approach, Li [9], in his experimental study, implemented an elective course on quality and patient safety, in 8 stages. After the course completion, a questionnaire prepared by the Chinese Cochrane Centre was applied. The chi-square test was applied to analyze the influence of patient safety education on students' attitude and their level of knowledge. Although students showed an improvement in knowledge after the application of the course, there was no significant change in their attitudes, demonstrating that attitude change in clinical practice requires constant and long-term repetition of knowledge about patient safety. The quasi-experimental study by Roh (10) also demonstrates the implementation of a 3-day patient safety course, divided into thematic categories within the major medical areas. To evaluate the construction of students' knowledge about patient safety, a 12-item questionnaire and two real cases were applied to analyze changes in systemic thinking and collective responsibility. Both the questionnaire and the cases were applied before and after the course. It was concluded that, in addition to improvement in patient safety concepts, different from Li's study (9), the students showed to have greater self-confidence in approaching topics such as medical error after the course.

A multicenter study [11] conducted in 4 medical schools in Sydney, with 1<sup>o</sup>- and 2<sup>o</sup>-year students, aimed to assess changes in attitudes among these students about patient safety after the application of the proposed program, which was an intervention comprising 8 seminar modules associated with tutorials (2h each), delivered over two years. Assessments using the Attitudes to Patient Safety Questionnaire-III (APSQ-III) regarding patient safety were made before the intervention (time 1), at the end of the first year of medical school (time 2), at the end of the second

year (time 3) and 12 months after the end of formal patient safety teaching (time 4). It was possible to conclude that there was significant improvement in the attitude of these students over time in 4/9 main items measured by the APSQ-III: value of patient safety

teaching, danger of long working hours, value of teamwork, and the contribution that patients can make to reduce error. Concomitantly, the informal feedback from students was very positive.

**Table 1:** General characteristics of the selected articles.

Reference/Authors	Year	Review	Method
Ferguson et al.	2015	Academic Medicine	Experimental
Roh et al.	2015	Medical Teacher	Experimental
Nabilou et al.	2015	PLOS ONE	Transversal
Shah et al.	2015	Journal Of Pakistan Medical Association	Transversal
Gaupp et al.	2016	BMC Medical Education	Experimental
Kow et al.	2016	World Journal of Surgery	Experimental
Li et al.	2016	Journal of Huazhong University of Science and Technology	Experimental
Farnan et al.	2016	BMJ Quality and Safety	Experimental
Dankbaar et al.	2017	BMC Medical Education	Experimental
Eltony et al.	2017	Education for Health	Experimental
Escher, et al	2017	BMC Medical Education	Prospective cohort study
Dumenco et al	2018	MedEdPORTAL	Experimental
Golebiowska et al.	2018	Journal of Education, Health and Sport	Experimental
Oates et al.	2018	BMC Medical Education	Observational non-randomized and non-controlled
Bartlett et al.	2018	MedEdPORTAL	Experimental
Kataimy et al.	2018	BMC Medical Education	Experimental
Liu et al.	2018	BMJ Open	Transversal
Opitz et al.	2019	GMS Journal for Medical Education	Experimental
Gaupp et al.	2019	PLOS ONE	Longitudinal controlled study
Beekman et al.	2019	Journal of Medical Education and Curricular Development	Experimental
Shahvet al.	2020	BMC Medical Education	Prospective cohort study

Another study that made use of the APSQ-III questionnaire was a survey [12] that provided a greater focus on the motivation of students regarding patient safety after a training focused on surgical skills. This study had as an outcome the finding that patient safety training and teaching in schools demonstrated positive attitudes on the part of students, in addition to increasing their motivation, assisting in the development of techniques and knowledge for safe practices.

Similar to such study pointed out [12], the article by Eltony et al. [13] describes about a 3-day course held for 6<sup>o</sup>-year medical students at the Faculty of Medicine, Suez Canal University, Egypt. The course cited addressed three main topics of the WHO patient safety curriculum guide, involving reflections, discussions and assignments. Pre- and post-tests were used to assess the effect of the course on students' knowledge, which showed a significant increase in the mean score on multiple choice question. Most students perceived the different aspects of the course positively,

including the structure and introduction, communication and teamwork skills they had developed. 46.7% of students perceived that incident occur most frequently in the emergency room, while only 6.7% in the outpatient department. Students indicated that the patient safety courses were a good opportunity to raise awareness about medical errors and patient safety issues in the existing health care system.

Finally, the study [14] evaluated medical students from 1<sup>o</sup> to 4<sup>o</sup> year of Medicine at the University of New Mexico (USA) during 6 months with extracurricular group sessions addressing the fundamentals of QuIPS (Quality Improvement and Patient Safety). Before starting the curriculum, 83.3% of students reported never having received formal training in QuIPS, and 95.8% students reported never having participated in a PDSA (plan-do-study-act) cycle, highlighting the need to include patient safety in the medical school curriculum.

