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# Is simulation useful in preparing doctors-to-be for patient death: A narrative review

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## Abstract:

Clinical and communication skills involved in managing patient death are essential for medical practitioners, yet these skills are often neglected in undergraduate medical education. We aim to review current reported evidence of simulation-based education on medical students' preparedness and performance toward patient death. A narrative review of the literature on simulation-based education for medical students on patient death was conducted. Data on study design, simulation dimension, evaluation tool, and outcome were collected and summarized. Eleven prospective studies were included for narrative review. Simulation modalities included mannequins, standardized patients, and online virtual reality. Heterogeneity in the evaluation tool of simulation-based education was demonstrated. Ninety percent of studies concluded positive outcome of simulation on improving medical students' preparedness in patient death. No negative or adverse learner reaction was reported. Simulation-based education may safely improve medical students' competence in handling patient death. Current data and evaluation tools of education outcomes are sparse and heterogeneous. Future research is encouraged to explore this under-researched topic, amid increasing interest in the use of simulation in medical education.

## Keywords:

Health communication, palliative treatment, patient care, patient simulation, undergraduate medical education

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## Introduction

The COVID-19 pandemic had largely limited medical students' clinical exposure before they stepped into their new roles as junior doctors.<sup>[1-3]</sup> Medical students often felt unprepared before their first encounter with patient death.<sup>[4]</sup> The lack of experience in patient death among medical students may translate into clinical incompetence and emotional stress when they face a dying patient as junior doctors.<sup>[4,5]</sup>

The increasing use of simulation in medical education had been observed to improve patient care and safety.<sup>[6,7]</sup> Simulation-based medical education allows the creation of a

carefully controlled environment mimicking real clinical scenarios, for participants to learn through practice and feedback.<sup>[8]</sup>

Simulation-based medical education could be broadly characterized in three dimensions: scope, modality, and environment.<sup>[6]</sup> The scope of simulation refers to the scale or range of clinical scenarios applied, depending on the learning objectives. The most used modalities of simulation in medical education include standardized patients, part-task physical trainers, virtual reality, and mannequin-based simulation. Environment refers to the place or platform where the simulation is conducted. "Fidelity" of a simulation-based education is a multi-dimensional concept commonly referred to as the level of realism presented to learners.<sup>[9,10]</sup>

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The simulation had been used in a variety of domains in health care,<sup>[7,11]</sup> and its use had been focused particularly on technical and procedural skills acquisition.<sup>[7,12-15]</sup> Non-technical skills such as cognitive and interpersonal skills are essential in clinical practice; however, these “soft skills” are often lacking in junior doctors due to inexperience and inadequate exposure during primary medical education.<sup>[5]</sup> With the challenge of a global pandemic, it is important for medical students and junior doctors to be prepared when facing patient death. As the use of simulation in health education is gaining popularity, this article explores its use for clinical scenarios of patient death and its potential impact on medical students.

This is the first narrative review in the literature to summarize current evidence on simulation-based education in preparing medical students for patient death.

### Materials and Methods

This review was performed following a systematic literature search [Figure 1]. The search strategy included a combination of search terms “simulation or mannikin or manikin or mannequin”, “medical”, “student or education”, and “death or mortality”. Medline, EMBASE, BNI, CINHL, Emcare, and PubMed databases were used to identify English-language publications on simulation-based medical education on patient death. No time limit was set for the search, and the review was conducted by two reviewers (GW and RK) independently of each other.

All studies that described the use of simulation in medical student education on patient death were included. The inclusion and exclusion criteria of this review article were based on the PICO (Population, Intervention, Comparator, Outcome) elements [Table 1] of this review. Non-English publications, books, and documents were excluded. Titles and abstracts of publications retrieved by the primary search were systematically screened, and potentially relevant studies were shortlisted for a full-text review. The search was supplemented by a full-text review of relevant-sounding references from the articles.

