

Topics of the WHO Patient Safety Curriculum Guide Proposals: How to Implement Them in the Medical Career and Evaluate Their Impact

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Abstract

Background: The harm to patients continues to involve a high burden of injury, disability, social cost, and death worldwide. To improve patient safety (PS) education, the WHO created a PS Curriculum Guide to assist multisectoral institutions. However, not much progress has been made in undergraduate studies. **Objective:** To establish steps and activities to easily and successfully integrate the topics of the WHO PS Curriculum Guide into the existing undergraduate curricula in the medical career. **Methods:** Mixed methods research (MMR), integrating quantitative and qualitative methods (2019–2024) to assess the strategies carried out in the medical faculty of the private Universidad Francisco de Vitoria (Spain) for the proper implementation of the WHO PS Curriculum Guide: curriculum mapping, curricular intervention, implementation, monitoring, evaluation by the academic committee of PS, and assessment. **Results:** All WHO's PS topics (n=11) were included in the teaching guides of some subjects (n=14) across all academic years in 2019. However, in some years, certain topics were taught but were missing in the teaching guide while others were not taught despite appearing in the guide (topic 10 [PS and invasive procedures] was not taught in any year). These findings promoted changes in the teaching guidelines for all academic years, an expansion of PS matters in some of the 14 subjects, the addition of new teaching activities, and improvements in assessment methods (e.g., new OSCE-4th in 2021). Since its implementation, an increase in the OSCE-4th score was observed. In 2024, all the PS topics included in the teaching guides were taught in the classes and vice versa. **Conclusion:** Comprehensive and integrated PS education in undergraduate medicine is feasible and impactful without implying an additional burden. It is a necessary foundation for building better healthcare from the early stages.

Keywords

patient safety, simulation, healthcare quality improvement, health profession education and medical education

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Introduction

Patient safety (PS) constitutes a fundamental pillar in medical practice, being a basic component of strategic targets of healthcare systems worldwide.¹ However, achieving optimal PS remains a challenge in healthcare delivery.² Many patients are still harmed due to unsafe healthcare (approximately 1 in 10 patients, as estimated by the World Health Organization [WHO]).^{2,3} Adverse events (AEs) due to risky medical attention, from which up to 80% of all are preventable,⁴ involve a high burden of injury, disability, and death worldwide.^{1,3} More than 3 million deaths occur annually because of this reason.^{2,3}

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Additionally, this patient harm promotes a significant increase in healthcare system utilization, resulting in a substantial social cost (US\$1 trillion to US\$2 trillion per year)^{3,5} (13% of health spending).⁵

Given the above, AEs associated with healthcare represent a global challenge, underscoring the need to train future professionals with competencies, skills, values, and attitudes that ensure safe and quality care. Aware of this global need, the WHO promotes PS education in multisectoral institutions, including universities,³ highlighting the importance of creating a PS culture at the beginning of training, and then reinforcing it during postgraduate education and continuing professional development.⁴

The WHO provides tools for this purpose, such as the Patient Safety Curriculum Guide that includes recommendations to assist in PS education.^{3,6} This guide (multi-professional edition; 2011⁷) proposes 11 specific PS topics, and suggests various ways to provide training, from seminars to practice groups: 1) defining patient safety, 2) human factors engineering, 3) understanding complex systems, 4) effective teamwork, 5) learning from mistakes, 6) managing clinical risk, 7) quality-improvement methods, 8) patient and caregiver interactions, 9) infection control, 10) safety in invasive procedures, and 11) medication safety.^{2,7}

The Spanish undergraduate medical education program lasts six years. The first three years consist of courses covering more basic content (pre-clinical years), while the final three years focus on more clinical content and include clinical rotations at healthcare facilities (clinical years). Objective structured clinical examination (OSCE)-style assessments are therefore administered during the final two years of the undergraduate program. In Spain, the PS Strategy of the National Health System has been promoted since 2005.⁶ However, although the need for PS training among health personnel has been recognized, little progress has been made in undergraduate studies.⁶ In fact, a recent study reported that few PS topics recommended by the WHO are included in the training plans of medical faculties, with the number of integrated PS topics in Spain being lower than in the rest of Europe.⁶

In this context, Universidad Francisco de Vitoria (UFV) undertook to implement the WHO PS Curriculum Guide in its undergraduate medical curriculum, with the aim of training competent physicians who are aware of the risks inherent in clinical practice. The purpose of this project was to respond to the need to adapt teaching to the current demands of healthcare systems, ensuring that graduates acquire solid competencies in PS. Our results can potentially help guide medical educators in other medical faculties in integrating the topics of the WHO PS Curriculum Guide into their existing undergraduate curricula.

Materials and Methods

Mixed methods research (MMR), integrating quantitative and qualitative methods, carried out in the medical faculty of the private Universidad Francisco de Vitoria in Spain. The design of the study, including the various steps and activities undertaken, is shown in [Figure 1](#).

The study started in 2019 and finished in 2024. Due to the COVID-19 pandemic, the study remained on hold in the 2020/2021 academic year.

