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High-fidelity simulation for graduate athletic training students and impact on students' learning experience

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Abstract

High-fidelity simulation can contribute to healthcare education as an adjunct to real-world simulated experiences in a safe learning environment. While high-fidelity simulation has been widely used in healthcare for training and professional education, application in athletic training education remains primarily at the undergraduate level. Using an interpretive phenomenological approach, the purpose of this paper is to gain a further understanding of entry-level master athletic training students' perceptions following high-fidelity simulation when used to amplify real-world student educational experiences. Focus group interviews were conducted and gathered students' perceptions of the experience. Eighteen participants (17 female, 1 male) completed focus group interviews. Data were analyzed through reading transcriptions, then summarizing data into codes which formed categories leading to the themes of master athletic training students' perception of the high-fidelity educational experience. Trustworthiness was established using informal member-checking, prolonged engagement, rich thick description, and investigator triangulation. Four themes emerge from the participants' experience: (1) skill application; (2) learning environment; (3) competence challenge; (4) communication and collaboration. High-fidelity simulation can be a valuable adjunct to an athletic training program's skill practice and development leading to improvements in students' confidence, communication and self-efficacy.

Keywords: Education, Teaching methods, Simulation, Clinical skills, Qualitative

Overview

Athletic trainers are multi-skilled health care professionals who prevent, examine, diagnose, treat and rehabilitate acute, chronic or emergent injuries and medical conditions (National Athletic Training Association). Presently, there are two entry-level professional degrees

for athletic training: either baccalaureate or master level. In 2025, the Commission on Accreditation of Athletic Training Education (CAATE), which establishes and ensures compliance and accreditation standards for athletic training education, will only recognize a master as the entry-level professional degree (CAATE). Research in pedagogical practices in athletic training have often been at the bachelor's level. With the transition to a master as the entry-level athletic training degree, research conducted at the master level may be useful as educators consider implementing pedagogical strategies such as high-fidelity simulation.

In healthcare education, clinical education and practicum experiences are critical in the transition from classroom learning to clinical application. Exposing students to conditions and scenarios and demonstrating competence in a variety of skills are primary goals of clinical education and necessary for meeting accreditation requirements. However, certain competences or standards may be hard or nearly impossible for students to encounter in clinical educational experiences. Programs may turn to varied methods to meet or achieve educational standards or competences. Simulation is a pedagogical technique to promote, improve, or validate a student's progression from novice to expert (Benner, 1984; Decker, 2007). Simulation can include students engaging with other fellow students, a standardized patient, or with some sort or technology often termed low-, medium- or high-fidelity. Standardized patient is a person trained to consistently portray a patient or other individual in a scripted scenario for the purpose of instruction, practice or evaluation (Robinson-Smith et al., 2009). Fidelity is the degree to which a simulated experience approaches reality with the intention that as fidelity increases realism would as well (Dieckmann et al., 2007). Technology used during fidelity can range from low- (case studies, role-play, task trainers), medium- (mannequins with breath sounds, heart sounds) to high- (full scale computerized patient simulators such as SimMan 3G) (Meakim et al., 2013).

As health professionals, an athletic training student's educational preparation includes both didactic and clinical responsibilities or sometimes called clinical educational experiences. Simulation is utilized in athletic training education to support didactic and clinical education by replacing or amplifying real experiences with guided, fully interactive opportunities meant to evoke or replicate substantial aspects of professional practice (CAATE). Athletic training education encourages implementing high-fidelity simulation into curriculum to support student learning and skill development. Previous research on high-fidelity simulation in athletic training education was conducted in undergraduate programs (Miller et al., 2018; Palmer et al., 2014; Paloncy et al. 2019). Qualitative inquiry promotes uncovering the value and meaning of an experience in participants own words, allowing them to elaborate on previously conducted research. Our study is the first to explore graduate athletic training students' lived experiences, through a phenomenological approach, of high-fidelity simulation. The purpose of our study was to expand the present

research in athletic training education on simulation, more specifically investigating entry-level master students' perception of high-fidelity simulation. This study also serves as a pilot-study for a larger qualitative study exploring students from varied graduate programs.