A data collection sheet was drawn up and populated with: study design, learner population, the scope of simulation, simulation modality, the environment

**Table 1: PICO**

Population	Medical students
Intervention	Simulation-based medical education
Comparator	Education outcome without simulation
Outcome	Medical students’ preparedness or performance toward situation(s) of patient death

of simulation, evaluation tool of learning outcome, involvement of analysis, and study outcome. The Scale for the Assessment of Narrative Review Articles (SANRA)<sup>[16]</sup> was used as a quality assessment instrument for this review article.

### Results

A total of 11 prospective studies [Table 2] evaluated the efficacy of simulation-based medical education on medical students’ performance or preparedness in patient death. Other publications included in this review were narrative or review articles (n = 11). Included studies were published between 2009 and 2021.

The number of medical students (study population) enrolled in each prospective study varied from 6 to 145. Simulation modalities, scopes, and environment in each study are summarized in Table 2. Simulation modalities used include mannequins, standardized patients, or a combination of both. One study<sup>[18]</sup> used an online virtual patient as a simulation modality. Three studies did not specify the environment of simulation.<sup>[19,23,26]</sup> A combination of simulation and didactic education was used in six studies (54.5%).

### Evaluation tool

Eight (72.7%) studies evaluated the outcome of intervention (simulation-based education) with