An initial **curriculum mapping** was conducted by an academic committee of PS, consisting of members from the university's management team who were experts in preventive medicine and simulation. They reviewed the **course syllabus** of the medical degree to assess whether the 11 topics included in the proposed WHO PS Curriculum Guide were integrated into the medical students' education (practical application: contents of the subjects involved, as well as training and evaluation activities). Moreover, they reviewed the **university's teaching guides** for the subjects to corroborate whether the contents related to PS were specifically indicated in a clear manner and aligned with WHO objectives.

The academic committee of PS also determined the existence of discrepancies between the contents of the university's teaching guides on PS and the practical application through meetings with the coordinators of each subject involved. These meetings were also used to reinforce the understanding of the contents of PS and made possible to identify areas for improvement or training needs on the PS topics proposed by the WHO in the medical career.

The academic committee and the coordinators used the findings to promote proposals for expanding and adding new content/concepts on PS on the subjects, as well as for adapting teaching methodologies and assessment methods based on the WHO recommendations (e.g., master classes, practical workshops, clinical simulation, mentoring, and interactive activities). Teaching guides were updated by the coordinators of the subjects with those proposals. This implied that all interventions were definitive (not a pilot test) and mandatory for all students at the medical faculty.

The academic committee followed up on the compliance of the PS features included in the updated teaching guides in the practical application. They analyzed each of the 11 items in the WHO PS Curriculum Guide, attending the classes of the subjects involved, to assess the practical application and verify the types of activities performed and the improvements implemented (accompaniment, more specific simulation, role-play, use of a surgical checklist, etc.).

Moreover, the academic committee tested the effectiveness of the new PS education curriculum in achieving PS competencies. They reviewed and analyzed the outcomes of an objective structured clinical examination in the fourth year

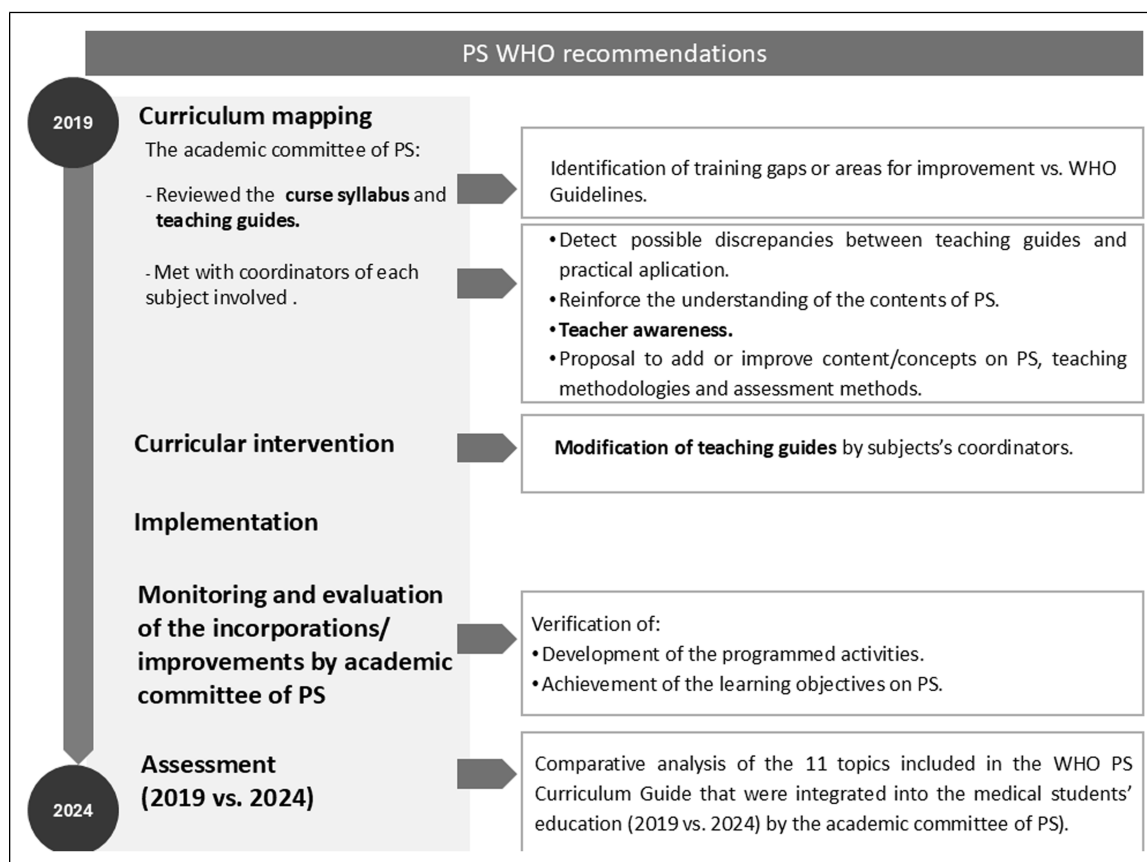


Figure 1. Steps and activities carried out at Universidad Francisco de Vitoria (medical school) for the proper implementation of the WHO PS curriculum guide
PS: Patient safety; WHO, World Health Organization

(OSCE-4th), a new evaluation method promoted within this study. The OSCE stations, that were designed according to predefined learning objectives consistent with WHO PS principles and institutional competency frameworks, directly assessed several competencies aligned with the WHO PS Curriculum, including communication skills, teamwork, patient identification, infection prevention, hand hygiene, recognition and prevention of clinical errors, and safe clinical practices. Importantly, PS-related competencies were assessed across multiple stations, providing a transversal evaluation of students' performance rather than relying on a single isolated station. The fourth year was chosen for this evaluation because it is the academic year in which the subject of preventive medicine is taught. For this reason, no eligibility criteria apply to this study, and all the students of fourth year were evaluated. When students finish it, they have completed at least 85% of the PS training itinerary.

