Systematic Reviews

PROTOCOL

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Using virtual patients to enhance empathy in medical students: a scoping review protocol

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Abstract

Introduction Empathy is a crucial skill that enhances the quality of patient care, reduces burnout among healthcare professionals, and fosters professionalism in medical students. Clinical practice and standardized patient-based education provide opportunities to enhance empathy, but a lack of consistency and reproducibility as well as significant dependency on resources are impediments. The COVID-19 pandemic has further restricted these opportunities, highlighting the need for alternative approaches. Virtual patients through standardized scenarios ensure consistency and reproducibility while offering safe, flexible, and repetitive learning opportunities unconstrained by time or location. Empathy education using virtual patients could serve as a temporary alternative during the COVID-19 pandemic and address the limitations of traditional face-to-face learning methods. This review aims to comprehensively map existing literature on the use of virtual patients in empathy education and identify research gaps.

Methods This scoping review will follow the Joanna Briggs Institute's guidelines and be reported according to PRISMA-P. The search strategy includes a comprehensive search across databases such as PubMed (MEDLINE), CINAHL, Web of Science, Scopus, ERIC, Google, Google Scholar, and Semantic Scholar, covering both published and gray literature without language restrictions. Both quantitative and qualitative studies will be included. Two independent researchers will screen all titles/abstracts and full texts for eligibility. Data will be extracted to summarize definitions of empathy, characteristics of virtual patient scenarios, and methods for measuring their impact on empathy development. Results will be presented in narrative and tabular formats to highlight key findings and research gaps.

Discussion As this review analyzes existing literature, ethical approval is not required.

Findings will be actively disseminated through academic conferences and peer-reviewed publications, providing educators and researchers with valuable insights into the potential of virtual patients to enhance empathy in medical education. This study goes beyond the mere synthesis of academic knowledge by contributing to the advancement of medical education and clinical practice by clarifying virtual patient scenario design and evaluation methods in empathy education. The findings provide a critical foundation for our ongoing development of a medical education platform aimed at enhancing empathy through the use of virtual patients.

Keywords Students, Medical, Empathy, Virtual reality, Scoping review

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Background

Empathy is an essential skill for physicians to provide high-quality patient care. Empathetic physicians can alleviate patient distress [1] and improve patient satisfaction [2]. They can strengthen trust and therapeutic relationships [3, 4], enhance treatment adherence, and improve health outcomes [5, 6]. Empathetic practice reduces the risk of medical malpractice and decreases healthcare provider burnout [7, 8]. Empathy, which is indispensable in clinical practice, is also important for medical students to enhance their professionalism [9] and reduce burnout [10].

Empathy is a competency that can be taught and enhanced [11]. Therefore, integrating empathy training into medical education curricula is essential for fostering the professional growth of medical students and preparing them to provide high-quality healthcare in the future. However, a decline in empathy among medical students during their training [12, 13] has prompted medical schools worldwide to explore innovative educational methods for enhancing empathy.

Empathy has been conventionally learned by directly interacting with patients and listening to and sharing their experiences [14]. The main forms of face-to-face learning include clinical practice and role-playing with standardized patients (SPs). Clinical practice provides essential opportunities to enhance empathy through direct face-to-face interactions with patients. It provides valuable opportunities for such learning. However, reduced hospital stays, shortages of clinical faculty [15], and measures to prevent the spread of infections such as the COVID-19 pandemic have reduced such opportunities for clinical practice [16]. Although the impact of the COVID-19 pandemic has lessened, concerns remain about the possibility of re-emergence due to new variants [17].

Role-playing with SPs, another method, has also been utilized to foster empathy [18]. SPs are trained actors who portray patients and evaluate medical students' performance [19]. However, SPs-based training is resource-intensive; it requires significant costs for training and employment [18, 20] and has inherent limitations in ensuring the reproducibility and consistency of diverse clinical scenarios [20]. Medical students may feel nervous during role-playing with SPs, making it difficult to perform at their usual level [21], and face-to-face learning with SPs may be restricted during outbreaks of infectious disease. These challenges highlight the need for scalable, cost-effective, reproducible, and consistent alternatives to traditional face-to-face learning for empathy education.

The limitations on face-to-face learning during the COVID-19 pandemic helped popularize virtual reality (VR) technology as a means to maintain the quality of clinical education with particular focus on the use of virtual patients [22, 23]. Virtual patients are interactive computer simulations that mimic real-world clinical education, learning, and assessment scenarios [24]; they are also cost-effective [22]. Virtual patients offer medical students access to diverse and standardized clinical scenarios, including critical and rare cases [25], and thus, opportunities for learning in a safe and flexible environment. This standardization ensures consistency and reproducibility, which are challenging to achieve with traditional face-to-face education. Additionally, virtual patients reduce the need for direct instructor involvement potentially alleviating the issue of instructor shortages. Medical students have reported that immersive interactions with virtual patients provide learning experiences comparable to clinical practice [26] and have expressed interest in using VR for empathy education [22]. Thus, employing virtual patients for empathy education is not merely a pandemic-specific temporary alternative but represents a promising tool for addressing the limitations of traditional face-to-face learning.

