

# Programmable Patient Simulators as an Educational Technique in Physical Therapy

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## ABSTRACT

In a session on cardiorespiratory education at the 2007 World Confederation of Physical Therapy meeting in Vancouver, Canada the speakers noted a worldwide shortage of physical therapists willing to work in intensive care settings, especially in critical care units and cardiac rehabilitation programs. Simulation is a technique used in healthcare education to replicate the essential aspects of a clinical situation, so that the learner can more effectively examine, assess and manage a similar event when it occurs in clinical practice.<sup>3,4</sup> While the use of patient simulators in the forms of role players and standardized patients has been a long-standing practice in physical therapy education, the use of programmable patient simulators is relatively new. The purpose of this article is to describe the programmable patient simulator technology available currently and to discuss the frequency and manner in which programmable patient simulation is used as an educational technique for training clinicians and student physical therapists.

World-wide, we are experiencing a shortage of physical therapists willing to work in intensive care settings (ICU)--especially in critical care units and cardiac rehabilitation programs<sup>1</sup> Thirty-one percent of student physical therapists surveyed reported "lower feelings of competency in cardiorespiratory care than in other specialties."<sup>2</sup> Physical therapists choose to not practice in these settings for a variety of reasons that may include 1) fear-avoidance secondary to the high mortality rate in this patient population; 2) dissatisfaction with their professional skills and training related to working in an ICU; and 3) dissatisfaction with their professional skills and training related to responding to specific emergency medical procedures. While student physical therapists may have internships to prepare for practice in acute and critical care settings, the reality is that some students never witness or intervene in a medical emergency during their professional training.

Simulation is a technique used in healthcare education to replicate the essential aspects of a clinical situation so the learner can more effectively examine, assess and manage a similar event when it occurs in clinical practice.<sup>3,4</sup> While the use of patient simulators in the forms of role players and standardized patients has been a long-standing practice in physical therapy education, the use of programmable patient simulators is relatively new. The purpose of this article is to describe programmable patient simulator technology available currently and to discuss the frequency and manner in which programmable patient simulation is used as an educational technique for training clinicians and student physical therapists.

### PROGRAMMABLE PATIENT SIMULATOR TECHNOLOGY

Programmable patient simulators are computer-operated, life-size mannequins with a variety of observable and clinical features that add to the degree of realism during simulation.

The degree of realism present in the programmable patient simulator or in the simulation is referred to as fidelity. High-fidelity simulators have observable features that can include diaphoresis, chest wall movements, pupils that react to light, eyelids that blink, and the ability to converse and vocalize symptoms. Clinical features may include palpable pulses, breath sounds, heart tones, bowel sounds, and a library of normal and abnormal sounds for each. High-fidelity simulators are connected to patient monitors that display a variety of parameters in real time including ECG, blood pressure, and oxygen saturation during the simulation experience.

The features available in programmable patient simulators provide the operator with the ability to design scenarios that realistically replicate complex medical conditions and situations. For example, when a simulation participant enters the room, a "patient" can be stable but suddenly complain of chest pain while demonstrating blood pressure and ECG changes on the patient monitor that are associated with the onset of an acute myocardial infarction. When the programmable patient simulator is incorporated into a high-fidelity environment with lines, tubes, alarms, monitors, etc., the simulated critical care setting and experience become realistic, engaging, challenging, and uncertain for the participant learning to work with complex patients or to manage a clinical event. Simulation forces participants to examine, assess, and integrate information in real time while witnessing the consequences of their decisions and actions.

High-fidelity simulation has the potential to be a transformational learning experience that permanently changes the participant's view of the clinical situation. Programmable patient simulation engages the participant in a student-centered, active-learning environment by creating hands-on learning experiences that promote critical thinking skills while facilitating clinical application and synthesis of knowledge in real time. High-fidelity

simulation demands that participants apply their knowledge, clinical skills and professional behaviors in the context of a realistic and unpredictable patient care situation. Learners can observe the consequences of their actions, as well as their inactions, without compromising patient safety. As a result, high-fidelity simulation offers faculty an opportunity to train participants for work in critical care settings in a manner that directly addresses potential concerns that they may have regarding their professional skills and lack of experience.

