

Editorial**Use of Simulation in Medical Education**

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Introduction

A paradigm shift in medical curriculum has occurred emphasizing on cognitive, psychomotor, and affective domains of learning, for appropriate patient management, patient safety and reducing the error. These changes highlight the importance of training practices to obtain proficiency in clinical skills rather than knowledge acquisition only.^{1,2} Globally all medical school need to provide the learning environment and opportunities to obtain the necessary clinical competencies.^{2,3} The clinical competencies include communication skills, skills in incorporating history taking, physical examination, ability to perform procedures, interpret laboratory results, ability to use the knowledge for clinical reasoning and diagnosis, with professional attitudes, awareness of empathy,

values and reflections. They also need to possess the ability for problem solving, team-work, and information technology skills.² Due to the changing health care system with growing medical accountability emphasizing patient safety, patient care, marginal medical errors together with the ethical issues concerning the patient examination, medical students face a reduced chance to access a wide variety of diseases and examination and consequently their clinical skill performance may not be adequate.² Newly graduated doctors are reported to be deficient in performing various skills due to inadequate preparation to play the role⁴ and subsequently this puts them in a great stress.⁵ Simulators is an ideally suited opportunity for medical students to acquire clinical training during their study period. This technique allows the students to experience in real time in class even

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before their exposure to the clinical atmosphere outside.⁶ Simulations are now increasingly used in medical education to ensure the students to acquire their knowledge, skills, and affect in a realistic setting.⁷ In this article, an overview of this educational tool is discussed.

Simulation

Simulation is an important educational tool that allows the students to practice experience within a safe supportive learning environment without exposing the patients to any harm.⁸ Simulation refers to the artificial demonstration of a complex real-world process with sufficient fidelity to achieve a particular goal, such as in training or performance testing.¹ Trainees of all level, undergraduate to postgraduate can practice using simulators to develop skills knowing that mistakes carry no harm to patients or learners.⁵

Types of simulators

Simulations are classified into two broad categories: compiler-driven and event-driven. The compiler driven includes the part task trainer while the event driven includes the standardized patient (simulated patient), hybrid simulation and computer-based simulators.^{1,9} In another way, computer-based simulators can be classified according to fidelity such as low, medium and high fidelity.

Part task trainers: Part task trainers are representing a specific part such as a limb or a body part or a structure. These are the static manikins, usually comprised of rubber/plastic body parts e.g. intravenous-insertion arms, laparoscopic aides, urinary catheter trainers, airway management heads, central line placement torsos, spinal columns (for spinal taps and epidural placement). These enables the students to practice an isolated clinical task or to gain a procedural or psychomotor skills, such as venipuncture, intubation, laparoscopic training, ophthalmoscopy, catheterization, basic life supports etc.^{1,5}

Simulated patients or Standardized Patients: A simulated or standardized patient is a person trained to accurately and consistently portray a patient with a particular medical condition. It is defined as an “actors used to educate and evaluate history taking and physical examination skills, communication, and professionalism.”¹⁰ Student assessment can be done on the performance of history-taking, physical examination, communication skills and

professionalism by examining the standardized patients. It has been found that with standardized test procedures and including an adequate number of cases, reasonable levels of reliability and validity can be achieved.⁷ It is very expensive to develop and maintain the standardized patient examinations as regular review and update of case materials and changes in disease prevalence is necessary. Quality assurance procedures must be implemented to assure that scores and decisions produced are appropriate.^{7,11} Regular training of the standardized patients is required, so that they can simulate a real patient repeatedly and in a consistent and reliable manner.^{12,13}

Hybrid simulation: It is a combination of standardized patients and part-task trainers

Computer-based simulations: The computer-based simulation helps one to explain the underlying physiology or pharmacology, simulated task through the computer interface. Computer programmed manikins to enable individuals or teams to perform in realistic scenarios and receive feedback on their decision making, collaboration and communication skills with other team members.⁹ Fidelity is the gradation of simulation comparing to reality; a higher fidelity mimics with a greater sense of realism.¹⁴

The low-fidelity simulator permits the trainers to acquire an isolated basic skill. Usually these are static and lack the real situation. For example, screen-based text simulators that create scenarios with different responses that are differentiated and selected by the user and the static manikins that are used for hands-on practice such as intubation and cardiopulmonary resuscitation manikins or intravenous insertion arm.¹⁵

