

Effectiveness of simulation-based medical education perceptions and attitudes



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ARTICLE INFO

Article history:

Received 19 October 2023

Received in revised form

29 January 2024

Accepted 1 February 2024

Keywords:

Simulation

Healthcare

Medical education

Health informatics

Public health

ABSTRACT

Simulation is a highly effective method often used in medical training. Simulation-based medical education (SBME) provides a way for healthcare professionals and patients to experience medical scenarios without actual risk to health or safety. This study focuses on comparing the views and opinions about SBME and traditional medical education (TME) among students from various levels and programs within medical colleges at Majmaah University in Saudi Arabia. A survey was used to gather information on students' perceptions and attitudes towards SBME and TME. The study analyzed responses from 472 healthcare students using Statistical Analysis System software. Of these participants, 52.33% were male and 47.67% were female. Most of the students, 80.30%, were pursuing bachelor's degrees, while 19.70% were in master's programs. The breakdown of their fields of study was as follows: 17.80% in medicine, 71.82% in applied medical sciences, and 10.38% in dentistry. A large majority, 93.43%, were familiar with SBME in general, and 90.89% knew about SBME in their specific field, indicating high awareness. Despite the challenges in using and maintaining SBME, the study found overall positive perceptions and attitudes towards it among healthcare students. Additionally, most participants believed that SBME offers a better learning environment, helps in reducing future medical mistakes, and supports every student's right to access SBME training.

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1. Introduction

Simulation is one of the best techniques that is widely used in medical education. In order to create an experience without really experiencing it, simulation is a technique or approach that is used (Gaba, 2004; So et al., 2019; Bona et al., 2023). With no risk to one's identity and health, whether healthcare professionals or patients, simulation can offer a secure environment for reflection and learning from errors (Rudolph et al., 2014; So et al., 2019). However, it is one of the medical educational techniques that are used, and it can be combined with other techniques to reach the ideal goal of medical learning and practices.

Traditional medical education (TME) consists of traditional lectures and traditional lab practices before real clinical cases in internship years at

medical institutions. However, simulation-based medical education (SBME) is considered a fundamental method or technique in healthcare education for many reasons, including the ability to observe and control the tasks of students, starting from the easiest level to the hardest level, possibility of assisting and direction in a quiet environment without serious and real cases, and the ability of creating tasks that are rare in real cases (Bradley, 2006; Cooke et al., 2006; Francom, 2018; So et al., 2019).

However, in medical education, to use the simulation for building a successful education environment, several components are required, including a group of students who interact as they would in real medical cases, a medical environment that reflects the real environment, availability of medical tools and techniques that would be in the real environment, issues-centered education that is similar to actual clinical experience, a medical environment that gives students the feeling self-confident, and variety of sources for giving the feedback (Wang, 2011; So et al., 2019).

SBME has both benefits and drawbacks. The benefits of SBME include the ability for consistent

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and repeated practice on various clinical procedures. It helps avoid the consequences of errors for both students and patients. SBME allows for immediate intervention and advice for students. It provides hands-on experience with real equipment and techniques. Scenarios can be easily repeated, and cases can be tailored to meet educational needs (Maran and Glavin, 2003; Ypinazar and Margolis, 2006; Al-Elq, 2010). However, disadvantages of SBME include the complexity of some simulators (CQHCA, 2000), high cost (Kim et al., 2016), the need for continuous monitoring and maintenance (McGaghie et al., 2010; Cook et al., 2011; Sevdalis, 2015), and continuous development of trainers (Okuda et al., 2009; Arriaga et al., 2013; Boet et al., 2014).

SBME can be categorized based on how closely the simulations resemble real-life scenarios. This includes low-fidelity simulators, medium-fidelity simulators, and high-fidelity simulators (Maran and Glavin, 2003; Seropian et al., 2004; Al-Elq, 2010). Low-fidelity simulators, which offer a basic level of realism, are suitable for beginners. An example of this is an intravenous insertion arm (Seropian et al., 2004; Al-Elq, 2010; Tosterud et al., 2013; Weekley et al., 2015). Moderate-fidelity simulators include additional features, such as pulse and the sounds of the heart and breathing, making them more realistic than low-fidelity simulators. An example of this is the cardiology simulator "Harvey" (Seropian et al., 2004; Al-Elq, 2010; Griffin et al., 2013; Raju et al., 2021).