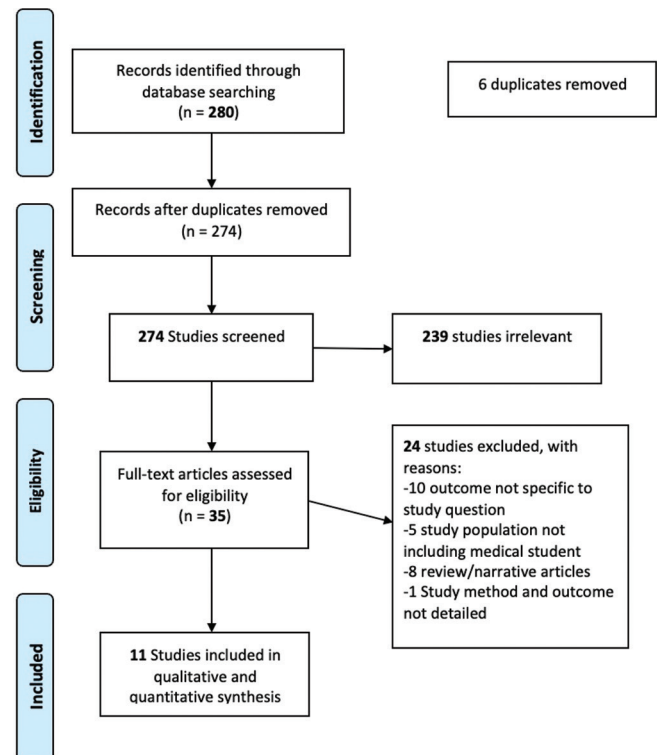


Figure 1: Systematic literature search flow diagram.jpg

**Table 2: Summary of included studies**

Prospective study	Learners (n)	Scope of simulation	Simulation modality	Environment of simulation	Evaluation tool of learning outcome(s)	Statistical analysis
Hobgood (2009) <sup>[17]</sup>	138	Death notification	Simulated survivors (standardized)	Room with simulated survivor	Assessment instruments (competence, interpersonal communication skills, self-confidence) completed by standardized patients	Yes
Tan (2013) <sup>[18]</sup>	130	End-of-life clinical situations (pain management, symptom control, discussing limited prognosis status)	Online virtual patient	Online virtual patient	Test on learners' knowledge of palliative care	Yes
Lamba (2015) <sup>[19]</sup>	120	Delivery of news of patient death	High-fidelity simulation mannequin	Not specified	Questionnaires for learners	Yes
Holling (2015) <sup>[20]</sup>	120	Brain death determination	High-fidelity simulation device (Mega-Code Kelly with Vitalism, Laerdal Medical GmbH)	Intensive care room	Questionnaires for learners	Yes
Hawkins A (2016) <sup>[21]</sup>	7	Patient death involving discussion of a no not attempt cardiopulmonary resuscitation	SimMan® mannequin -Standardized patients	Simulated ward environment	Interview of learners	No
Weiss (2017) <sup>[22]</sup>	56	Sudden patient death	High-fidelity mannequin (Gaumard®)	Emergency room setting	Questionnaires for learners	Yes
Parikh (2017) <sup>[23]</sup>	105	Palliative/end-of-life care scenarios	Standardized patient encounters	Not specified	Survey for learners to provide narrative comments	No
Lewis (2018) <sup>[24]</sup>	145	A patient with brain death, with the presence of family	SimMan® mannequin	Simulated patient bedside	Multiple choice questions for learners	Yes
Wells (2019) <sup>[25]</sup>	6	A dying patient with concerned relatives	High-fidelity simulator Standardized patients	Simulated ward side-room	Questionnaires for learners and thanatophobia scores	Yes
Jacobs (2020) <sup>[26]</sup>	9	Communication at the end of life	Standardized patients	Not specified	Questionnaires for learners	Yes
Jeffers (2021) <sup>[27]</sup>	120	Case of asystolic arrest: death exam and death notification	Mannequin with standardized patients	Simulation room	Questionnaires for learners	No

self-efficacy questionnaires or surveys completed by learners [Table 2]. No standardization of these self-rating instruments was observed. Learners' subjective preparedness in caring for dying patients before and/or after the simulation was assessed with question words including "Preparedness," "awareness," "comfort," "self-efficacy," and "confidence."

Objective evaluation instruments were used in three (27.3%) studies, in the forms of tested knowledge and performance scoring. No standardization of these evaluation instruments was observed among these studies. In a study conducted at New York University Medical School,<sup>[24]</sup> learners' knowledge of brain death was tested with 10 multiple-choice questions. Hobgood *et al.*<sup>[17]</sup> used evaluation instruments on students' communication interpersonal skills, self-confidence, and competence completed by the simulated survivors. Tan *et al.*<sup>[18]</sup> used a test to assess students' knowledge of palliative care; the content of the questions was not documented.

## Outcome

The outcome and conclusion from the eleven studies included in this review are summarized in Table 3.

Overall, 10 (90.9%) prospective studies concluded positive outcomes of simulation-based education in medical students' preparedness and confidence when facing patient death. Quantitative statistical analysis of the controlled study was performed in eight (72.7%) studies<sup>[17-20,22,24-26]</sup> among which six studies<sup>[18-20,22,24,26]</sup> concluded statistically significant improvement in students' preparedness with patient death.

One study<sup>[17]</sup> assessed student performance (competence, communication, and confidence scores) in delivering death notification, and no statistical difference was found between the study group (n = 70) exposed to a simulated survivor and the control group (n = 68) without such exposure.

None of the included studies reported negative outcomes or adverse learner reactions during the simulation activities.

**Table 3: Study outcomes**

Study	Study outcome and conclusion
Hobgood (2009) <sup>[17]</sup>	No improvement in students' competence, communication, or confidence scores.
Tan (2013) <sup>[18]</sup>	Significant improvement in students' knowledge score and self-assessed comfort level with all aspects of end-of-life management.
Lamba (2015) <sup>[19]</sup>	Significant increase in students' comfort, confidence, and knowledge in delivering news of patient death.
Holling (2015) <sup>[20]</sup>	-Significant improvement in students' confidence and knowledge in the evaluation of brain death. -No significant difference in students' motivation to engage with the topic of brain death evaluation.
Hawkins A (2016) <sup>[21]</sup>	The observed improvement in students' preparedness and communication skills.
Weiss (2017) <sup>[22]</sup>	Significant progression of students' perceived self-efficacy.
Parikh (2017) <sup>[23]</sup>	70% of respondents agreed that simulation allowed the development of crucial conversation skills needed for palliative/end-of-life care communications.
Lewis (2018) <sup>[24]</sup>	-Significant improvement in students' awareness and comfort in dealing with brain death. -Significant improvement in students' knowledge of brain death.
Wells (2019) <sup>[25]</sup>	-Observed improvement in students' preparedness in caring for dying patients. -No statistically significant reduction in mean thanatophobia scores post-simulation.
Jacobs (2020) <sup>[26]</sup>	Significant improvement in students' communication ability.
Jeffers (2021) <sup>[27]</sup>	The observed improvement in students' preparedness for skills required for a dying patient.