The medium-fidelity simulator provides a more resemblance of reality but here the trainers are not fully immersed in the situation. It consists of screen-based graphical simulators and the mechanical manikins. The screen-based graphical simulators deliver a more realistic representation. Computer software produces physiological signals that are displayed on a computer screen. These are most suitable to demonstrate conceptual theory underlying drugs. For example, through this system, students can be exposed to the basics of history taking and physical examination to prepare students for their first encounters with real patients. These computer-based programs are often interactive programs, run on an ordinary computer

that simulate some aspect of the doctor–patient interaction. Advantage is that these are portable, and relatively less costly. But usually do not confer actual practical skills.¹ The mechanical manikins contain software that enable it to be interactive simulators such as some cardiopulmonary resuscitation manikins.¹⁵ The interactive features such as pulse, heart sounds, and breathing sounds are present but without the ability to talk and they lack chest or eye movement.²

A high-fidelity simulator permits the trainer to be fully immersed where they receive a response to the treatment interventions. The high-fidelity simulator is a full-body manikin which is computer driven that behaves like the real patient. This simulator is able to talk, open and close the eye with a pupillary reaction, able to breathe and have urine output, demonstrate peripheral pulses and blood pressure, and measurable gases.^{1,15} These simulators allow the user to interact like a real patient in a real clinical environment. Drug administration into this simulator will produces an appropriate physiological and pharmacological response according to the programmed age and sex. According to the response, clinician can take appropriate response such as oxygen supplementation, endotracheal intubation etc.^{1,9,15}

Virtual reality and haptic systems are a new form of simulator; a concept of advanced human-computer interaction. They can permit the manipulation of three-dimensional organs or body systems as if they were real and also provide the user with a real time sense of touch.⁷ These simulators combine powerful complex computer-generated imagery with sensory feedback. Haptic systems denote producing kinaesthetic and tactile perception. These simulators are often combined with a part-task trainer; so that the trainers perceive a physical interaction within the virtual environment due to the haptic feedback which creates a feeling of resistance while using instruments within the simulated environment. This is mostly used in vascular access training, endoscopy training and training of laparoscopic surgical techniques.^{5,9}

The benefits and drawback of using simulators

The use of simulated patients as an alternative of actual patients, prevents any discomfort to the actual patient.^{16,17} Simulation training allows the students to practice a number of competences ranging from isolated tasks to more complex clinical situation in a safe environment. Thus,

all students are offered equal and standardized opportunities and they are able to repeatedly do the same task to attain the competence which is not possible in a real patient. This helps them to develop self-confidence, professional knowledge, critical thinking skill, decision-making skill, clinical judgement, and their better groundwork for future doctors. Preventing error in real patient by working in ethically safe environment on simulation is another great advantage.^{18,19,20} In addition, students acquire professionalism, communication skill, time management, teamwork and they can self-assess their own progress.¹⁵ This innovative tool is greatly accepted for assessment of skills, and professionalism and communication skills in many OSCE examinations.^{6,9} The simulation based medical education provides learners the opportunity to gain medical-procedural experience through deliberate practice where the notion of 'learning by doing' has become less acceptable especially when invasive procedures are needed.⁸

Although it is a safe, feasible, cost-effective educational tool that enables students to work with patients in a team, there are a number of factors that hinders its effectiveness. The cost and funding for the simulator technologies, and the training of the simulated patients as well as the instructors are the limitations in effective simulation training.²⁰ Simulation is greatly adopted for the education and training in developed countries. Developing countries attempting to introduce it faces problems in view of its high cost, and uncertainty in its consistency and validity.^{10,21}

Education is the backbone of a nations' development and educators are the scholarly asset of educational institutions who are involved in the development of whole process of education.^{22,23,24} The field of medicine is continuously changing with advancement of basic, clinical and technological sciences.^{25,26} As the medical field is changing with the advancement of science and technology, medical educators' role is also changing from being a deliverer of materials to a facilitator of learning²⁷ with increasing demand of an effective mentoring.²⁸ High-quality teaching and training are central to high-quality patient care.²⁹ So, teaching in medical education is an ever-evolving processes and medical teacher need appropriate training to enabled them to be competent in order to meet the needs of the students.²⁷ Faculty development is the basis of curriculum development, and faculty development

activity is an integral part of an institution for its educational development.²⁷ To conduct an effective simulation-based teaching and learning session to the students, qualified and competent trainers are vital. Moreover, the simulated patients also should be well trained to portray the real clinical picture of a patient. Therefore, faculty development and training of the simulated patients are very much needed to ensure the standard of simulation training.³⁰

Conclusion

Changing health care systems and patient safety concerns have forced medical education to

adopt different types of simulators for training and acquiring knowledge and skills by medical students. Institutes need to provide sufficient budget and also the training of the simulated patients and the faculty for its proper functioning.

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