**Sub-category 2:** E-learning and distance learning courses. Gaupp et al. [15] conducted a quasi-experimental controlled study, in which the intervention group participated in a mandatory e-learning course on patient safety between October and December 2016, while the control group did not receive any didactic session on patient safety allowed the institution's curriculum. In both groups technical knowledge and attitudes towards patient safety were measured before the intervention, right after the intervention and one year after the course. Such online course focused on the following topics: teamwork, error management, situational awareness, and crisis resource management, being taught in three main modules with an interactive case-based approach in which students, working in virtual groups of six people, perform tasks such as multiple-choice tests, video analysis, and case studies. A total of ninety participants submitted data for the three measurements from October 2016 to January 2018. It was shown that the technical knowledge of the intervention group improved significantly and remained high after one year of the course. Furthermore, students who participated in e-learning education felt more prepared to practice patient safety, even one year after the intervention. However, there was no significant effect on changing attitudes toward patient safety.

In a longitudinal experimental study [15], the author implemented an online course on patient safety aligned with the principles of problem-based learning. To measure students' knowledge regarding patient safety, the Attitudes to Patient Safety Questionnaire (GAPSQ) and the Systems Thinking Scale (STS) were used both in the pre- and post-test, in order to compare learning levels before and after the course. After e-learning the levels of systems thinking showed significant improvements, increasing from 36.7% to 76.45% of correct answers after e-learning. In another experimental study [16], the author used an interactive game for iPad with 10 scenarios called PASSED - Patient Safety in Surgical Education. Before starting the session, students completed a questionnaire to determine their understanding of patient safety. Next, a lecture was given on the concepts of patient safety and then they participated in the online game. After completing the game, they filled out a post-intervention questionnaire. The instrument used to assess the students' perception was the Attitudes to Patient Safety Questionnaire III (APSQ-III). Most students felt that the game trained them to understand medical error processes, improving their understanding of patient safety and preparing them to avoid medical errors. Similarly to Gaupp's study [15], Kow's approach [16] showed that levels of understanding about patient safety concepts improved significantly after e-learning.

Dutch 4<sup>o</sup>-year medical students were randomly assigned to a study [17] in which a game that included videoconferences, e-modules, and biofeedback exercises was used, and this game also included text-based lectures on the same topics. One of the groups acted as a control group with no additional participation in the educational events. After performing this e-learning during the clinical introduction course, all students completed a knowledge test, a self-efficacy test, and a motivation questionnaire in order to assess whether there was knowledge acquisition, awareness, and motivation about patient safety through a game when compared to their peers who studied the same topics using an electronic module.

**Sub-category 3:** Workshops and simulations: In the modality of workshops and simulations, the longitudinal experimental study of Ferguson [4], with the implementation of the Quality Improvement and Patient Safety (QuIPS) Scholarly Pathway - a 3-year program that included interactive sessions, experiences in groups and the

development of an academic project focused on patient safety, assessed the student's knowledge before and after the activity through the Quality Improvement Knowledge Assessment Tool (QIKAT). The student's knowledge measured by the QIKAT increased significantly after the course (mean score in the pre-test: 7.07 and mean score in the post-test: 9.59), demonstrating that students increased their understanding of patient safety.

Following the practical approach, Farnan's study [18] performed the implementation of a simulation that encompassed common security threats in hospitals. After entering the scenario, students were asked to identify and document as many security risks found in the scene as possible. Students were evaluated based on the percentage of risks found in the projected scenarios. In the simulation, although students were able to correctly identify some common risks in hospitalization, including improper use of catheters, hand hygiene, and medication-related errors, in general, the most frequently identified situations were those dealing with patient discomfort. At the end of the activity, students recognized the clinical usefulness of such simulations for improving patient safety concepts.

The quasi-experimental study [19], which used the pre- and post-test methodology, conducted a workshop on patient safety during an anatomy course, with a simulation containing a "retained sponge" discovered during an anatomy dissection laboratory, with the intention of introducing the teaching of medical error, followed by a presentation and discussion on the subject. This study had a positive outcome on the students' attitudes towards patient safety, as well as the importance of knowing how to recognize and report medical errors. At the same time, the study shows that integrating patient safety education into a pre-existing course is a safe and effective teaching model that can be applied by other medical schools.

Two studies [20,21] also used an experimental approach to evaluate the knowledge of medical students regarding patient safety. For this purpose, these studies report the application of a pre-test or questionnaire to the study population, with the intention of evaluating and comparing their post-test or final questionnaire responses after the application of an intervention, such as workshops, courses, games, and simulations.

