International Journal of Current Pharmaceutical Research

ISSN- 0975-7066 Vol 14, Issue 4, 2022

Review Article

SIMULATION AND ITS COMPONENTS

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Received: 20 Apr 2022, Revised and Accepted: 12 Jun 2022

ABSTRACT

One of the most important steps in curriculum development is the introduction of simulation-based medical teaching and learning. Simulation is a generic term that refers to an artificial representation of a real-world process to achieve educational goals through experiential learning. Simulation based medical education is defined as any educational activity that utilizes simulation aides to replicate clinical scenarios. Although medical simulation is relatively new, simulation has been used for a long time in other high-risk professions such as aviation. Medical Simulation has been proven to reduce medical errors and the associated costs all while improving outcomes in patient care. While the use of simulation is mandated and regulated in aviation and many other high-performance industries, the methodology has yet to be required in healthcare [1].

Keywords: Simulation, Medical teaching, Clinical scenarios, Healthcare

DOI: https://dx.doi.org/10.22159/ijcpr.2022v14i4.2003 Journal homepage: https://innovareacademics.in/journals/index.php/ijcpr

INTRODUCTION

Simulation is the artificial representation of a complex real-world process with sufficient fidelity with the aim to facilitate learning through immersion, reflection, feedback, and practice minus the risks inherent in a similar real-life experience. Simulation is a method or technique that is employed to produce an experience without going through the real event [2]. Simulation opens up opportunities that are not available in real event learning, such as apprenticeships, and at the same time provides a multifaceted safety container for learning. Safety container is an important consideration for learners, especially in professional training. Simulation can provide a safe environment to reflect on and learn from mistakes without threat to professional identity [3].

In medical education, there should be exposure to live patients so that medical students and doctors can acquire the necessary skills. There is also, on the other hand, an obligation to provide optimal treatment and to ensure patient's safety and well-being. These two competing needs can sometimes pose a dilemma in medical education. Also, medicine is a discipline that is a science as well as an art and repeated exposures with enhanced experience will help improve skills and confidence [4].

Simulation is a step in the circle of learning that follows knowledge acquisition, skills proficiency and decision-making learning. It is a technique rather than just a technology that promotes experiential and reflective learning.

Simulation-based learning

Simulation is a technique for practice and learning that can be applied to many different disciplines and types of trainees. It is a technique (not a technology) to replace and amplify real experiences with guided ones, often "immersive" in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion. "Immersive" here implies that participants are immersed in a task or setting as if it were the real world [5, 6].

Simulation-based learning can be the answer to developing health professionals' knowledge, skills, and attitudes whilst protecting patients from unnecessary risks. Simulation-based medical education can be a platform for learning to mitigate ethical tensions and resolve practical dilemmas. Simulation-based training techniques, tools, and strategies can be applied in designing structured learning experiences, as well as be used as a measurement tool linked to targeted teamwork competencies and learning objectives. Simulation-based learning itself is not new. It has been applied widely in the aviation industry (also known as CRM or crew resource management), anesthesiology, as well as in the military. It helps to mitigate errors and maintain a culture of safety, especially in these industries where there is zero-tolerance for any deviation from set standards [4, 6].

Circle of learning

The Circle of Learning is a framework that identifies stages of learning in healthcare education and illustrates the process of going from theoretical knowledge to clinical practice. It consists of five steps.

1. Knowledge acquisition: Knowledge acquisition is the first step in the simulation. In this step the individual will acquire knowledge through charts, textbooks, journals, anatomical models etc.

2. Skills proficiency: Is the process of developing psychomotor skills through repetitive practice to master practical procedures, typically using task trainers and simulators. Here, checklists and skills labs play an important role. Checklists ensure objective and standardized learning of skills.

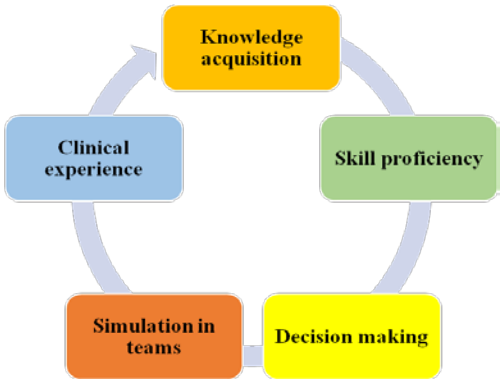

Fig. 1: Circle of learning [7]

3. Critical thinking/decision making: Is using problem-based learning/computer programs/case studies that provide intelligent feedback to develop critical thinking and decision-making skills.