However, high-fidelity simulators are the best and the most expensive, such as human patient simulators (HPS) (Issenberg et al., 2005; Al-Elq, 2010). High-fidelity simulators are regarded as the most effective in SBME for various reasons. These simulators can breathe, talk, blink, and respond to actions. They can be integrated into all curriculum areas of a program, providing a clear educational pathway, specific outcomes, and immediate feedback. Furthermore, they allow for a structured sequence of learning steps and the use of controlled environments and tools (Issenberg et al., 2005; Al-Elq, 2010; Lewis et al., 2012; Hanshaw and Dickerson, 2020; Carey and Rossler, 2022).

Even if some advanced healthcare students stated that SBMEs do not like real clinical cases (Decarlo et al., 2008; Walsh et al., 2017; AlBalawi et al., 2022), according to the World Health Organization (WHO), SBME is one of the best methods and techniques in teaching healthcare students because it provides a realistic, safe teaching environment (WHO, 2011; AlBalawi et al., 2022).

In the universities of Saudi Arabia, SBME became a common method of education in healthcare fields (Lababidi et al., 2015; Boker et al., 2017; Albagawi, 2019; AlBalawi et al., 2022). Thus, Saudi students' perceptions of the efficiency of using SBME to teach them are very important. Therefore, the goal of this study is to observe the perceptions and attitudes of SBME versus TME among different levels of healthcare students from different medical colleges

and programs at Majmaah University in Saudi Arabia.

2. Materials and methods

2.1. Study design

This is a cross-sectional study designed to examine the perceptions and attitudes toward SBME among healthcare students at various educational levels from different medical colleges and programs at Majmaah University in Saudi Arabia. The study received approval from Majmaah University (IRB No: MUREC-Nov. 6/COM-2022/6-1). An online questionnaire was distributed to these medical students, and the data collected were subsequently analyzed.

2.2. Study questionnaire

The questionnaire for this study was developed as an online self-administered survey consisting of 17 questions. Initially, it was pilot-tested with 25 healthcare students. Following this test, the questions were revised and carefully adapted to align more closely with the study's goal of examining the perceptions and attitudes toward SBME among healthcare students from various levels and programs at Majmaah University in Saudi Arabia. Consequently, the final version of the questionnaire was divided into three sections. Section 1 gathered demographic information, including gender, educational level, college, program, and awareness of SBME. Section 2 focused on assessing the students' perceptions of SBME, while Section 3 explored their attitudes toward SBME.

2.3. Study subjects

All participants in this study were Saudi students enrolled at Majmaah University. They included medical students from various levels and programs across different medical colleges within the university. Participation in the study was optional and voluntary, with no incentives offered for responding. The online questionnaire was distributed to participants along with the approval number from Majmaah University and the researcher's contact information.

2.4. Study analysis

Student responses were analyzed using various descriptive methods to characterize the sample. Subsequently, different inferential and regression methods were employed to explore associations, assessments, and relationships among the data. Statistical significance was indicated by p-values of ≤ 0.05 . The Statistical Analysis System software (SAS version 9.4) was utilized for the analysis in this study.

3. Results and discussion

This cross-sectional study, conducted at Majmaah University in Saudi Arabia, included 472 participants and aimed to investigate the perceptions and attitudes towards SBME among students from various levels across different medical colleges and programs. Of these participants, 52.33% were male and 47.67% were female. A majority of 80.30% were

bachelor-level students, while 19.70% were master-level students. Among the participants, 17.80% were enrolled in the College of Medicine, 71.82% in the College of Applied Medical Sciences, and 10.38% in the College of Dentistry (Table 1). Additionally, 93.43% of participants were generally aware of SBME, while 90.89% were aware of SBME within their specific specialty (Table 1).