Literature review

High-fidelity simulation is frequently utilized in healthcare education to simulate patient situations for teaching and practice through coursework or as a supplement to clinical educational experiences. High-fidelity human-patient simulators are computerized life-size mannequins capable of talking, blinking and reproducing physiological signs and symptoms that healthcare students may see in clinical experiences and patient care. High-fidelity simulation-based training is employed often in nursing as it provides opportunity for repeated instruction and practice that mimics real-world settings without risk to an actual patient. The use of these human-patient simulators promotes improved patient related outcomes (McGahie et al., 2011; Peberdy & Ornato, 2008); improved knowledge, clinical reasoning and decision-making (Cant & Cooper, 2010; Harder, 2010; Hart et al., 2014; Ko & Kim, 2014; Linsey & Jenkins, 2013); student satisfaction (Abodo & Ravert, 2006; Rhodes & Curran, 2005; Schoening et al., 2006; Smith & Roehrs, 2009); and confidence (Cant & Cooper, 2010; Fabro et al., 2014; Scherer et al., 2007; Schoening et al., 2006).

High-fidelity simulation in allied health care

Students enjoy and are satisfied with learning through high-fidelity simulation (Abdo & Ravert, 2006; Rhodes & Curran, 2005; Shoening et al., 2006; Smith & Roehrs, 2009). A study investigating baccalaureate nursing students' satisfaction after five high-fidelity simulation sessions found that the simulation experience enhanced students learning and helped improve their decision-making skills (Abdo & Ravert 2006). As a whole, participants felt very positive regarding the experience, the transferability, realism and value. While a student's satisfaction with this pedagogical approach does not objectively measure the impact of high-fidelity simulation, it enables the students to elaborate on their attitudes toward this teaching approach.

Evidence demonstrates that high-fidelity simulation in healthcare education can improve knowledge, clinical reasoning and decision-making (Cant & Cooper, 2010, 2016; Fluharty et al., 2012; Hart et al., 2014; Ko & Kim 2014). Fluharty et al. (2012) conducted a quasi-experimental study investigating simulation outcomes of baccalaureate nursing students across four different schools. Participants completed one simulation experience that mimicked a hospice environment and caring for a dying patient. Participants pretest to posttest scores on the Knowledge Related to End-of-Life Care found that through high-fidelity simulation, the participants demonstrated an increase in knowledge. Cant and

Cooper (2010), through a systematic review of nursing research, found 12 studies exploring high-fidelity simulation as a valued teaching tool. Of these 12 studies, six indicated additional gains in nursing students' knowledge and critical thinking in conjunction with high-fidelity learning experiences. Implementing high-fidelity simulation for certain skills and techniques that can be practiced, assessed and require students to make complex decisions, provides a way for faculty to assess critical thinking and problem-solving.

In addition to expanding knowledge and critical thinking, high-fidelity simulation improves student confidence (Cant & Cooper, 2010; Fabro et al., 2014; Schoening et al., 2006). Schoening et al. (2006) investigated undergraduate nursing students employing high-fidelity simulation with problem-based learning scenarios in high-risk obstetrical clinical experiences. After the simulated clinical experiences, students completed a 10-item evaluation. Results demonstrated that students felt the simulated experience was effective to meet course objectives and increased their confidence in the clinical setting. Athletic trainers work in diverse environments and at times under high stress situations that require the practitioner to be focused. High-fidelity simulation offers a way students can practice skills in safe, controlled and supervised environment. While several researchers (Cant & Cooper, 2010; Fabro et al., 2014; Schoening et al., 2006) conclude student confidence improves in relation to the high-fidelity learning experience, the translation into clinical practice is still questionable.

