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LETTER TO EDITOR

A Short Review of the Experience of the University of Medicine and Pharmacy of Tîrgu Mureș in Medical Simulation

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Medical simulation is used in a growing number of medical education institutions all over the world. Since 2013, the University of Medicine and Pharmacy of Tîrgu Mureș has introduced a number of simulation methods into the curriculum of certain subjects, the number of which is expanding. This article sums up some of the knowledge available in the literature regarding medical simulation and presents the general framework under which it is used in medical learning in our University.

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To the editor:

Rather than being a single educational technology, medical simulation is an ever larger array of tools, techniques and methods that are used in a growing number of medical education institutions all over the world. The reasons behind the introduction of this special chapter of medical education were multiple, and among them are the acquisition, retention and development of medical skills, and the need to assess these skills against a standardized set of criteria.

Historically, medical simulation is a relatively new method of education. It owes its birth to the apparition of military simulation techniques, in the 1900s, and was steadily developed beginning with the 1950s. One of the cornerstones of medical simulation technology was the first simulation mannequin, Resusci Annie, produced in 1960 (1). Nowadays, there are numerous highly advanced, complex simulation and training mannequins in use.

However, defining medical simulation as "the use of simulation mannequins" would be an oversimplification of the matter. One of the most widely used categorizations of medical simulation states that it comprises five main designations: verbal simulation, standardized patients, task trainers, computer patients and electronic patients (2). We believe a brief explanation of these categories would be useful.

Verbal simulation is actually role playing, the simplest method of simulation, in which one part takes the role of a patient and the other plays the examiner. It does not require a complex technical setting or preparation.

The standardized patient category of simulation is, in fact, a higher-grade, more complex evolution of verbal simulation. Under this category, a group of people (preferably trained actors, but not necessarily) are taught the signs, symptoms and medical history of certain diseases and how to communicate with potential examiners. Students undergoing standardized patient training would interact with them and acquire knowledge about a particular pathology. There are two main advantages of this method: first, some of the cases taught would be hard or impossible to be examined by students in a true clinical setting, either due to the rarity of the disease or to patients' refusal to be examined; the second advantage would be that a series of students are seeing, some of them for the first time, a standard set of signs and symptoms pertaining to a certain disease.

Task trainers are models of different human organs, limbs or even entire regions of the human body. These models are built to train students in a particular set of technical skills, depending on the nature of the model. There is a wide variety of task trainers available, and their complexity ranges from basic to almost life-like. For example, some of the most widely used task trainers are vascular access models and small surgical maneuver simulators. On these, students can train by exercising various types of intravascular injections, sutures, incisions etc., until a satisfactory level of technical skill is achieved. Other task trainers include models for a very specific and narrow technical field – e.g. thoracic drainage, or simulators intended for a wider gamut of skills – ultrasound simulators, laparoscopic surgery simulators, endoscopy simulators. These task trainers are a valuable addition to medical student training (3) because some of the techniques that the students practice on them are quite complex, some of them even dangerous if not done properly, and not every student would have the chance to exercise them in a hospital, on live patients.

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Additionally, since the stress factor induced by the presence of a real patient is lacking (4), students can focus on perfecting the techniques and repeat them as many times as needed.

Another category of medical simulation is software-based training, and includes computer patients. As the name would suggest, this type of simulation entails the use of computers and computer programs ranging from simple to very complex, in order to trains students to recognize and adapt to various situations. These simulations may include a very narrow field of medical conditions (for example, the use of programs focused solely on cardiovascular or anesthesia-related pathology) or, at the opposite end of the spectrum, may present the student with a very complex setting, in which therapeutic, but also crisis management decisions need to be taken. Some of the software belonging to the latter category include emergency room management simulators and even natural disaster management systems.

The last category of the aforementioned medical simulation classification, and arguably the most complex, is the electronic patient. Full scale human-like mannequins fall under this category. These mannequins can also range from fairly simple (the so-called "low fidelity" and "medium fidelity" mannequins) to very complex ("high fidelity" mannequins). The simpler simulators are usually built with a limited range of simulation possibilities – for instance, basic life support training (resuscitation) or obstetrics/gynecology mannequins. This is not to say that these simulators are limited to a single action or maneuver that they can teach. The obstetrics/gynecology mannequins, for example, have basic external controllers that allow them to be programmed to simulate, beside normal birth, various complications, incidents or accidents that can appear during the birthing process, and they also can be subjected to intravenous line insertions, oro-tracheal intubations, and vital sign monitoring.