Descriptive statistics included the mean (standard deviation [SD]) of the total score of the fourth-year OSCE. A paired 2-samples t-test was used to compare the means of two measurements taken from the same sample at the beginning (Sep 2021) and at the end (Apr 2022) of the fourth year. Results were considered significant at $p < 0.05$. The mean scores (SD) of the OSCE-5th and OSCE-6th performed by the same sample of students were also assessed. Analysis was made through ANOVA, Post hoc, and paired t-test comparing the scores of the different evaluations.

Ultimately, the improvement in compliance with the WHO recommendations compared to the baseline situation (2019) was assessed at the end of the study (2024). This analysis included the comparison of the number of subjects with contents on PS contained in the teaching guides, the topics addressing in each year (both the included in the teaching guides and those taught in the classes), the type of activities and the assessment methods, and the percentage of recommendations complied before (2019) and after (2024) the intervention carried out during this study.

This manuscript follows the Defined Criteria To Report Innovations in Education (DoCTRINE) reporting guideline.⁸

Results

[Table 1](#) summarizes the findings of the assessment performed in our study. The study was conducted at Universidad Francisco de Vitoria (Madrid, Spain), which offers a six-year undergraduate medical program with approximately 150 students per year, resulting in a total of around 900–1,000 medical students enrolled across the program.

Curriculum Inclusion/Changes

After the initial evaluation in 2019, we verified that all WHO PS Curriculum Guide topics (100%) were already included in the teaching guides of some subjects within the six academic years of the medicine career at Universidad Francisco de Vitoria ([Table 1](#) and [Figure 2](#)). The PS contents were distributed in the teaching guides of 14 subjects (Bioethics, Clinical Method-I and -II; Clinical Rotation- I and -II, Communication, Geriatrics, Introduction to Surgery, Legal Medicine and Toxicology, Medical Humanities, Pharmacology, Preventive Medicine, Primary Care and Family Medicine (Rational use of medicines), and Skills and Competencies of the Person) ([Tables 1](#) and [2](#)). The academic year with more PS matters was the fourth year ([Figure 2](#)), with all the topics addressed except topic 10 (PS and invasive procedures).

[Figure 2](#) shows the WHO PS curriculum guide topics included in the teaching guides and taught in each academic year of the medical degree before (2019) and after our study (2024). [Table 2](#) details the subjects whose teaching guides were modified by adding or modifying the PS matters of the different topics.

It was detected that two topics (2 [Importance of applying human factors for PS] and 4 [Being an effective team player]) were being addressed in the classes of some academic year (first and second years [topic 2] and third, fourth, and fifth years [topic 4]) but were not explicitly included in the corresponding teaching guides ([Table 1](#) and [Figure 2](#)). These findings, along with the purpose of improving the teaching of PS, as proposed by the WHO, led to modifying the teaching guides of subjects for all academic years ([Table 2](#)).

In the first and second years, topic 2 (Importance of applying human factors for PS) was included in both the teaching guides for the subjects Skills and Competencies of the Person and Medical Humanities. In the third year, topic 4 (Being an effective team player) was included in both the teaching guides of the subjects Medical Humanities and Clinical Methods-I. In the fourth year, content on PS topics 2 and 9 (Infection prevention and control), which were already included in the subjects Clinical Methods-II and Preventive Medicine, respectively, were added to the teaching guides of the subjects Skills and Competencies of the Person and Medical Humanities, respectively.

The PS contents on topics 3 (understanding systems and the effect of complexity on patient care) and 5 (Learning from errors to prevent harm) were expanded in the teaching guide of the Preventive Medicine subject. Moreover, topic 4 (Being an effective team player) was included for the first time in the fourth year in the subject Clinical Methods-II. In the fifth year, topic 4 was included in the subject Clinical Rotation-I, and in the sixth year, topic 10 (PS and invasive procedures) was included in the teaching guide of the subject Clinical Rotation-II.

Expansion

Although all topics ($n = 11$) were already included in the teaching guides of some subjects across all years, it was observed that only 10 topics (91%) were taught in the classes. Topic 10 (PS and invasive procedures) was not taught in the classes of any year, despite being included in the teaching guide of the Introduction to Surgery subject in third year ([Table 1](#) and [Figure 2](#)). Another case of PS content included in the teaching guide but not taught in class was topic 11 (Improving medication safety), which was included in the teaching guide of the Clinical Rotation-II subject (Clinical Workshops) in the sixth year; however, it was addressed in the third and fourth years ([Table 1](#) and [Figure 2](#)). In 2024, all the PS topics included in the teaching guides were taught in the classes and vice versa.