Patient related outcomes are vital as health care professionals make important decisions and determine treatment effectiveness. Evidence demonstrates that clinical skills acquired through high-fidelity simulation in medical education is directly transferred to improved patient care practices and better patient outcomes (McGahie et al., 2011; Peberdy & Ornato, 2008). McGahie et al. (2011) suggests that high-risk skills (that could be potentially life-threatening) that can be challenging in real-time or with actual patients can be beneficial in the simulation environment to assist in improved patient care practices. High-fidelity simulation can be a good educational adjunct to assist students in practicing clinical decision-making and refining skills in a controlled environment. Investigating pedagogical practices that can transition athletic training students to practitioners with sufficient skill acquisition that also emphasizes patient safety is relevant to advancing athletic training education.

High-fidelity simulation in athletic training education

High-fidelity simulation in athletic training education has also been investigated. Presently there are two quantitative studies on high-fidelity simulation that investigated students at the bachelor's level (Miller et al., 2018; Paloncy et al., 2019). Miller et al. (2018) completed a pretest-posttest study design of undergraduate athletic training students. Participants completed questionnaires after both a high-fidelity and student simulation in one

emergency skill scenario. They concluded that the high-fidelity simulation enhanced the students' perceptions of their confidence, knowledge, and decision-making skills. Paloncy et al. (2019) investigated undergraduate athletic training students' emergency cardiovascular care skills with high-fidelity simulation and found that self-efficacy scores improved after high-fidelity simulation. Presently, little research has explored graduate athletic training students who completed high-fidelity simulation experiences. Overall, our research aims to contribute to the better understanding of the use high-fidelity simulation in athletic training education and to gauge the extent to which the use of high-fidelity simulation can impact students' learning experiences. More specifically our objective was to understand how graduate athletic training students experienced the use of high-fidelity simulation as we explore how to improve high-fidelity in our curriculum.

Material and methods

We employed a phenomenological approach to further understand students' perspectives on high-fidelity simulation. Qualitative research emphasizes what is uncovered from observation and experience, as opposed to ideas and objectives provided a priori, and our study sought to understand the meaning and experiences of graduate athletic training students. A qualitative approach allowed us to explore experiences of the participants in a comprehensive and holistic manner and to enhance learning and understanding of graduate students' perceptions of high-fidelity simulation. Further exploring a high-fidelity experience enabled us to understand and describe the principle of the experience as perceived by the participants (Creswell, 2005).

Participants

Participants were selected through a purposeful sample of students enrolled in one entry-level master athletic training program. Within this program, students complete five semesters of clinical educational experiences over two years. All participants were enrolled in the 3rd clinical experience, thus they were all 2nd year students in an entry-level master program. Students in this entry-level master program all complete high-fidelity simulation as a requirement of the program. After completing the high-fidelity simulation experience, a recruitment script was read in a subsequent course asking for volunteers. Consent forms were handed out during this announcement for volunteers. Students who signed consent forms were contacted by the principal investigator for scheduling of focus group interviews at a convenient time. The consent form outlined confidentiality which included giving every participant a pseudonym, so that no direct link could be made between the participant and the response that was given in the focus group interview. All data was kept on the principal investigator's password-protected computer and on password-protected storage. The data was only accessible to the principal investigator and co-investigator.

Our sample consisted of 18 participants (17 female, 1 male) who volunteered for this study (Table 1). While this sample was primarily female, this was a direct reflection of the female to male ratio of the cohort. All participants had no previous experience with high-fidelity simulation. Theoretical saturation, up to the point where additional data provided no new insight, was met at the fifth focus group interview (Creswell, 2005). The principal investigator heard the same comments repeatedly, and no further interviews were conducted.