Dumenco [20] reports the realization of an interactive workshop for 1<sup>o</sup>-year medical students in the United States on patient safety. Active learning principles were used, with application of assessment concepts, diagrams, pre and post questionnaires with multiple choices and clinical cases. The students' satisfaction with the workshop was also evaluated. There was significant growth in students' scores from pre-test to post-test and also a reduction in the range/ variance of scores.

Concomitantly, Golebiowska [21] reported in their study, also experimental, the performance of training workshops on basic and advanced surgical sutures for 115 medical students at the Medical University of Lublin. Knowledge of safety procedures was measured by a 15-question test, with the purpose of examining the level of awareness and knowledge of students about procedures contained in the surgical safety checklist. This surgical safety checklist (Checklist) attempts to prevent errors in surgery. It was possible to conclude that most medical students were interested in learning about patient safety; however, despite 15 years of introduction in the surgical field, medical education methods among undergraduate students are still insufficient.

The study by Shah [22] is a prospective cohort in which workshops were conducted for medical students between 2015 and 2018, addressing five topics on quality and patient safety: process mapping, root cause analysis, cycles of study-action plans, evidence-based medicine and patient transfer. Transformations in the knowledge, attitudes, and behaviors of students who took the workshops were assessed through pre-, mid-, and post- surveys. The results of such workshops provided a significant improvement in students' confidence regarding the topic, in addition students felt more comfortable teaching about quality and patient safety to their peers and showed a greater interest in pursuing projects on such subject in their careers. Finally, this study showed that few students have formal instruction on quality and patient safety tools.

## Category 2: Studies Without Interventions

Although no methodological resources were used, the article by Liu [23] shows that longitudinal studies using validated instruments should also be used to evaluate patient safety education programs, their importance and impact on local health development, as well as highlighting the importance of exploring the culture of reporting errors. The anonymous APSQ-III questionnaire was used to evaluate patient safety education programs and their impact on health education, comparing the answers of students from 4 different universities in China. The positive result was that students had a positive opinion about patient safety and its importance, but none of them had been exposed to any formal patient safety curriculum during their undergraduate studies.

In turn, a cross-sectional analytical study [3] sought to investigate perceptions, knowledge and attitudes of students regarding patient safety education by applying a questionnaire with two parts. The first part sought students' demographic information and the second consisted of 26 questions addressing patient safety, error management, and attitude toward patient safety education in universities. When asked about their level of knowledge about patient safety, more than 40% of students classified their own knowledge as poor. Corroborating the results presented by Liu [23], the students also showed a significant gap in the approach to patient safety during medical graduation and about 80% of the students demanded a greater approach to the subject in their training.

A cross-sectional survey [22] also sought to evaluate medical students' perceptions of patient safety issues by applying a structured and anonymous questionnaire with 20 items related to patient safety issues. The questionnaire showed that 96% of students agreed that patient safety is an important topic and 93% of them stated that the topic should be part of the medical curriculum. Nevertheless, similarly to the studies by Nabilou [3]; Liu [23], the study evidenced that there was a significant knowledge gap among medical students regarding patient safety issues.

## CONCLUSION

In an attempt to point out evidence, it can be observed that the data presented in this systematic literature review identify a comprehensive view on the insertion of patient safety in the teaching-learning process during undergraduate medical education. The inclusion of this theme in medical curricula is done in various ways, with the implementation of classroom courses, e-learning, distance learning courses, workshops, and simulations. Despite the diversity in the methodologies used, patient safety training and teaching in medical schools contributes significantly to the students' understanding of patient safety concepts, besides allowing the improvement of knowledge on issues related to

medical error, quality of health care, and teamwork. Although the approaches have proven effective in the teaching-learning process, especially in view of the evaluations carried out in the different studies, there is a gap in the change of attitude of the students, demonstrating that in clinical practice a constant and long-term repetition of the knowledge employed during graduation on patient safety is required. Even if some methodological limitations have been detected, such as the limited time, making the evaluations detect only immediate and short-term effects, not identifying more precisely the influence of the course in the students' behavior; it is emphasized, finally, that the implementation of the patient safety theme in undergraduate courses in Medicine still occurs in a diffuse manner, with various types of evaluations and with specific approaches, with few longitudinal actions that integrate the theme to other planned contents. Students, in turn, recognize the need for a broader and systematized approach to the topic during graduation, from which it would be possible to consolidate a culture of safety among students in training. It is important to highlight that the commitment of educational institutions and teachers is the driving force for the formation of a doctor who can qualify health care as a dimension of patient safety.

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