The number of subjects in which safety was addressed remained unchanged. Changes were performed in Medical Humanities (first, second, third and fourth years), Skills and Competencies of the Person (first, second and fourth), Preventive Medicine (fourth year), Clinical Methods -I (third year) and -II (fourth year), and Clinical Rotation -I (fifth year) and -II (sixth year).

Application

Regarding the practical application, this study led to an improvement in the number of topics taught in the classes of third and sixth years, addressing topic 10 (PS and invasive procedures) and topics 10 and 11 (Improving medication safety), respectively ([Figure 2](#)). Furthermore, new activities for teaching PS were added ([Table 1](#)): simulation exercises in fourth year (topic 9 [Infection prevention and control]) and the activities of the workshops of the Clinical Rotation-II subject in sixth year

Table 1. Results of the Curriculum Mapping and Curricular Intervention

WHO PS curriculum topic	Year	Subject in which the topic was addressed. 2019	Teaching guide 2019	Changes in PS curriculum 2024 vs. 2019	Taught in class 2024	Activities for teaching PS 2019 (normal text) 2024 (normal text + <u>underlined text</u>)	Assessment methods 2019 (normal text) 2024 (normal text + <u>underlined text</u>)
1 What is PS?	4 th	- Preventive Medicine:	Yes	NA	Yes	Lectures Independent study	MCQs Extended written work
2 Why applying human factors is important for PS?	1 st	- Skills and Competencies of the Person (Mentoring)	No	Contents included in the teaching guide of each subject	Yes	Accompanying	Extended written work Portfolio
	2 nd	- Medical Humanities (Mentoring)	No		Yes	Small group discussion Debate	Extended written work
	3 rd	- Medical Humanities - Skills and Competencies of the Person - Clinical Method-I	Yes	NA	Yes	Accompanying Small group discussion Debate Simulation exercises Role-play Small group discussion	MCQs Extended written work Direct observation in simulated contexts Direct observation in simulated contexts
	4 th	- Clinical Method-II	Yes	OSCE-4 th	Yes		OSCE-4 th
	5 th	- Clinical Rotation-I (Communication and Simulation exercises)	Yes	PS items in Skills and competencies of the person (Mentoring) NA	Yes	Simulation exercises Learning from peers	OSCE-5 th
	6 th	- Clinical Rotation -II (Communication, Simulation exercises, and Teamwork theory [in CRM system and in leadership-emotional management workshop])	Yes	NA	Yes	Small group discussion Simulation exercises	OSCE-6 th
3 Understanding systems and the effect of complexity on patient care	4 th	- Legal Medicine and Toxicology: Topic: Health law IV. Professional liability - Preventive Medicine: (Swiss cheese model of system accident)	Yes	Preventive Medicine: Concepts of PS were expanded	Yes	Lectures	MCQs
						Debate Small group discussion	SAQs.

(continued)

Table 1. (continued)

WHO PS curriculum guide topic	Year	Subject in which the topic was addressed. 2019	Teaching guide 2019	Changes in PS curriculum 2024 vs. 2019	Taught in class 2024	Activities for teaching PS 2019 (normal text) 2024 (normal text + <u>underlined text</u>)	Assessment methods 2019 (normal text) 2024 (normal text + <u>underlined text</u>)
4 Being an effective team player	3 rd	- Medical Humanities (Professionalism and self-care) - Clinical Method-I	No	Contents included in the teaching guide of each subject	Yes	Accompanying	MCQ
	4 th	- Clinical Method-II	No	Content included in the teaching guide.	Yes	Small group discussion Simulation exercises	Extended written work. Direct observation in simulated contexts
	5 th	- Clinical Rotation-I	No	OSCE-4 th Content included in the teaching guide	Yes	Small group discussion Simulation exercises Learning from peers	Direct observation in simulated contexts OSCE-4 th Direct observation in simulated contexts.
	6 th	- Communication	Yes	NA	Yes		OSCE-5 th Direct observation in simulated contexts.
5 Learning from errors to prevent harm	4 th	- Clinical Rotation-II - Preventive Medicine (mainly Cardiorespiratory system/ auscultation)	Yes	Concepts of PS were expanded	Yes	Lectures	OSCE-6 th MCQs Extended written work MCQ
6 Understanding & managing clinical risk	4 th	- Preventive Medicine - Clinical Method-II -Clinical reasoning	Yes	NA	Yes		
7 Using quality-improvement methods to improve care	4 th	- Preventive Medicine	Yes	NA	Yes		MCQs

(continued)

Table 1. (continued)