Simulation experience

Prior to requiring students to complete high-fidelity simulation within the curriculum, our program was meeting educational standards using task trainers or standardized patients. Considering conditions that require evaluating changing physiological signs and symptoms, the program was challenged with replicating the realism of physiological presentations such as abnormal lung or heart sounds or deteriorating vital signs (blood pressure, heart and respiratory rate, oxygen saturation) due to anaphylactic shock. The Physician Assistant Studies program at our University had a SimMan3G® and staff resources to support using this technology. Over a period of two years prior to our study, we facilitated a partnership between Athletic Training Education and Physician Assistant Studies to implement high-fidelity simulation into the program. This included creating formal objectives of the simulation experience (Table 2). The equipment used and available to the students in our simulation is listed on Table 3. We annually reviewed our high-fidelity simulation cases

Table 1 Study participants

Pseudonym	Age
Olivia	24
Isla	28
Sophie	24
Ella	23
Charlie	22
Ava	23
Amelia	28
Grace	23
Freya	23
Aria	26
Harper	29
Mia	26
Rosie	26
Evie	24
Ruby	29
Willow	27
Maisie	25
Chloe	25

Table 2 Objectives of simulation experience

1.	Provide holistic, empathetic care.
2.	Revisit and practice key skills and concepts.
3.	Prepare for and adjust to the unknown or unexpected.
4.	Provide a safe environment for students to evaluate conditions not always evaluated in the sports medicine center.
5.	Clinically evaluate and manage a patient with an emergent injury or condition to include a health history, assessment of vital signs and level of consciousness, activation of emergency action plan, secondary assessment, selection and use of relevant and appropriate tests, tools and measures to determine body function, and clinical diagnosis.
6.	Provide interventions that may include administering emergency medications, initiating referral to facilitate diagnosis and treatment planning.
7.	Provisions of the appropriate emergency care.
8.	Develop collaborative communication amongst team members, working together to problem-solve and make decisions to formulate and carry out care plans for patients.

and procedures and sought feedback from students. Based on this annual review we made minimal changes to our scenarios or procedures utilized in this study.

Prior to completing the simulation experience, all students completed a pre-brief session to familiarize themselves to SimMan (SimMan3G®) manikin and the room SimMan was located. Students were introduced to SimMan and provided a demonstration of the various functions, including talking to SimMan, and allowing time for students to familiarize themselves with where to check pulses, take blood pressure, practice auscultations, and other capabilities of the manikin itself. All students were scheduled for the simulation experience in groups of 3 for 90-minute time frames. This time included three simulation cases, each scenario approximately 20-minutes in length, followed immediately by a short debriefing. The students were tasked with completing an evaluation, gathering vital signs, and determining diagnosis and treatment/referral options.

Table 3 Equipment available for students

1.	High-fidelity manikin – appropriately dressed for simulation experience
2.	Emergency action plan – venue specific
3.	Peak flow meter – including normative data
4.	Pulse oximeter
5.	Blood pressure cuff
6.	Stethoscope
7.	Pen light
8.	Oxygen tank with non-rebreather and nasal cannula
9.	Epi-pen
10.	Medical kit with gloves, wound care management supplied, tape, scissors

For each of the different simulation scenarios, students assumed a different role; lead, assist or scribe. Prior to beginning each simulation scenario, students read an initial impression of the situation that included patient name, chief complaint and physical location. The students were also provided an emergency action plan. A lead faculty member was physically present in the simulation lab throughout each scenario to observe and provide any clarification as necessary. Each group then entered the simulation lab to conduct an evaluation including: taking a detailed history, observation, assessment of vital signs, determining the condition, selecting appropriate treatment, and determining referral and return to participation. The scenarios were emergent cases of anaphylactic shock, spontaneous pneumothorax and asthma. Developed over the last two years, the scripts for the cases outlined and included location of the patient, identifying patient data, chief complaint, detailed descriptions of signs and symptoms for the presenting conditions and any vital signs changes to occur throughout the simulation. None of the patients went into cardiac arrest during any of the scenarios as performing skills related to a patient in cardiac arrest was not a learning objective. Immediately after completing all three scenarios, the lead faculty conducted a debrief with the group of students. All students were asked the same set of questions, which focused on how the students perceived the experience: what went well, what might they change next time, and further discussion on each case presentation.