4. Simulation in teams: Allows a group of students to practice and role-play realistic scenarios to improve technical-critical thinking, physical skills and clinical decision-making skills and non-technical skills like communication, time-management during clinical care, leadership and teamwork. Students have the opportunity to apply their previous knowledge and skills attained in a classroom to real-world situations, which require making decisions that in many cases well before they experience it in their clinical practicum experiences.

5. Clinical experience and practice: Is learning through reflecting on the management of real patients, personal tuition, and exchange of knowledge with colleagues [7].

Benefits of simulation in the healthcare system

1. Simulation helps in developing the participants skills and allow them to learn from error.

2. Helps in safer patient care.

3. Simulation may deepen the learning conversation, improve motivation, assist with the Novice to Expert by providing scaffolding and opportunities to develop an understanding from another participant's perspective.

4. Feedback can be given to learners immediately and allow them to understand exactly what went wrong/right and how they can improve. Debriefing tools-video, feedback and peer review are all key features of this learning strategy.

5. Can be applied to clinical and non-clinical environment.

6. Simulation can benefit the individual learner, the multidisciplinary team, and the hospital as a whole

7. Allows participants to train in complex infrequent clinical scenarios

8. Immediate debriefings allow for reflection and improvements in knowledge, skill and team performance

9. Simulation-based learning can be customized to suit beginners, intermediates and experts and adapted on the fly to cater for the learner's ability [8].

Classification of simulators in medical education

Simulators can be classified according to their resemblance to reality into low-fidelity, medium-fidelity and high-fidelity simulators[9]

1. Low fidelity simulators: Low-fidelity simulators are often static and lack realism or situational context. They are usually used to teach novices the basics of technical skills. Example of a low-fidelity simulator is the intravenous insertion arm [9].

Fig. 2: Intravenous arm [10]

2. Moderate fidelity simulators: Moderate fidelity simulators give more resemblance of reality with such features as pulse, heart sounds, and breathing sounds but without the ability to talk and they lack chest or eye movement. They can be used for both the introduction and deeper understanding of specific, increasingly complex competencies. An example of a moderate fidelity simulator is the "Harvey" cardiology simulator [9].

3. High-fidelity simulators: High-fidelity simulators combine part or whole-body manikins to carry the intervention with computers that drive the manikins to produce physical signs and feed physiological signs to monitors. They are usually designed to resemble reality. They can talk, breathe, blink, and respond either automatically or manually to physical and pharmacological interventions. Good examples of a high-fidelity simulator are the Nursing Anne Simulator [9].

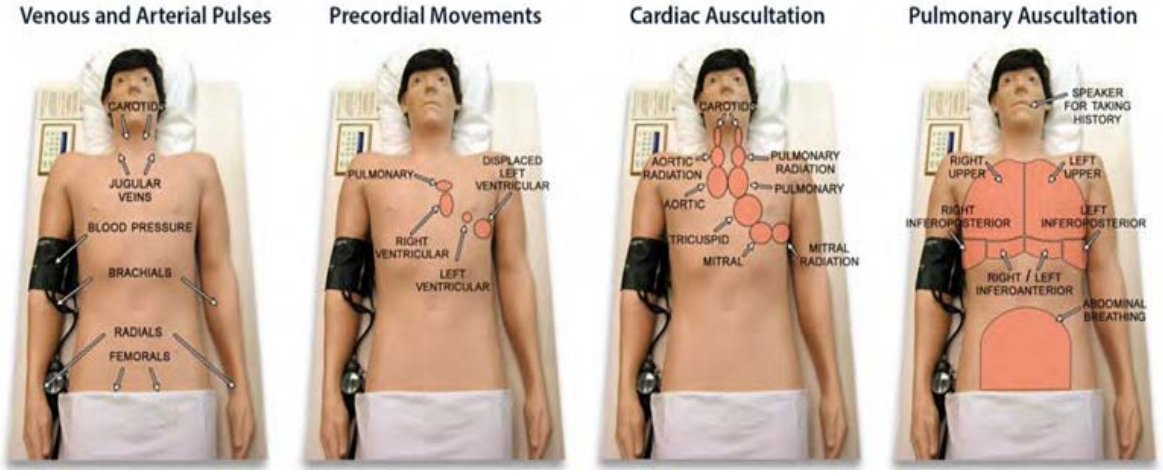

Fig. 3: Harvey cardiology simulator [11]