The most advanced mannequins, however, cover a much wider spectrum of pathologies that they can display. They are very developed from a technical standpoint. Usually controlled by a very complex software, they can be programmed to exhibit various reactions to the input of the students. The most advanced human patient simulators do not even require an operator to alter the parameters of the response. Since they contain various sensors (including, but not limited to gas pressure sensors, liquid input and output sensors, gas analyzers, medication analyzers), once they are programmed into a certain set of pathologic parameters, they can react on they own to the therapeutic decisions that the students take, by automatically recognizing and using the data fed back by the sensors. These simulators can also be connected to real operating room anesthesia equipment or to various kits allowing the simulation of traumas or casualties.

The University of Medicine and Pharmacy of Tîrgu Mureş started to use medical simulation as a complementary tool for medical student education on October 1, 2013, when the Center for Simulation and Practical Skills was opened. This center occupies the former building of the University Library, which has undergone an extensive repurposing and remodeling process. From an architectural point of view, the building has two floors and a basement. The basement contains the administrative offices, student locker rooms and some of the technical infrastructure. The ground floor has two main simulation rooms that are used for basic skill training but can be immediately be repurposed if need arises, a large modular lecture room and a debriefing room. The first floor also has two large simulation rooms, used for more complex simulations, 8 standardized patient rooms, a debriefing room, a server room and the central command room.

The simulations taking place in the Center fall under three main categories. The first one is Basic Skill training, in which mainly 3rd and 4th year students perform various medical and surgical maneuvers that they need to master in day-to-day practice. In order to allow this, they have access to over 20 types of task trainers, providing the opportunity to exercise vascular access, intramuscular, intradermic and intra-articular injections, auscultation, chest drainage, urethral catheter insertion, naso-gastric tube insertion etc. The second category is the Standardized Patient which, on the date of its introduction, was a premiere for Romania. This type of simulation takes place in the aforementioned eight rooms, which simulate a medical practice with basic-to-average amenities. A group of volunteer medical students are employed as standardized patients, learning how to act during a simple physical examinations or the basic manifestations of simple diseases and acting as patients for the 3rd and 4th year students who undergo Standardized Patient training. The teaching staff observes the interaction between student examiners and patients and assesses all the key points that the examiners need to cover during this type of simulation.

The third type of simulation provided by the Center for Simulation and Practical Skills is Advanced Simulation. In this category, full scale mannequins are used to train students in more complex clinical settings. The infrastructure consists in a Basic/Advanced Life Support mannequin, an obstetrics/gynecology mannequin, a pediatric simulator and a complex human patient simulator mannequin. This type of simulation is reserved for higher year students (5th and 6th year) and is mostly aimed at training students how to perform under stressful emergency situations and how to act as a team (5). As opposed to the Basic Skills training, wherein students individually perform the tasks they are required to, in Advanced Simulation each student of the group taking part in the training is assigned a certain role.

The information technology infrastructure of the Center includes an e-learning software that provides information for the teaching staff that can be used in assessing student performance, and also integrates all the scheduling aspects of the activities in the Center.

The curricular integration of the medical simulation into the syllabus of the University was achieved by seamlessly introducing simulations into the curriculum of each subject in which students are required to develop a set of medical and surgical skills. At the opening of the Center, only three subjects benefitted from simulations – Medical Semiology, Surgical Semiology and Surgery. Gradually, the simulation activities were integrated into the curriculum of more subjects and, to date, there are more than 10 departments that require simulations for student training, including Urology, Gynecology, Internal Medicine, Anesthesia and Intensive Care etc. Almost 4000 students have undergone simulation training since the 2013-2014 academic year, and the feedback received regarding their perception about the quality and usefulness of medical simulation in their training was overwhelmingly positive.

Based on the experience that we gathered so far in using simulation as a tool for medical student education, we feel that this method of teaching is a necessary step forward in ensuring a modern training, providing students with the skills they need in order to perform in a more and more demanding field.

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