For faculty or programs wishing to design and implement high-fidelity simulation into their curriculum, please review our section titled "Suggestions for implementing simulation."

Data collection

Prior to conducting this study, the interview protocol and informed consent was reviewed and approved by the Institutional Review Board of the researcher's institution. All participants signed an informed consent form before initiating focus group interviews. Data were collected through focus-group interviews which allowed participants to express their thoughts about their high-fidelity experience. Each participant completed one focus group interview. Participants were placed in groups based on availability. Focus group interviews, rather than one-on-one, were chosen to support student comfort sharing their experience, which may have been hindered during one-on-one interviews. The focus group interviews included no more than four participants. The principal investigator conducted all focus group interviews and encouraged all participants to provide information on their own experiences and was careful not to allow dominant students to control the conversation. All participants were notified that their responses would remain confidential.

The interview guide was designed to explore students' perceptions of high-fidelity simulation and included open-ended questions which allowed for individual responses and

Table 4 Semi-structured focus-group interview questions

1.	Tell me about your experience with high-fidelity simulation?
2.	Share your thoughts about the high-fidelity simulation. a. General thoughts, challenges, can you elaborate, tell me more.
3.	Can you share how you felt during the high-fidelity simulation?
4.	Describe how you felt during the high-fidelity simulation.
5.	Tell me your thoughts on the importance of high-fidelity simulation on clinical educational experiences. a. General thoughts, benefits, challenges, can you elaborate?
6.	Is there anything else you would like to share regarding the high-fidelity simulation experience?

gave the principal investigator opportunities to pursue emerging ideas and gain additional insight (Creswell, 2005). Participants were asked to further clarify or describe any questions that were answered with a simple yes or no. The interview guide (Table 4) was based on the principal investigator's experience with qualitative research. An expert in athletic training education reviewed the guide for content, bias and clarity. The principal investigator and expert in athletic training education met to discuss the interview guide, and edits were made based on feedback from the experienced qualitative researcher. Focus group interviews lasted 30 minutes on average and were audio recorded utilizing H4n Pro (version 4.0, Zoom, Hauppauge, NY).

Data analysis and data credibility strategies

Two researchers transcribed the audio recordings verbatim and then replayed the recordings to verify accuracy. All transcriptions and information were stored on a password-protected laptop and server. Throughout the focus-group interviews, notes were taken and kept with the transcriptions in the principal investigator's locked office. Audio files were stored on a password-protected server. Records of interviews were kept in separate files and labeled with pseudonyms.

We adopted a content analysis methodology approach to discover the perceptions of the participants (Erlingsson & Brysiewica, 2017). Two investigators independently read transcripts to gain a general understanding and interpret the perceptions of the participants experience. As the experiences of the participants were analyzed, the two investigators independently labeled each individual experience in codes and grouped the codes into categories. Several consensus meetings occurred between the two investigators throughout the data analysis process to ensure consistent use of codes and categories while also checking for a common understanding and concepts and categories. From the categories, themes emerged to express the underlying meaning of the high-fidelity experience.

To ensure consistency and authenticity and to reduce bias, data credibility was established through informal member checks, prolonged engagement, rich thick descriptions and investigator triangulation. Informal member checks occurred during the interviews to check for understanding as participants confirmed or adjusted reflections while clarifying questions were asked regarding the participants responses (Creswell, 2005). The two researchers had extended time with the data, or prolonged engagement, through transcribing, reading and re-reading the transcriptions. Prolonged engagement supported the researcher's ability to fully consider the context of information throughout the data analysis. Additionally, rich thick descriptions, in the form of participants quotes, were used to help the reader determine if findings can be transferred to similar situations (Creswell, 2005). Investigator triangulation involves multiple investigators collecting and analyzing data (Merriam, 2009). In this study, the two researchers reviewed the data independently by reading and re-reading the transcription notes to determine themes. The two researchers completed three consensus meetings during the analysis process to discuss and reach agreement on findings. Through these processes of informal member checking, prolonged engagement, rich thick descriptions, and investigator triangulation, credibility and validity were established.