Fig. 4: Nursing anne simulator [12]

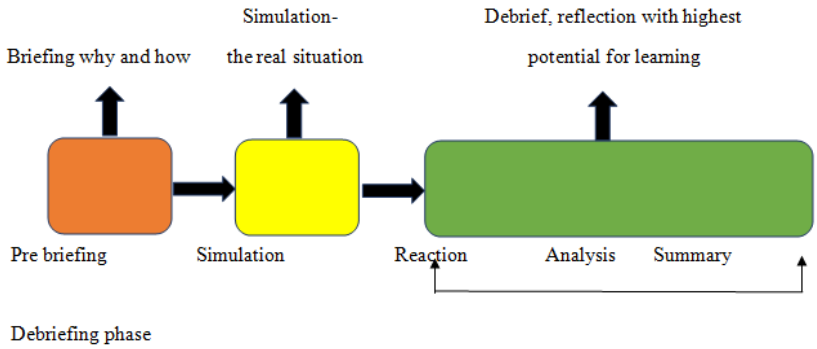

Fig. 5: Structure of simulation scenarios

Structure of simulation scenerios

Structure of the simulation consist of three phases.

- Pre briefing phase
- Simulation scenarios
- Debriefing phase

1. Pre briefing phase: A short introduction to the simulation is key to ensuring a meaningful learning experience. The pre-brief also introduces learners to the concept of simulation and orients them to the simulation environment, equipment, and embedded participants. It allows for expectation setting for performance, confidentiality, and is a crucial component to a practical simulation experience. The instructor should also disclose the purpose of the simulation scenario [13].

2. Simulation scenarios: In this simulation phase, the instructor will put the participants into the simulation lab for running a simulation scenario.

3. Debriefing phase: Debriefing is the heart and soul of simulation-based training. Debriefing is defined as an after-event discussion regarding the performance and thought process of the team during the scenario to promote reflective learning and improve clinical performance.

Debriefing is the intentional discussion following the simulation experience that allows participants to gain a clear understanding of their actions and thoughts process to promote learning outcomes and enhance future clinical performance [14, 15].

Phases of debriefing

Debriefing consist of three phases

- **Reaction phase:** in this the facilitator will ask regarding the emotions or reaction of participants when he/she is in the simulation scenarios.
- **Analysis phase:** in this phase, the facilitator will engage the group in discussion regarding the particular scenarios by asking open-ended questions like what happened/why did it happened.
- **Summary phase:** in this phase, the facilitator will ask the participants regarding the take-home message means regarding their new learning, what they learned from the o particular scenarios and the application of the learning experience to the future encounter [16].

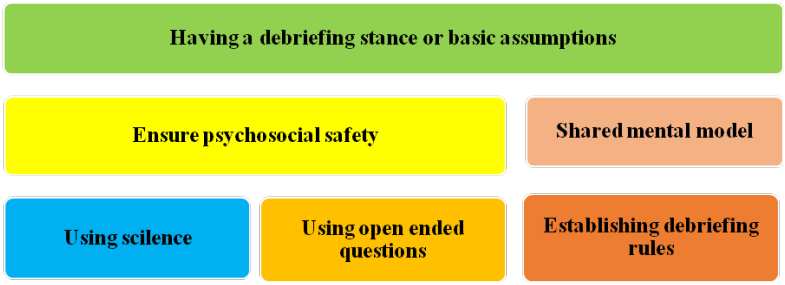

Fig. 6: Element of debriefing and its characteristics

CONCLUSION

Simulation-based training has opened up a new educational application in medicine. Evidence-based practices can be put into action by means of protocols and algorithms, which can then be practiced via simulation scenarios. The key to success in simulation training is integrating it into traditional education programme. The clinical faculty must be engaged early in the process of development of a programme such as this. Champions and early adopters will see the potential in virtual reality learning and will invest time and energy in helping to create a curriculum. They can then help to engage the wider medical community. Teamwork training conducted in the simulated environment may also offer an additive benefit to the traditional didactic instruction, enhance performance, and possibly also reduce errors.

FUNDING

Nil

AUTHOR CONTRIBUTION

All the work have been carried out by me.

CONFLICT OF INTERESTS

Declared none

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