### CASE FOR USING SIMULATION TECHNOLOGY

A rise in the national focus on patient safety in recent years has resulted in increased attention on the use of programmable patient simulators for educational purposes.<sup>3-8</sup> The 2003 report by the Institute of Medicine, *Health professions education: A bridge to quality*, challenged all professional healthcare education programs to integrate five competency areas into their curricular designs and clinical experiences.<sup>9</sup> The five competency areas are patient-centered care, interdisciplinary teams, evidence-based practice, quality improvement, and informatics. Competencies are defined in the report<sup>9</sup> as the "habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values and reflection in daily practice." High-fidelity simulation provides a means to address, practice and assess all five of these competency areas in the context of a realistic patient care setting. The use of programmable patient simulators has been shown to have a positive impact on learning and improved performance of student nurses on subsequent simulation experiences.<sup>4-8,10-12</sup> Critical assessment skills, performance and retention of information by medical students is significantly improved when training includes the use of programmable patient simulators.<sup>13-16.</sup>

Along with a growing concern for patient safety is the recognition

of the need for interprofessional education and training to develop effective multidisciplinary healthcare teams. Patient care has become more complicated requiring teamwork and a multidisciplinary approach; yet, education of healthcare professionals is still often provided in “silos” within each discipline.<sup>17</sup> The Institute for Health Improvement (IHI) published a set of goals in 2006 that were designed to improve patient safety.<sup>18</sup> Improved communication and teamwork among healthcare professionals during emergency situations was viewed as a priority in the IHI report. This report specifically focused on the use of programmable patient simulators as a means to improve communication and teamwork of healthcare professionals.<sup>18</sup> Improved performance of emergency medical teams has been demonstrated when high-fidelity simulation is incorporated into the training of medical and nursing students.<sup>14,19</sup>

Programmable patient simulators provide physical therapy faculty an opportunity to engage with other healthcare disciplines in creating scenarios that provide participants experience working as a member of an interprofessional team to manage patient care. Debriefing following an interprofessional simulation provides an opportunity for professionals from different healthcare disciplines to see and discuss the patient care situation from the perspective of another healthcare professional. Scenarios can be repeated, or new scenarios provided so that participants have opportunities to learn, practice and demonstrate their professional skills and behaviors as a member of interprofessional healthcare teams in a realistic clinical environment. In addition, faculty have an opportunity to verify that participants have demonstrated mastery of the information, skills and behaviors required for work in a critical care setting.

### DEBRIEFING THE SIMULATION EXPERIENCE

Central to simulation-based learning is

the experience-analysis and feedback following the simulation event known as “debriefing.” During the debriefing process, the rationale for treatment choices is discussed and related to the learning situation the participant experienced.<sup>20-23</sup> The general consensus in the literature and among simulation experts is that optimal learning occurs when simulation is followed immediately by a verbal debriefing process rather than being delayed.<sup>24-26</sup> Video recordings of the simulation, debriefing logs generated during the simulation by the computer software, and behavior checklists can be used to provide objective feedback and facilitate analysis.

While classroom learning often involves an instructor imparting knowledge, simulation debriefing is an active learner-centered experience. Skillfully-led debriefing enables participants to express emotional states, explain their internal frames of reference (rationales), analyze their clinical decisions, and synthesize information related to their clinical performances.<sup>27</sup> Best practice patterns for the debriefing process favor having a facilitator that encourages and guides a learner-centered discussion of the simulation experience.<sup>27</sup> The role of the facilitator is to answer clinical questions and clarify best practice patterns while promoting reflection. This process enables learners to reflect upon and discover the internal frames of reference they used to make their clinical decisions and to identify areas in which they met professional standards and any areas that need improvement. Following participant reflection, the facilitator may provide additional insights that may result in further modification or expansion of the participant’s internal frames.<sup>24</sup> The debriefing process provides the simulation participant with an opportunity to reflect, learn, synthesize and integrate information that will improve their clinical performances in similar situations in the future.<sup>22,27</sup> A growing body of literature on simulation research in healthcare

professions indicates that debriefing and this reflective process are the most important aspects of the simulation-based learning experience.<sup>4-6,20,24</sup>