Table 1: Distribution of participants by demographics and awareness of SBME

		Healthcare students		Total
Gender	Male	247 (52.33%)		472 (100%)
	Female	225 (47.67%)		
Level	Bachelor level	379 (80.30%)		472 (100%)
	Master level	93 (19.70%)		
College and program	College of Medicine	Medicine and surgery	84 (17.80%)	472 (100%)
		Nursing	139 (29.45%)	
		Public health	6 (1.27%)	
	College of Applied Medical Sciences	Physical therapy and health rehabilitation	77 (16.31%)	
		Medical laboratory sciences	48 (10.17%)	
		Radiological sciences and medical imaging	46 (9.75%)	
College of Dentistry	Medical equipment technology	23 (4.87%)		
	Dental surgery	49 (10.38%)		
Awareness of SBME	Awareness of SBME in general	Yes	441 (93.43%)	472 (100%)
		No	31 (6.57%)	
	Awareness of SBME in specialty	Yes	429 (90.89%)	
		No	43 (9.11%)	

The perceptions of SBME among the participants indicate significantly higher positive rates compared to TME. The majority of the healthcare students who took part in this study are aware of and hold positive

perceptions toward SBME. All p-values are less than 0.05, indicating statistically significant associations (Table 2).

Table 2: Distribution of participants by perceptions toward SBME

Perception question	Healthcare students			p-value
	Yes	No	Total	
SBME enriches my practical skills more than TME	423 (89.62%)	49 (10.38%)	472 (100%)	0.001
SBME improves my skills in understanding clinical issues more than TME	421 (89.19%)	51 (10.81%)	472 (100%)	0.001
SBME improves my skills in interpreting clinical issues more than TME	421 (89.19%)	51 (10.81%)	472 (100%)	0.001
SBME improves my clinical decision-making skills more than TME	424 (89.83%)	48 (10.17%)	472 (100%)	0.001
SBME improves my skills in communication with other healthcare professionals more than TME	374 (79.24%)	98 (20.76%)	472 (100%)	0.007
SBME improves my skills in communication with patients more than TME	386 (81.78%)	86 (18.22%)	472 (100%)	0.005
SBME supports teamwork more than TME	412 (87.29%)	60 (12.71%)	472 (100%)	0.011

The attitudes towards SBME among the participants also demonstrate significantly higher positive rates compared to TME. Most healthcare students who participated in this study are not only

aware but also hold positive attitudes towards SBME. All p-values are less than 0.05, indicating statistically significant associations (Table 3).

Table 3: Distribution of participants by attitudes toward SBME

Attitude question	Healthcare students			p-value
	Yes	No	Total	
SBME environment is better than TME	441 (93.43%)	31 (6.57%)	472 (100%)	0.001
SBME increases students' ability to avoid future medical errors more than TME	436 (92.37%)	36 (7.63%)	472 (100%)	0.003
Every student should have the opportunity to receive SBME	459 (97.25%)	13 (2.75%)	472 (100%)	0.004
My attitudes have changed positively toward SBME	447 (94.70%)	25 (5.30%)	472 (100%)	0.002

TME consists of traditional lectures and traditional lab practices before real clinical cases in internship year at medical institutions. However, SBME is one of the best techniques widely used in medical education, which creates and develops clinical experiences that simulate real medical cases. Therefore, SBME can provide a safe environment for learning with no risk to the identity and health of the individual, whether it is a healthcare professional or a patient. However, it is one of the medical education techniques that are used and can be combined with

other technologies to reach the ideal goal of medical education.

This cross-sectional study conducted at Majmaah University in Saudi Arabia revealed that perceptions and attitudes toward SBME were more positive compared to TME among healthcare students. The study included 472 participants from various medical programs and levels across different colleges at Majmaah University. Of these, 247 participants (52.33%) were male, and 225 (47.67%) were female. The majority, 379 participants

(80.30%), were undergraduate students, while 93 (19.70%) were pursuing master's degrees (Table 1).

This cross-sectional study involved a diverse group of healthcare students from three different medical colleges at Majmaah University to gather a wide range of perspectives. The colleges included are the College of Medicine, the College of Applied Medical Sciences, and the College of Dentistry. Participants were enrolled in various programs such as medicine and surgery, nursing, public health, physical therapy and health rehabilitation, medical laboratory sciences, radiological sciences and medical imaging, medical equipment technology, and dental surgery. The distribution of participants in these programs was as follows: 84 (17.80%) in medicine and surgery, 139 (29.45%) in nursing, 6 (1.27%) in public health, 77 (16.31%) in physical therapy and health rehabilitation, 48 (10.17%) in medical laboratory sciences, 46 (9.75%) in radiological sciences and medical imaging, 23 (4.87%) in medical equipment technology, and 49 (10.38%) in dental surgery (Table 1).