WHO PS curriculum guide topic	Year	Subject in which the topic was addressed. 2019	Teaching guide 2019	Changes in PS curriculum 2024 vs. 2019	Taught in class 2024	Activities for teaching PS 2019 (normal text) 2024 (normal text + underlined text)	Assessment methods 2019 (normal text) 2024 (normal text + underlined text)
8 Engaging with patients and carers	1 st	- Skills and Competencies of the Person - Medical Humanities	Yes	NA	Yes	Lectures Case discussion Accompanying Accompanying Small group discussion Simulation exercises Small group discussion	Portfolio
	3 rd *	- Clinical Method-I (Medical records + Simulated exploratory workshops)	Yes	NA	Yes		MCQs Direct observation in simulated contexts
	4 th	- Bioethics	Yes	OSCE-4 th	Yes		Direct observation in simulated contexts.
	5 th	- Clinical Method-II - Clinical Rotation -I	Yes	NA	Yes	Simulation exercises Learning from peers	OSCE-4 th Direct observation in simulated contexts.
	6 th	- Clinical Rotation -II (Communication, Simulation exercises, and teamwork theory [in CRM system and in leadership-emotional management workshop])	Yes	NA	Yes		OSCE-5 th Direct observation in simulated contexts.
9 Infection prevention and control	4 th	Preventive Medicine: (Communicable diseases, tuberculosis)	Yes	PS items in the Medical Humanities subject: Infection prevention → Improvements in scenario-based simulations	Yes	Lectures Simulation exercises	MCQs
10 Patient safety and invasive procedures	3 rd		Yes	Introduction to surgery subject: one class of PS	Yes	Lectures	MCQs
	6 th		No	Clinical Rotation-II _Surgery workshops (invasive, etc); Protocols, surgery checklists... were addressed	Yes	Small group discussion Simulation exercises (protocols, surgery checklists...)	OSCE-6 th

(continued)

Table 1. (continued)

WHO PS curriculum guide topic	Year	Subject in which the topic was addressed. 2019	Teaching guide 2019	Changes in PS curriculum 2024 vs. 2019	Taught in class 2024	Activities for teaching PS 2019 (normal text) 2024 (normal text + <u>underlined text</u>)	Assessment methods 2019 (normal text) 2024 (normal text + <u>underlined text</u>)
11 Improving medication safety	3 rd	- Pharmacology. Adverse reactions and PhV + reinforcement in practical activities (PhV website)	Yes	NA	Yes	Lectures	MCQs
	4 th	- Primary care and family medicine: Rational use of medicines				Small group discussion	
	6 th	- Geriatrics: Polypharmacy in the elderly	Yes	NA	Yes	Lectures	MCQs
			Yes	Clinical Rotation-II Workshops in Primary Care- 6 th year- Polymedicated	Yes	Small group discussion Debate	OSCE-6 th

ADR, adverse drug reaction; CRM, Customer Relationship Management; MCQ, Multiple-choice questions; MRSA, Methicillin-resistant Staphylococcus aureus; OSCE, Objective structured clinical examination; PS, patient safety; PhV, pharmacovigilance; SAQs, short-answer questions.