### STANDARDIZATION OF CLINICAL EXPERIENCES

While the use of patient simulators in the forms of role players and standardized patients has been a long-standing practice in physical therapy education, the use of programmable patient simulators is relatively new. When high-fidelity patient simulators are incorporated into a realistic setting such as a mock critical care unit with all of the lines, tubes, alarms, monitors, etc., the learning environment becomes realistic and immersive for the participant learning to work with complex patients. Simulations can be tailored to meet specific educational objectives and outcomes related to acute care and critical care settings, e.g. the role of a physical therapist in responding to an emergency or how to communicate effectively with interprofessional team members during a crisis. When a participant performs poorly during simulation, patient safety is not compromised. In addition, following the debriefing process, the participant can be given an opportunity to demonstrate incorporation and integration of the constructive feedback in the same, or a different, clinical scenario specific to the defined objectives. High-fidelity patient simulation provides clinicians and student physical therapists an opportunity to demonstrate clinical competence and confidence for managing a complex clinical situation, as well as provide an objective and realistic measure of participant performance with complex patient situations that can be designed according to objectives defined prior to setting up scenarios.

As an example of standardizing clinical experiences, we have incorporated nursing students into the simulation experiences of our student physical therapists. One specific outcome we have defined is for the physical therapist and nursing students to work together as a team to respond to the emergency

and stabilize the patient. When our student physical therapists are working with a programmable patient simulator that becomes unstable or develops a medical emergency, they call for student nurses to assist in managing the event. Student program evaluation data indicate this activity has been extremely valuable in addressing fears in recognizing and managing an unstable patient, as well as for improving teamwork and communication between the interprofessional team members. Students report that this simulation experience has enhanced their understanding of and respect for other healthcare team members.

Simulation technology is used currently to practice and assess clinicians' understanding of emergency procedures. For example, simulation has a pivotal role in advanced life support training programs to manage cardiac and respiratory arrest.<sup>12,20,28-32</sup> In courses for anesthesiologists and advanced practice nurse anesthetists, simulation has been used extensively to perfect technical and communication skills in managing difficult intubations, surgical emergencies, and adverse patient responses to medications.<sup>13,22,33-35</sup> Simulation increasingly forms the curricular base for orientation programs and post licensure continuing education courses in medicine and nursing. Course models that combine online learning modules with hands-on simulation experiences are used effectively in critical care orientation programs for nurses in clinical practice and form the basis for courses that address annual competencies or introduce new treatment protocols or equipment.<sup>35-38</sup> Just as high-fidelity simulations can be used with nursing and medicine to meet such specialized objectives, a physical therapy continuing education course could utilize programmable patient simulation technology to provide a dynamic learning environment for therapists interested in developing, expanding or practicing the skills, behaviors and best practice patterns requisite for acute care/critical care practice. This type

of continuing education course could directly address potential concerns regarding inadequate professional preparation for working effectively in these high acuity practice areas. We believe that high-fidelity simulation can be used in both entry-level professional education and continuing education courses for practicing clinicians in a manner that would address the shortage of physical therapists willing to practice in these settings. In addition, high-fidelity simulation provides an opportunity and means for clinicians and students from a variety of healthcare disciplines to develop skills specific to interprofessional practice.

### CURRENT USE OF PROGRAMMABLE PATIENT SIMULATION IN PHYSICAL THERAPIST EDUCATION

We contacted the 210 accredited physical therapist education programs listed on the CAPTE web site in 2009 and requested their participation in an on-line survey. We received replies from 142 programs (67.6% response rate). Sixty-two (44%) of the respondents reported using programmable patient simulators while 80 (56%) respondents denied use of the technology. In the physical therapy education programs that stated use of programmable patient simulators, 79% had medical or nursing programs that were currently utilizing programmable patient simulators to train students. The three most frequently reported uses of programmable patient simulators in physical therapy education programs were training student physical therapists to 1) perform a cardiopulmonary examination; 2) perform an acute/intensive care exam or 3) respond to a medical emergency. Of the 80 physical therapy programs that reported not using programmable patient simulators, 61% did have either a medical or nursing program or both that were utilizing the technology.