Moreover, ensuring the awareness of SBME is an essential step for further investigations of perceptions and attitudes of SBME among these participants. 441 (93.43%) of these students are aware of SBME in general, while 31 (6.57%) of them are not fully aware. Also, 429 (90.89%) of these students are aware of SBME in their specialty, while 43 (9.11%) of them are not fully aware (Table 1).

The results of this study indicate that the perceptions of SBME among participants are significantly more positive compared to TME. A large majority of the healthcare students involved in this study are aware of and hold favorable perceptions toward SBME. All p-values are less than 0.05, indicating statistically significant associations (Table 2). Specifically, 423 participants (89.62%) believe that SBME better enhances practical skills compared to TME. Additionally, 421 participants (89.19%) believe that SBME more effectively improves skills in understanding and interpreting clinical issues. Furthermore, 424 participants (89.83%) believe that SBME enhances clinical decision-making skills more effectively than TME (Table 2).

Moreover, 374 (79.24%) of the participants stated that SBME improves the skills of communication with other healthcare professionals more than TME, while 386 (81.78%) of the participants stated that SBME improves the skills of communication with patients more than TME. Therefore, 412 (87.29%) of the participants believed that SBME supports teamwork more than TME (Table 2).

This cross-sectional study revealed that the majority of healthcare students from various medical colleges and programs at Majmaah University in Saudi Arabia are fully aware of SBME, both generally and within their specialties. Additionally, most students concurred that SBME enhances practical skills, aids in understanding and interpreting clinical issues, and improves clinical decision-making skills. They also agreed that SBME bolsters skills in

communicating with both healthcare professionals and patients and supports teamwork more effectively than TME.

Similar to their perceptions, the attitudes towards SBME among participants are significantly more positive compared to TME. The majority of the healthcare students who participated in this study are aware of and hold positive attitudes toward SBME. All p-values are less than 0.05, indicating statistically significant associations (Table 3). A total of 441 participants (93.43%) believe that the SBME environment is superior to the TME environment. Additionally, 436 participants (92.37%) believe that SBME enhances students' ability to avoid future medical errors more effectively than TME. Furthermore, 459 participants (97.25%) agree that every student should have the opportunity to participate in SBME, and 447 participants (94.70%) reported a positive change in their attitudes towards SBME (Table 3).

This cross-sectional study demonstrated that the majority of healthcare students from various medical colleges and programs at Majmaah University in Saudi Arabia are fully aware of and have highly positive attitudes towards SBME, both generally and within their specific specialties. Moreover, most students agreed that SBME provides a better learning environment than TME. They also believe that SBME more effectively enhances students' abilities to avoid future medical errors and that every student should have the opportunity to participate in SBME.

4. Conclusions

While several studies have explored SBME, this cross-sectional study specifically examined the perceptions and attitudes toward SBME as compared to TME among 472 healthcare students from various levels and programs at Majmaah University in Saudi Arabia. The findings indicate positive perceptions and attitudes toward SBME among these students. Although the complexity of SBME is often viewed as a disadvantage, it offers numerous benefits. These include the ability to engage in continuous and consistent practice on different clinical procedures, reduce the risks and consequences of errors for both students and patients, provide immediate feedback and advice, utilize real equipment and techniques, easily repeat scenarios, and tailor cases to meet educational needs.

5. Recommendations

Majmaah University is regarded as one of the leading Saudi universities capable of offering advanced educational technologies, including SBME. Consequently, the results of this cross-sectional study may not reflect the perceptions and attitudes toward SBME at other Saudi universities. It is recommended that further research and follow-up studies be conducted to explore these aspects more broadly. Additionally, since healthcare students are

typically high-performing, SBME is considered a favorable technology for them, regardless of its complexity.

Compliance with ethical standards

Ethical approval

This study was approved by Majmaah University (IRB No: MUREC-Nov. 6/COM-2022/6-1).

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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