The Scale for the Assessment of Narrative Review Articles (SANRA) [Table 4] summarizes overall high-quality standards (sum score of 12) of this narrative review article.

## Discussion

Studies reviewed in this article used simulation with different modalities, scopes, and environments toward the learning objective of improving medical students' competence in face of patient death. All but one<sup>[17]</sup> of the reviewed publications concluded the positive effect of simulation-based education on medical students' preparedness and confidence in dealing with patient death. However, the majority of studies included in this review were single-center, non-randomized studies with a small sample size. Simulation outcomes in the included studies were mostly in the form of questionnaires filled by learners, with a lack of objective or quantitative analysis of student performance.

Confronting patient death is emotionally challenging to healthcare professionals,<sup>[28]</sup> even senior doctors with years of clinical experience may find it difficult when facing a dying patient and their family. Primary medical education largely focuses on the science and clinical knowledge to prevent patient death by teaching students about the right diagnosis and treatments. However, patient death could often be unexpected and inevitable despite advances in medicine. Medical students who lack clinical experience are often ill-equipped when they face their first patient death as junior doctors, the emotional and cognitive effects that followed might translate into poor performance.<sup>[29]</sup>

Managing patient death involves a spectrum of medical expertise, from palliative care to diagnosis and certification of death, to supporting relatives through the bereavement stages.<sup>[30]</sup> Patient death had been recognized as an important yet emotionally challenging topic in medical education,<sup>[31]</sup> yet undergraduate teaching of this topic among medical schools in the UK had been variable.<sup>[32]</sup> Medical students should be taught the psychosocial and clinical complexity of death, and the importance of interprofessional teamwork in managing a dying patient. Communication skills and ethical lessons are part of medical school education, but there is currently no standardized teaching program on the management of patient death.

Exposing medical students to a carefully controlled environment with simulated patient death could potentially improve their preparedness, communication skills, and medical management when facing a dying patient. However, this review revealed that there is a lack of level I and II evidence to support the use of simulation in improving medical students' preparedness or performance when encountering patient death.

The importance of a well-designed simulation in healthcare has been stressed by Gaba *et al.*<sup>[7]</sup> When designing simulation-based education for medical students, it is important to consider different dimensions of the simulation applied. A well-constructed simulation could potentially improve the quality of healthcare. However, it could be difficult to quantitatively measure the effectiveness of simulation as it is often reflected in the long-term performance of learners.<sup>[7]</sup>

A literature review published in 2016<sup>[33]</sup> explored the ethics and potential benefit of simulated death in medical education. Prospective studies with the utilization of simulated death were included in this review; some studies measured learners' ability to react professionally to a dying patient while some studies focused on the effect of simulated death on the clinical performance



**Table 4: Scale for the assessment of narrative review articles—SANRA\***

Quality Aspect	Evaluation Score
1. Justification of the article's importance for the readership	The importance is explicitly justified—2 points RATIONALE: The authors identified a perceived gap in current training, and they thoroughly explained the clinical and personal implications for medical students.
2. Statement of concrete aims or formulation of questions	One or more concrete aims or questions are formulated—2 points RATIONALE: The aim of the review is clear and explicitly stated “efficacy of simulation-based education in preparing medical students for patient death”.
3. Description of the literature search	The literature search is described in detail, including search terms and inclusion criteria—2 points RATIONALE: The literature review is clear and easily reproducible. The PRISMA guidelines were followed
4. Referencing	Key statements are supported by references—2 points -RATIONALE: The authors supported the most relevant key statements with references.
5. Scientific reasoning	Appropriate evidence is generally present—2 points -RATIONALE: Evidence for key arguments was clearly presented, and the study design was thoroughly explained.
6. Appropriate presentation of data	Relevant outcome data are generally presented appropriately—2 points -RATIONALE: Outcome data were selected and presented correctly and thoroughly.
Sum score	12