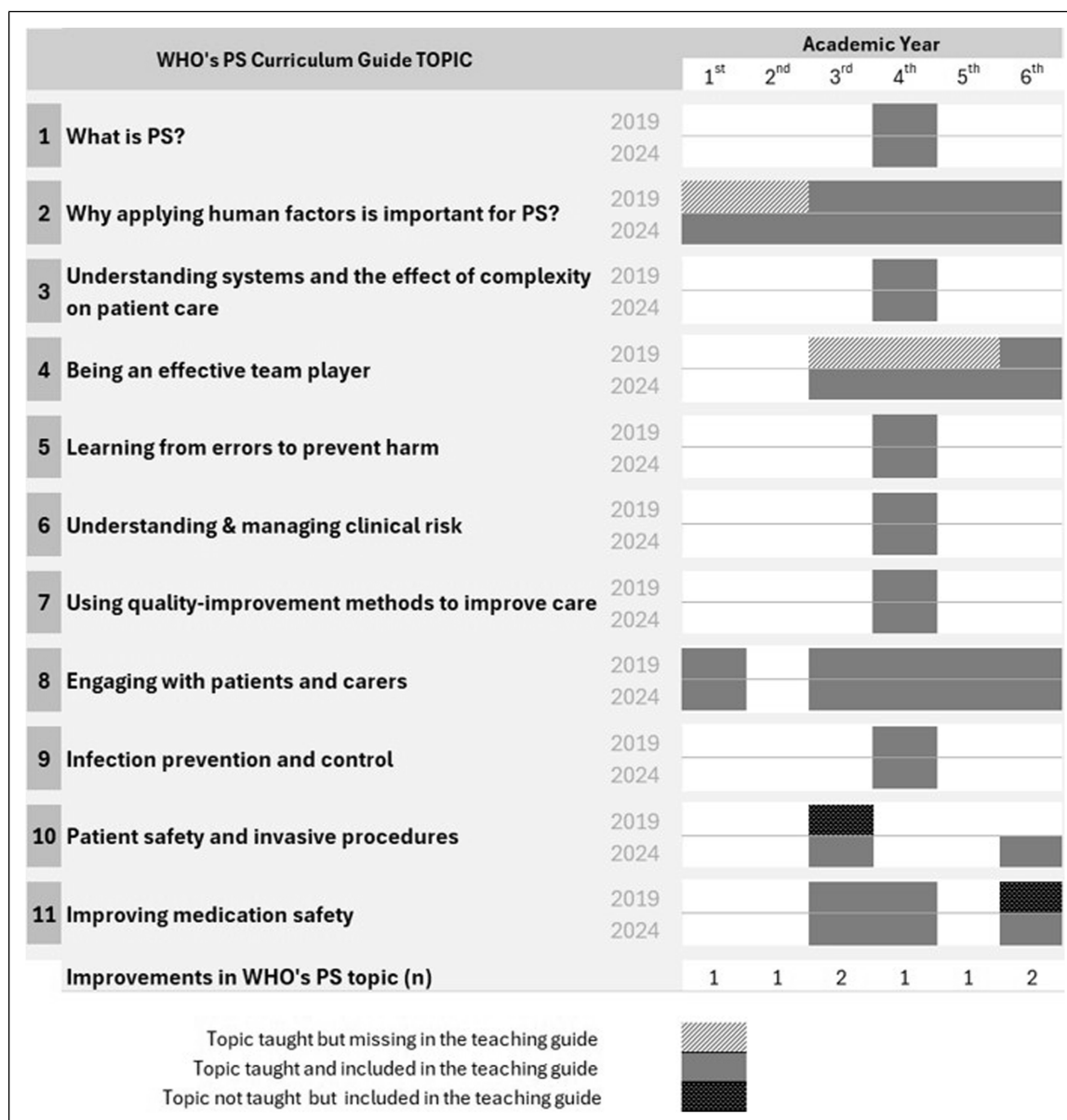


Figure 2. Changes in the WHO PS curriculum guide topics included in the teaching guides and taught from 2019 to 2024 in the medicine career.

PS, patient safety; WHO, World Health Organization

(Surgery workshops- topic 10 and workshops in Primary Care- topic 11). The assessment methods were also improved with the introduction of a new OSCE in the fourth year (OSCE-4th) (Table 1), which was maintained until the sixth year.

Comparing the competencies in prevention and health promotion of 96 students evaluated with this OSCE-4th at the beginning of the fourth year (in 2021) prior to the complete implementation of the recommendations (WHO) versus this same evaluation in 2022, 2023 and 2024, we observed that the mean of the scores of the OSCE-4th increased from 1.20 out of 10 points (SD, 1.895) to 7.99 out of 10 points (SD, 2.378) in 2022, 6.6 out of 10 points (SD 1.47) in 2023 and 6.1 out of 10 points (SD 0.84) in 2024 (ANOVA $p < 0.001$). In the post hoc test, statistically significant differences were found between all years except 2023 vs. 2024.

Table 2. Subjects With WHO PS Curriculum Guide Topics in Their Teaching Guides Already Included in 2019 (Normal Text) and Added (Underlined Text) or Modified (PS Matters Expanded) (**Highlighted Text**) in 2024

WHO PS curriculum guide topic	Subjects	Academic year
1 What is PS?	Preventive Medicine	4 th
2 Why applying human factors is important for PS	Skills and Competencies of the Person (Mentoring)	<u>1st</u> , <u>2nd</u> , 3 rd , <u>4th</u>
	Medical Humanities	<u>1st</u> , <u>2nd</u> , <u>3rd</u>
	Clinical Method -I	<u>3rd</u>
	Clinical Method -II	4 th
	Clinical Rotation -I	5 th
	Clinical Rotation -II	6 th
3 Understanding systems and the effect of complexity on patient care	Preventive Medicine	4th
	Legal Medicine and Toxicology	4 th
4 Being an effective team player	Medical Humanities (Professionalism and self-care)	<u>3rd</u>
	Clinical Method -I	<u>3rd</u>
	Clinical Method -II	<u>4th</u>
	Clinical Rotation -I	<u>5th</u>
	Clinical Rotation -II	<u>6th</u>
	Communication	6 th
5 Learning from errors to prevent harm	Preventive Medicine	4th
6 Understanding & managing clinical risk	Preventive Medicine	4 th
	Clinical Method -II	4 th
7 Using quality-improvement methods to improve care	Preventive Medicine	4 th
8 Engaging with patients and carers	Skills and Competencies of the Person	1 st
	Medical Humanities	1 st
	Clinical Method -I	3 rd
	Clinical Method -II	4 th
	Bioethics	4 th
	Clinical Rotation -I	5 th
	Clinical Rotation -II	6 th
9 Infection prevention and control	Preventive Medicine	4 th
	Medical Humanities	4 th
10 PS and invasive procedures	Introduction to Surgery	<u>3rd</u>
	Clinical Rotation -II (Surgery workshops)	<u>6th</u>
11 Improving medication safety	Pharmacology	<u>3rd</u>
	Primary Care and Family Medicine: Rational use of medicines	3 rd
	Geriatrics	4 th
	Clinical Rotation -II (Workshops in Primary Care)	<u>6th</u>

PS, patient safety; WHO, World Health Organization.

Discussion

This study describes the comprehensive integration of the WHO PS Curriculum Guide into a medical undergraduate program and analyzes its curricular and evaluative impact. Unlike most existing literature, focused on postgraduate education or isolated interventions, this experience demonstrates that transversal and systematic implementation is possible across all academic years.

