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Current Literature Summary: Review of High-Fidelity Simulation in Professional Education

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INTRODUCTION

Simulation has been used by the military, aviation, industry, and increasingly in the health care professions as a means to conduct training, evaluation, and research. More than just a technology, however, simulation is a technique used to replicate real-world experiences in an immersive environment and in a fully interactive format. The most critical issue in any type of training or learning environment is how well learning transfers from the training setting to the performance setting in the real world. High-fidelity simulation-based training has become increasingly popular because it allows for repeated instruction and practice in the health professions without risk to actual patients and does so in a manner that can be made to replicate the real-world setting. A growing body of research suggests that simulation is an effective tool for educating health care professionals. We will deviate from the usual format of this column to present an editorial describing the evolution and adoption of high-fidelity simulation in different professional education and certification programs. This editorial will also discuss how high-fidelity simulation may be applicable to athletic training education, research, and practice.

High-fidelity simulation is rapidly becoming a more recognized educational technology and is used as a teaching tool in many professional programs. In searching the sports medicine and athletic training literature, no studies were found regarding the use of high-fidelity simulators in the professional education of these students. The lack of evidence on high-fidelity simulation as an effective teaching tool in athletic training education prompted this purposeful review of medical and health care simulation educational outcomes.

Simulation involves the immersion of a student in a realistic scenario created within a physical space that replicates the real environment with fidelity sufficient to suspend disbelief on the part of the student.[1] The reality of the simulation is directly affected by the fidelity of the elements. Low-fidelity simulation includes elements such as anatomical models, peer role-playing, and simple mannequins with low output capabilities.[2] These elements rarely provide students with the level of realism necessary to suspend disbelief and become fully immersed in a scenario.[2] High-fidelity human-patient simulators are computer-operated, life-sized mannequins capable of the physiological reproduction of signs and symptoms typically encountered as part of a medical emergency. The output of the device provides realistic chest and heart sounds, pulses, and laryngeal reflexes and allows monitoring of all vital signs in a manner identical to that used in a real setting. High-fidelity simulation provides the opportunity for students to practice and learn in a safe environment as close to reality as possible. Through this educational tool, students can make mistakes without harming an individual. High-fidelity simulation has been widely reported to provide learners and patients with a safe environment for practice and error.[3]

Typical high-fidelity simulation design consists of a simulated scenario followed by a debriefing session. The simulated scenario provides the student with a real clinical problem under the pressure of a realistic simulation. It is through the realism of the simulated scenario that students are able to suspend reality and thus are encouraged to use critical thinking and active learning to integrate basic clinical teaching and advanced clinical decision-making skills.[4] A guided debriefing session immediately after the simulated scenario allows an opportunity for reflection. This lets students identify actions taken and any actions they would change when presented with a similar scenario. Additionally, students are able to discuss feelings and reactions to the scenario in the debriefing session.

Simulation as a teaching and training tool has been successfully incorporated into the education of professionals with high-risk performance environments such as pilots, astronauts, military personnel, police officers, and firefighters.[5–7] Innovations in simulation, technology, and educational practices within these professions have contributed to the development of medical simulation.[5,8] The earliest form of medical simulation in resuscitation training first began in 1960

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with the development of a task trainer, Resusci-Annie.[8] This simple plastic model provided a low-fidelity simulation opportunity for the practice of mouth-to-mouth breathing and is currently used internationally for task training and skills assessment in cardiopulmonary resuscitation certification.[1]

Medical specialties such as anesthesia, critical care, and emergency medicine were among the first to use high-fidelity simulation in teaching and assessment of clinical management skills, dating back to the late 1960s.[5,8] However, it was not until the late 1980s and early 1990s that high-fidelity simulation accelerated as a teaching and assessment tool in medical and health care education programs. Improvements in computer technology and changes in health care delivery, such as minimally invasive surgical techniques, have contributed to the increased use of high-fidelity simulation in the education arena.[1,8] Over the past decade, continued advances in high-fidelity simulation design, technology systems, and academic environments have led to the significant and widespread use of high-fidelity simulation in medical and health care education programs.[5,8,9]

In addition, the recent focus on interprofessional practice in hospitals and medical clinics has led many medical, nursing, and other health care programs to explore simulation as an interprofessional education (IPE) teaching tool.[10] Studies have demonstrated that immersion in IPE activities through high-fidelity simulation scenarios have resulted in improved emergency-care team performance.[11,12] Considering these recent studies as evidence of its effectiveness, simulation as a method and strategy for team training in emergency medicine and other health care settings is rapidly moving toward becoming mandatory for ongoing practice and a standard component of educational curricula.[11,13,14]

Yuan et al[15] conducted a systematic review of evidence on improving knowledge and skills through high-fidelity simulation in medicine and nursing. Results revealed positive learning effects using high-fidelity simulation in medical and nursing education. These positive learning effects translate to improvements in students' clinical competency. This effect illustrates that clinical reasoning and decision making in medical education improves as a student applies classroom core knowledge through simulation.[9,12,16] Cant and Cooper[2] conducted a systematic review of 12 studies using high-fidelity simulation as an educational tool in nursing programs. All studies reported simulation as a valid teaching tool, and 6 of the studies showed additional gains in the nursing students' knowledge and critical-thinking ability.

In addition to beneficial effects for outcomes of knowledge, clinical skills, and decision making, simulation has a positive effect on true patient-related outcomes.[1,17] A growing body of evidence shows that clinical skills acquired in medical simulation directly transfer to improved patient care and better patient outcomes.[17,18] This has led to the incorporation of simulation scenarios into training areas of emergency medicine, critical care, surgery, and anesthesia, with a desire for patient safety and quality in patient care as the driving force.[3,11]

Enhancement of the traditional clinical educational model with evidence-based practices in high-fidelity simulation is becoming a high priority for medical education policy and research.[18] In fact, in 2010 the American Board of Anesthesiology became the first medical specialty to require high-fidelity simulation as a standard component to maintain board certification. At that time, participation in a multimodal, high-fidelity simulation course was mandated as a new Maintenance of Certification in Anesthesiology (MOCA) requirement (to be completed every 10 years).[19]

Review of the effectiveness of high-fidelity simulation on multiple aspects of medical and health care education demonstrates an evidence-based platform for the integration of this educational tool into athletic training programs. Athletic training educators could use this platform to incorporate high-fidelity simulation into athletic training curricula as a teaching and learning method for basic knowledge and skill acquisition including physiological evaluation of the heart, lung, and bowel sounds, as well as assessment of respiration rate, blood pressure, pulse points, and responsiveness in primary and secondary evaluations. Furthermore, high-fidelity simulation can be used in athletic training curricula as an adjunct for clinical practice by creating an opportunity to expose students to low-incident events they may not encounter in clinical settings, such as cardiopulmonary resuscitation, splinting, spine boarding, and transfers. In addition to the opportunity to develop, synthesize, and apply knowledge in a replica of a real experience, high-fidelity simulation allows athletic training students to work individually or as a team through a patient scenario and then reflect on their clinical decisions to learn from mistakes without causing harm to the patient.

Considering the lack of evidence specifically relating to the effects of high-fidelity simulation on athletic training education, research examining the application of this educational technology into our profession is warranted. Future research could investigate the effectiveness of high-fidelity simulation on athletic training students' knowledge acquisition, skill performance, self-confidence, learner satisfaction, clinical reasoning, and critical thinking skills. Additional research is also needed in the exploration of best practices of high-fidelity simulation within athletic training education for instructional design and curricular integration, including faculty development and training, compared with traditional teaching strategies.

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