We know that interactions with virtual patients can enhance medical students' empathy at an effective cost [22, 27–29]. However, virtual patients face challenges in replicating realistic and complex human behavior [22], and empathy training might be more effective with SPs or role-playing between students [19, 30]. Some medical students have reported feeling that virtual patients do not adequately nurture empathy [31]. Some studies even suggest an economic burden [22]. These conflicting results may stem from factors such as the lack of consensus on the definition of empathy in medical students [32], variations in the content of virtual patient interaction scenarios, differences in program structures, and diverse methods used to evaluate empathy.

While reviews have been conducted on the effects of virtual patients on medical students' clinical reasoning skills [33] and communication training [34, 35], no reviews specifically focus on empathy among medical students. Related reviews have examined facilitators and barriers to empathy in VR experiences among disability support workers [36], the effects of empathy training in VR experiences among the general public [37], and methodologies for enhancing empathy [38]. However, these studies using VR targeting disability support workers or the general public do not use virtual patients and do not target medical students. They focus on the effects and methodologies of enhancing empathy through VR and do not comprehensively examine the definitions of empathy among medical students' interaction scenarios with virtual patients or assessment methods.

As virtual patients gain attention as educational tools for fostering empathy in medical students, it is necessary

to comprehensively review existing literature and identify research gaps to further expand the scope of research on this topic. This study aims to investigate existing knowledge on virtual patients for enhancing empathy in medical students using a scoping review. We will map definitions of empathy among medical students' frequency of virtual patient utilization, virtual patient scenarios and programs, and methods of evaluating the effects of virtual patients to identify research gaps.

This study aims not only to consolidate academic knowledge but also to achieve practical outcomes such as promoting professionalism among medical students, reducing the risk of burnout, and improving the quality of patient care by the clarifying scenario design and evaluation methods for empathy education using virtual patients. Our ongoing project is to develop a medical education platform that facilitates empathy cultivation through face-to-face interactions with virtual patients in a simulation environment modeled after a clinical setting. This review serves as a foundation for this project while also contributing to the broader advancement of medical education employing virtual patients. It also addresses the evolving educational landscape shaped by the COVID-19 pandemic, where we highlight the potential of virtual patients not merely as a temporary substitute but as a solution to challenges inherent in traditional face-to-face learning, such as a lack of consistency and reproducibility and high resource dependency. Virtual patient-based education is expected to effectively foster the empathy required of medical students in clinical practice and advance its application in medical education and clinical settings.

Methods

Unlike a systematic review, a scoping review aims to comprehensively map a broad range of knowledge by including all sources of information regardless of research design or quality. This approach facilitates the exploration of new research fields, clarification of key concepts foundational to a particular area, and the rapid synthesis of available literature and types of evidence, making it particularly useful for identifying research gaps [39]. In this protocol, we have adopted the scoping review methodology to comprehensively map the literature on the underexplored topic of using virtual patients to enhance empathy in medical students.

This protocol was designed based on the six-stage approach by Arksey and O'Malley [39] and the scoping review guidelines of the Joanna Briggs Institute [40]. Specifically, we will (1) identify the research questions and eligibility criteria; (2) identify relevant studies; (3) perform the study selection; (4) chart the data; (5) collect, summarize, and report the results; and (6) conclude with consultation. This scoping review will be reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) [41]; specifically, the PRISMA extension for a scoping review (PRISMA-ScR) checklist will be followed to report this study [42]. We plan to conduct this scoping review from December 1, 2025, to June 30, 2026. This protocol has been registered on Open Science Framework (https://osf.io/43mue/).

Step 1: Identify the research questions and eligibility criteria

Based on the population, concept, and context framework [40], we developed the inclusion and exclusion criteria as follows:

(a) Population: The population includes undergraduate medical students, regardless of their study level. Students enrolled in master's or doctoral medical programs, residents, and physicians are excluded. Undergraduate students in pharmacy, nursing, dentistry, or other health science fields are also excluded. There are no language restrictions. Studies where data on medical students cannot be separated from those on other health science students but include over 80% of medical students are also included.

(b) Concept: The concept focuses on empathy among medical students. This review aims to clarify the intrinsic concept of empathy among medical students. It only includes literature with a clear definition of empathy. Their distinction is emphasized because empathy and sympathy (primarily defined as an emotional response) result in different clinical outcomes [43]. Therefore, studies on sympathy and compassion are excluded.