In a systematic review carried out in 2011, the year in which the WHO PS Curriculum Guide was launched, the urgent necessity of early incorporation into medical school curricula (undergraduate) of the knowledge of human error and the factors influencing adverse events to improve PS was identified.⁹ However, most of the literature published on the evolving curriculum in quality improvement and PS of health care in medical education continues to focus on graduate medical education.¹⁰ This also occurs in Spain, where most PS training actions have focused on continuing education in postgraduate studies, and the training in undergraduate studies depends more on the interest of each professor.⁶ In our study, our commitment to promoting PS training at undergraduate studies is reflected in the fact that two PS topics (2 [Importance of applying human factors for PS] and 4 [Being an effective team player]) were taught in several subjects without being included

in the teaching guides. In line with this, it has also been reported that much of the PS teaching of undergraduates takes place through the informal or hidden curriculum (while students are on clinical placement).¹¹ It all suggests the need to expand formal PS teaching in healthcare undergraduate curricula.¹¹

Since the beginning of Universidad Francisco de Vitoria's teaching, there has been an awareness of the importance of creating a PS culture at the beginning of medical training; therefore, aspects of PS were included in the medical curriculum. This justifies the fact that there are not barriers, previously identify as limiting factors to ensuring PS as a major component of education and training, at our faculty such as: busy curriculum, absence of buy-in from stakeholders, lack of a mandate from school's dean's office, weaknesses in educational coordination and planning, limited leadership interest, and insufficient senior medical champions.^{3,9,12} However, the availability of the WHO's recommendation to implement PS training at universities led us to try to improve in this area.

Regarding the process we followed to improve our curriculum, from curriculum mapping to implementation, the initial steps we took correspond to the four stages of curriculum implementation reported by Ginsburg et al. (2017), who examined PS curriculum implementation in low-income and middle-income countries.¹³

To the best of our knowledge, this is the first article to detail the implementation of all 11 educational topics suggested by the WHO, based on its recommendations, covering all key areas of PS knowledge across all academic years of the medical degree. In the nursing education setting, a nursing college published a step process to integrate PS topics into the existing curriculum.¹⁴ Like us, the modifications distributed PS topics sequentially across the curriculum, integrated into clinical education. This is best received than solely taught in pre-clinical lectures modules,¹⁵ in concordance with the fact that PS is not a traditional stand-alone discipline and can and should be built into all areas of health care.⁷ Moreover, integrating into the existing curriculum does not necessarily require new blocks of time (a potential barrier).⁹

Our curriculum mapping showed that 10 of 11 WHO's PS topics were assessed in some way during all the academic years already in 2019. This finding differs from that published by Aranaz Andrés et al in 2024.⁶ In his study, none of the 38 Spanish medical faculties assessed had implemented all the recommendations from the WHO's PS curriculum guide, with a maximum of seven items addressed in only one faculty.⁶

Topic 10 (PS and invasive procedures) was the unique topic not addressed at any time during the career, despite being included in the teaching guide of one subject (Introduction to Surgery, third year). The same happened in the sixth year with item 11 (Improving medication safety) in the Clinical Rotation-II subject. However, this topic was addressed in third and fourth years. Meeting with coordinators of each subject involved allowed us to reinforce the understanding of the contents of PS and teacher awareness. In 2024, these findings were solved, covering all WHO topics appropriately in both teaching guides and practical application.

Regarding the curriculum inclusion and changes, after the curriculum mapping, there were no changes in the subjects in which PS items were addressed. However, in the different academic years, the PS topics were expanded in some of those subjects in which they already included PS, or were added when they were not yet included. As previously reported, the Preventive Medicine subject is the one in which PS items are most frequently included.⁶ This signature is taught in fourth year, together with other subjects in which PS items are also included: Clinical Methods-II, Legal Medicine and Toxicology, Bioethics, Geriatrics, Skills and Competencies of the Person, and Medical Humanities. In the last two subjects, the PS topics were added after the intervention of this study. This justifies that the fourth year is the one with the most PS topics addressed (10 [PS and invasive procedures]/11 [Improving medication safety]).

As a consequence of all the changes introduced during this study, all the topics from the WHO PS Curriculum Guide were not only appropriately incorporated into our undergraduate medical curriculum but also taught in classes, seminars, or simulated scenarios. This suggests that the successful implementation of the curriculum was supported by a shared institutional vision, faculty engagement, and a teaching culture oriented toward continuous improvement, all of which have been identified as critical success factors in the literature.¹³ The integration did not require adding new instructional hours but rather reorganizing content within existing subjects, consistent with WHO guidance.⁷