We contacted the 62 physical therapy programs that identified themselves as users of programmable patient simulators in our first survey and requested their participation in a

follow-up on-line survey. We received usable responses to the second survey from 29 of the 62 schools (47% response rate). Users of programmable patient simulators in physical therapy education programs reported that 55% were using high-fidelity patient simulators and 52% reported using more than one form of programmable patient simulator in their program e.g., high-fidelity simulators, mid-fidelity simulators or virtual patient simulators.

Some form of debriefing at the conclusion of a simulation was reported by 69% of the physical therapy education programs that participated in our survey of users of simulation technology. These programs reported that debriefing consisted of feedback by role players, observers, and faculty. One program reported incorporating computerized logs and video generated during high-fidelity simulation into the debriefing process. While debriefing has been shown to be an essential element for improving the skills and behaviors of the simulation participants, our survey results indicated limited use of the best practice patterns for the debriefing process and the technology available with programmable patient simulators. This finding suggests potential opportunities for faculty to expand and enhance student physical therapist learning, skills and behaviors when simulation and debriefing are used in conjunction as an education technique.

### SIMULATION OUTCOME DATA

Outcome data gathered from simulation studies in nursing and medicine have demonstrated the effectiveness of programmable patient simulation experiences for the participants and justify the expense in terms of money and faculty time.<sup>5,6,10-12,28,39</sup> The types of outcome data collected and reported by participants in our second survey included practical examination scores, confidence scales, post-test knowledge exam, reflection pieces and performance on clinical internship.

However, 55% of respondents did not report collecting any outcome data regarding the simulation experience. Establishing outcome measurements will be important as physical therapy education programs attempt to justify the expense of a programmable patient simulation program in terms of money, faculty time and student learning. In addition, outcome data can be utilized to determine the most effective strategies and applications of this teaching technique for clinicians and students.

### PATIENT SAFETY AND INTERDISCIPLINARY HEALTHCARE TEAMS

A major issue in preparing student physical therapists for clinical practice is the growing concern for patient safety and recognition of the need for interprofessional education to develop effective healthcare teams. Approximately 40% of survey respondents that utilize simulation technology reported that their physical therapy education programs do not use any form of programmable patient simulator to train student physical therapists to respond to a medical emergency. In addition, 48% of respondents reported that their education program did not use any form of programmable patient simulator to train student physical therapists to work as an interprofessional team member during a medical emergency. These results suggest limited use of simulation technology for emergency and interprofessional team training which may be related to some student physical therapists not feeling adequately prepared to deal with emergency situations. High-fidelity simulation provides educators with a technique to address this gap in professional preparation.

Programmable patient simulators create an opportunity for students from multiple healthcare disciplines including nursing and medicine to practice team communication and role clarification in a safe learning environment where inexperience will not adversely affect patient

outcomes. Our survey data indicate that programmable patient simulator use in physical therapy education programs was higher at schools where nursing programs or medical schools used the technology (79.0% vs. 61.3%) suggesting that collaboration among healthcare educators may help foster integration of the technology and the educational technique into physical therapy education curricula. Moreover, sixty-one percent of the physical therapy schools that reported not using programmable patient simulators stated that medicine or nursing program(s) at their schools used programmable patient simulators. Such programs may have the potential to form alliances to make simulation technology and interprofessional simulation experiences more widely available to their physical therapy education programs with minimal start-up costs and time as the simulation equipment, lab and expertise are already in place.

### SUMMARY

Many physical therapists choose to not practice in acute and critical care settings for a variety of reasons. Although internships have the potential to provide some students with experiences that prepare them to practice in critical care settings, the reality is that some students never witness or intervene in an actual medical emergency during their professional training. We believe that programmable patient simulators in a realistic setting can be used as an educational technique to directly address the concerns of clinicians and students regarding work in critical care setting, while simultaneously standardizing and expanding the experiences of our students with complex patients in acute and critical care environments. We believe programmable patient simulators are highly valuable for working on interprofessional healthcare team issues related to patient care and communication during emergency situations. In addition, high-fidelity simulation provides a realistic means

to prepare and assess clinicians and students for work in a complex healthcare environment.

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