(c) Context: The context focuses on using virtual patients in medical education. This includes avatars used with VR and other VR technologies. Sources related to augmented reality, mixed reality, virtual patients, and VR that are not focused on medical education are excluded.

(d) Search period: Regarding the search period, while research on VR in medical education existed before 2010, significant advancements and many relevant studies have been published since then [44, 45]; therefore, sources prior to 2010 are excluded.

(e) Type of source: The study will include both peer-reviewed primary studies and gray literature, the latter referring to non-commercially published reports and other documents not subjected to formal peer review. We will impose no restrictions on research design, encompassing experimental stud-

ies, observational studies, qualitative research, and systematic reviews.

This scoping review intends to address the following questions:

1. What evidence has been reported on the use of virtual patients to enhance empathy in medical students?
2. What are the definitions of empathy for medical students?
3. How frequently do medical students use virtual patients?
4. What is the content of the scenarios and programs, and what are the technical characteristics used in virtual patients-based clinical practice training that enhances empathy?
5. How is empathy in medical students enhanced using virtual patients, evaluated, and assessed?

Step 2: Identify relevant studies

Published literature will be searched using PubMed (MEDLINE), CINAHL, ERIC (Education Resources Information Center), Web of Science, and Scopus. The search for gray literature will be conducted using Google, Google Scholar, and Semantic Scholar.

The search strategy is tailored to each database, using comprehensive combinations of keywords, Medical Subject Headings (MeSH), and subject terms related to the population (medical students), concept (empathy), and context (virtual patients), combined with the Boolean operators "AND" and "OR" (as detailed in Additional file 1). The search strategy trialed in PubMed (MEDLINE) is presented in Table 1. The initial search was conducted by the first author on December 26, 2024. A medical librarian with expertise in the field provided valuable assistance in the development process.

Screening gray literature is time-consuming, and the likelihood of finding highly relevant articles is low [46]. Therefore, we will employ a method that involves screening only the first 100 hits, which are considered the most relevant [46]. Reference lists of all included studies were screened using a snowball approach to identify further relevant articles.

Step 3: Study selection

After the search, the identified literature will be uploaded to Zotero 6 (Center for History and New Media, George Mason University, USA). After the duplicates are removed, these articles will be imported into Rayyan [47]. Professional translators will translate literature written in languages other than English. Two independent reviewers will meticulously evaluate the study titles and abstracts based on the review's inclusion and exclusion criteria.

Table 1 Initial search in the PubMed (MEDLINE) electronic database

No	Query	Results
#1	"Students, Medical" [MeSH] OR "medical student*" [TW] OR "Education, Medical" [MeSH] OR "medical educat*" [TW] OR "undergraduate medical student*" [TW] OR "undergraduate medical education*" [TW] OR "medical education curriculum*" [TW] OR "medical teach*" [TW] OR "medical train*" [TW]	264,141
#2	"empathy" [MeSH] OR "empath*" [TW]	40,441
#3	"Virtual reality" [MeSH] OR "virtual reality*" [TW] OR VR [TW] OR "virtual patient*" [TW] OR "virtual environment*" [TW] OR "virtual world*" [TW] OR "avatar*" [TW] OR "virtual human*" [TW] OR "VPs" [TW]	39,150
#4	#1 AND #2 AND #3	48
#5	#1 AND #2 AND #3 Filter: from 2010 to 2024	47

VPs virtual patients

The full texts of selected articles will be thoroughly examined by two independent reviewers according to the study criteria. If the full text of an evidence source does not meet the inclusion criteria, the reviewers will document the reasons for exclusion. In cases of disagreement during the selection processes, another reviewer will be consulted to resolve issues through discussion [22]. The participating reviewer will refer to the predefined inclusion and exclusion criteria and the documented reasons for exclusion to identify and resolve the root cause of the disagreement.

The kappa statistic will be used to quantify interrater reliability among the independent reviewers [48]. The final scoping review will include a detailed report on the search results and the process for study inclusion presented using the PRISMA 2020 flow diagram [42].

Step 4: Chart the data/data items

The data selected from the sources will be charted using a data extraction tool we created using Microsoft Excel (Table 2). This task will be performed by two independent reviewers who will thoroughly review each article and extract all relevant data.

The extracted data will include details such as (i) author, (ii) year of publication, (iii) country of study, (iv) aim, (v) study design, (vi) study setting, (vii) population and sample size, (viii) intervention or concept, (ix) findings regarding medical students' empathy, (x) definition of empathy, and (xi) virtual patients' scenario and program. Table 2 is a draft and may be refined through several discussions during the review.