Regarding the teaching strategies to effectively educate students on PS, those recommended by the WHO focus on active learning, real-world application, and fostering a culture of safety.⁷ These strategies, which we follow, include didactic lectures, case-based learning, small-group discussions, simulation-based training, team-based learning (learning from peers), workplace-based learning (in workshops for Clinical Methods and Clinical Rotation subjects, accompanying...), and reflective practice and debriefing (discussion). They are used to be supported with several tools such as role-play exercises and independent studies. Although the WHO guide specifies for all topics that didactic lectures are not usually the best way to teach students about PS,⁷ we detected 5 PS topics in which lectures were the unique teaching strategy we follow (5 -Learning from errors to prevent harm, 6- Understanding & managing clinical risk, 7- Using quality-improvement methods to improve care, and 9- Infection prevention and control PS and invasive procedures). To improve this topic, we added simulation exercises for teaching topics 9 (Infection prevention and control) and 10 (PS and invasive procedures); for the last topic, we also added small discussion groups. Simulation-based training in medical education has shown numerous advantages for

improving skill acquisition and retention¹⁶; however, it entails challenges such as the cost associated with purchasing and maintaining equipment, as well as specialized facilities and personnel trained on technological and system advances for safe care.^{3,16} In the Francisco de Vitoria University facilities, there are both the equipment and the trained personnel necessary for its use, so we did not encounter these barriers.

Regarding the assessment methods, the intervention performed in this study also led to improvements in those used to evaluate the acquisition of knowledge on PS. In 2019, the methods used in the medicine faculty of Francisco de Vitoria University included direct observation in simulated contexts, extended written work (reflective writing), multiple-choice questions (MCQs), portfolios, short-answer questions (SAQs), and OSCE. Previous to this study, an OSCE had been included in the fifth year in addition to the mandatory OSCE in the final year (sixth) of medical school. During the study, we added an additional OSCE in the fourth year. This OSCE-4th, implemented at both the beginning and end of the year (2021), showed a progressive increase in performance: from 1.20/10 in the first cohort to 7.99/10 the following year, and maintained scores of 6.6 and 6.1 in subsequent years. This improvement reflects a real acquisition of practical PS competencies and confirms the OSCE's value as a valid assessment tool for these skills.¹⁰ Then, the OSCE-5th and OSCE-6th demonstrated the maintenance of that knowledge, which can reflect the efficacy of the modified PS curriculum. To attribute these gains to the PS curriculum integration we dismissed several potential confounders such as cohort differences, examiner variability, changes in OSCE difficulty, or concurrent curricular reforms. OSCE assessments were performed longitudinally in the same group of students throughout their clinical training. Examiner variability was minimized by using a stable committee of experienced faculty evaluators who routinely participate in OSCE assessments and undergo training aimed at promoting homogeneity and objectivity in scoring procedures. The OSCE committee routinely reviews performance metrics to maintain an appropriate and comparable level of assessment difficulty across successive OSCE administrations, and no major concurrent curricular reforms specifically targeting PS competencies were introduced during the study period beyond the structured PS curriculum integration described in this study.

Strengths and Limitations

This study offers one of the few comprehensive, longitudinal descriptions of the implementation of the WHO PS Curriculum Guide across an entire undergraduate medical program. Strengths include its long observation period (2019–2024), the integration of both quantitative and qualitative data, and the inclusion of all WHO PS topics, providing a broad and detailed view of the process. Conducted in a real institutional context, it reflects practical challenges and feasible strategies for embedding PS education within medical curricula.

However, as a single-center study based in a private university, generalizability is limited. Although this curriculum modification might be considered limited by the resources of individual schools (e.g., simulation facilities, faculty expertise), the WHO's proposal to incorporate key aspects of patient safety into medical student education is designed for all types of universities, whether public or private. The guide offers various types of activities to implement this patient safety curriculum based on the capacity and resources of each institution. Most of the changes introduced in our curriculum have been made based on these recommendations in subjects within the medical curriculum common to all undergraduate programs, without requiring resources beyond those typically available to an educational institution. Therefore, we believe this proposal is transferable and adaptable to other institutions, both public and private. Evaluation was primarily based on curricular mapping and OSCE performance rather than on long-term behavioral or clinical outcomes. Moreover, the COVID-19 pandemic interrupted part of the implementation timeline, which may have influenced the data.

Future multi-center and longitudinal research could assess the sustainability, scalability, and impact of this educational approach on clinical practice.

Conclusions

We detailed the procedures carried out by the private Universidad Francisco de Vitoria (Spain) to achieve a comprehensive and successful integration of the WHO PS Curriculum Guide into a medical undergraduate program. This experience demonstrates that PS education in undergraduate medicine is both feasible and impactful. Therefore, future focus should be on achieving the implementation of the WHO's PS topics in existing curricular courses. Educating for safety does not imply an additional burden, and it is a necessary foundation for building better healthcare.

Moreover, one of the key lessons learned from this initiative is the importance of interprofessional training from early stages. Building trust and collaboration between different health professions during undergraduate education may translate into more effective and humane clinical teams in the future, improving coordination and patient outcomes.

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Ethical Considerations

Ethical approval for this study was obtained from the Institutional Ethics Committee of Universidad Francisco de Vitoria (Ref. UFV-PS2020/03). The study did not involve individual patient data.

Author Contribution

All authors contributed equally to the conception, design, execution, analysis, and interpretation of the study, and to the drafting and critical revision of the manuscript. All authors approved the final version for publication.

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Data Availability Statement

Data are available upon reasonable request.

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