\*Baethge C, Goldbeck-Wood S, Mertens S. SANRA—a scale for the quality assessment of narrative review articles. *Res Integr Peer Rev.* 2019;4:5. Published 2019 Mar 26. doi: 10.1186/s41073-019-0064-8

of learners.<sup>[34]</sup> Most of the reviewed studies concluded that simulated death could bring a positive impact on learners, preparing learners for the difficult situation of patient death.

The topic of “simulated death” had been controversial in the literature.<sup>[35-37]</sup> The main concern of patient death in the simulation was the psychological stress on participants.<sup>[38]</sup> In a well-designed simulation-based medical education, feedback is an essential component for students to reflect on their performance.<sup>[14]</sup> The cause(s) of patient death in a simulation scenario should be comprehensively discussed such that learners understand each possible causative event leading to patient death. In reality, patient death could often be due to the patient or environmental factors that are irreversible despite medical efforts.<sup>[39,40]</sup> On the other hand, medical errors should be prevented whenever possible.<sup>[41]</sup> Medical educators in situations of simulated death should debrief and provide feedback for learners to understand what could have been improved to help prevent the patient’s death or whether the death was inevitable in the scenario(s).

The aim of this review is based on the PICO study question of whether simulation could improve medical students’ preparedness or performance toward patient death. Thus, this review only included studies where the outcome measured was learners’ ability or preparedness toward patient death. This review supported our current understanding that simulation-based education could be beneficial in preparing medical students for patient death, and in reducing the potential psychological stress when junior doctors face their first patient death. Overall, the use of simulation in the included studies provided a safe approach for medical students to learn and practice the management of patient death.

As a narrative review, this article focuses on providing an overall summary and interpretation of the current use of patient death simulation in medical education.<sup>[42]</sup> This topic is currently under-researched but continues to develop. There are several limitations in this review. Firstly, there is a lack of randomized controlled trials for evidence-based synthesis. Most studies included in this review adapted a quasi-experimental design. The risk of bias was only addressed in one study<sup>[26]</sup> in which no statistical quantification was performed for the estimated degree of bias. Secondly, marked heterogeneity was observed in the evaluation tool among the included studies. A significant proportion (72.7%) of included studies used questionnaires or surveys as a tool for the evaluation of learning outcomes; however, there was no standardization in the format of these methods of evaluation, thus the overall outcome of these studies could not be quantified for a meta-analysis. On the other hand, statistical analysis was performed in only eight (72.7%) studies, while three studies were significantly limited by the small number of participants. In one study,<sup>[18]</sup> there was no documentation of the content or number of questions asked by educators for evaluation of the outcome of students. The lack of objectivity due to sparse data limited the overall statistical analysis in this review. Lastly, the results from this review could be affected by confounding factors present in each study due to differences in simulation design. More future research is needed to demonstrate the safety and effectiveness of simulation of patient death in medical education. A summary of current understanding and interpretation of this topic aims at stimulating new insights on simulation modalities, scopes, and environments. With the advancement in simulation techniques and resources,<sup>[43]</sup> more robust future research will help medical educators design a constructive learning experience for medical students before they face their first dying patient as a doctor.

## Conclusion

Simulation-based education could potentially improve the performance and preparedness of medical students

in the clinical scenario of patient death. A well-designed simulation with feedback may improve the quality of education outcomes. Current evidence on the use of simulation in preparing medical students for patient death mainly comes from small cohort studies, without consensus on evaluation tools to measure education outcomes. Future research is encouraged to explore this under-researched topic, amid increasing interest in the use of simulation in medical education.

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### Conflicts of interest

There are no conflicts of interest.

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