Table 2 Data extraction form

Categories	Type of data
1. Basic characteristics	Author
	Year of publication
	Country of study
	Aim
	Study design
	Population and sample size
	Intervention or concept
	Findings regarding medical students' empathy
2. Information relating to the review	Definition of empathy
	Virtual patients' scenario and program (virtual patients' scenario content, duration of virtual patients' scenario, frequency of virtual patients' use)
	Type of virtual patients (3D VR, VRE, VR with head-mounted display, VR simulation)
	Virtual patients' mode
	Developer
	Access (cost, website, article)
	Usage instructions
	Evaluation or validation of methods for enhancing medical students' empathy

Extracted data from each reviewer will be compared. In cases where disagreements arise among the independent reviewers, another reviewer will be involved in discussions to ensure a common understanding and consistency [22]. If any data are missing or additional information is needed, the authors will be contacted as appropriate. This procedure will assist in identifying gaps in the research. This review aims to map an overview of existing evidence; therefore, we will not assess the risk of bias in the extracted studies [42].

Step 5: Collect, summarize, and report the results

The proposed scoping review aims to map the evidence on the use of virtual patients to enhance empathy in medical students and to identify research gaps in this area. To fulfill this objective, the extracted data will be presented in tables according to specific data items. The characteristics and impact of virtual patients on medical students' empathy will be illustrated in tables or graphs, accompanied by a narrative description of the findings.

Step 6: Consultation

Consulting stakeholders is often an important step in scoping reviews to gather additional sources of information and perspectives [49]. However, as this review is being conducted as a separate qualitative study on virtual patients aimed at enhancing empathy in medical students, no stakeholder consultation will be included in this review.

Discussion

The purpose of this scoping review is to investigate existing evidence on the use of virtual patients to enhance empathy among medical students aiming to comprehensively map the definitions of empathy virtual patient scenarios, and methods for evaluating empathy, and to identify previously unexplored research gaps. Virtual patients, which gained attention during the COVID-19 pandemic, have been suggested as a means to overcome the challenges of traditional face-to-face learning such as limitations in consistency and reproducibility difficulties in standardization and heavy resource dependence. This review highlights the potential of virtual patient-based empathy education not merely as a temporary substitute but as a contributor to the development of a sustainable educational model.

The strength of this review lies in its being the first to comprehensively and systematically investigate studies on virtual patients specifically focused on empathy education encompassing a wide range of literature including non-English sources. By identifying research gaps in virtual patient studies—particularly their ability to ensure reproducibility, consistency, and the provision of a safe and flexible learning environment for medical students—this review is expected to foster further research in this domain and contribute to the standardization of empathy education as well as the enhancement of clinical practice training.

Conversely, this review has certain limitations. First, while this study adopts a rigorous methodology based on the Joanna Briggs Institute's guidelines for scoping

reviews [40], its nature as a scoping review neither allows for the quantitative evaluation of the intervention effects of empathy education nor for the determination of causality or effect sizes nor can it generate or interpret themes based on qualitative analysis. As this review does not assess the quality of included studies or restrict the types of study designs, we expect variability in the reliability and generalizability of the findings. The scope of the databases searched is limited, raising the possibility that some relevant studies may not have been captured.

Despite these limitations, this review aims not only to consolidate academic knowledge but also to provide a practical framework for effectively fostering empathy in medical students through the standardization of scenario development and evaluation methods for empathy education using virtual patients. By leveraging virtual patients, medical students are expected to develop the ability to listen empathetically to patients' suffering and distress, thereby significantly contributing to the establishment of trust between patients and students. Moreover, patients are more likely to perceive medical students as trustworthy individuals since medical students' abilities and values also affect trust in medical students [50].

Accumulating such positive empathetic experiences during medical education enhances medical students' professionalism and fosters a patient-centered approach in clinical practice after graduation, where empathy-driven consultations are prioritized. This approach is anticipated to improve the quality of patient care and reduce the risk of burnout among medical practitioners, ensuring substantial practical outcomes in clinical settings.

Finally, this review highlights its relevance as a critical foundation for the ongoing development of medical education platforms aimed at cultivating empathy through face-to-face interactions with virtual patients. The findings are intended to be disseminated through presentations at national and international conferences and publications in peer-reviewed academic journals in order to promote the development of new standardized models for empathy education and contribute to the advancement of medical education and clinical practice.

Abbreviations

SPs	Standardized patients
VR	Virtual reality
VRs	Virtual patients

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13643-025-02793-4.

Additional file 1. Search strategy for databases and search engine.

Additional file 2. PRISMA-P (Preferred reporting items for systematic review and meta-analysis protocol) checklist.

Additional file 3.

Additional file 4.

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Authors' contributions

RY led the review's conceptualization and design. KF, KX, and SK each made substantial contributions to its drafting and critical revision. All authors read and approved the final manuscript.

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Data availability

Not applicable.

Declarations

Ethics approval and consent to participate

We plan to analyze existing research studies and do not intend to involve medical students. Ethics approval was not required because this protocol does not involve human or animal subjects. All data used is publicly available and does not contain identifiable personal information.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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