Results

After completion of data analysis, four common themes emerged: (1) skill application; (2) learning environment; (3) competence challenge; (4) communication and collaboration. A description of each theme and supporting sub-themes follows, including verbatim quotations from participants that support each theme.

Skill application

Through high-fidelity simulation, participants felt they were able to practice, review and apply skills not normally seen in clinical practice. The first theme, skill application, emerged from participant's perceptions of the influence of high-fidelity simulation on their ability to practice skills they did not, or might not regularly encounter in clinical practice. Participants mentioned the high-fidelity simulation was good practice and believed the repetition was beneficial.

Prepared

Participants agreed the high-fidelity simulation experience facilitated good skills practice, helping them to feel prepared for similar situations in the future. Isla detailed that skill practice with the mannequin would transition to patient care: "I think being able to practice on the mannequin will definitely make us feel more prepared to actually do it [treatment] on another patient." Maisie also shared that this experience "was really good practice for

some things we may or may not see often." Charlie perceived that practicing skills during high-fidelity would help them feel more comfortable using these skills stating "practicing skills that we don't typically use in the clinical experience day to day, so we feel more comfortable doing that [skills], definitely." Aria also remarked the simulation experience helped promote being prepared for any situation in the future by practicing skills she may not see at clinical sites:

> I think it really is important to practice it, and I think the more you practice it [skills] the better you are going to get at it … that is with everything … whether we do CPR or the more we practice c-spine. When those emergency situations occur, we are not just blanking, we already have everything mapped out in our mind. Of course, situations are always going to be different but if you have the basis down of what you need to do and what the most important things are then I feel like you will be prepared for any situation.

Review skills

Participants also stated the high-fidelity experience enabled them to particularly review and practice skills related to an injury or condition they were not exposed to during their clinical rotations. Harper agreed "It was definitely a good review of skills that we had maybe learned but … we have all said they were not necessarily things we see every day at our clinical sites … being able to review." Sophie further commented on the application and review that "I like the opportunity to take what I did learn in the classroom and apply it."

Participants in this study perceived high-fidelity simulation favorably as it allowed them to review and apply important skills learned in the didactic setting to a scenario that may not be commonly seen in their clinical educational experiences.

Learning environment

Participants agreed that high-fidelity simulation was a low stress, safe and controlled space to learn. The second theme, learning environment, emerged from participant's perceptions that the high-fidelity simulation experience provided a different learning space and allowed students to actually see and objectively assess changing vital signs and physical exam findings. The majority of participants commented on the manikin's realism, and their ability to listen to heart and lung sounds and assess vital signs.

Realism

High-fidelity simulation allowed participants in this study to practice heart and lung auscultations and assess real-time pathological vital signs. Mia stated that "we are taking

the pulse and blood pressure and we are given these numbers [with standardized patients] but, with the SimMan we get to actually feel them and actually take the pulse and the blood pressure and actually hear what it is that we are looking for." Charlie also commented on the realism and unique learning environment:

> The availability to control what the SimMan was given essentially whether it was heart rate whether it was high or low [heart rate], whether his blood pressure was off, pulse ox … all those things that can be controlled in high-fidelity simulation setting whereas you cannot fake that [vitals] with your classmates.

Participants in this one study valued and felt confident in clinical decisions due to the realism and learning environment high-fidelity simulation provided.

Safe learning space

The participants viewed the high-fidelity simulation as a controlled space to learn. Not grading the simulation experience allowed for low-stakes assessment and practice, and as such the majority of participants perceived this learning environment to be safe and challenging. For all participants in this study, this high-fidelity simulation was their first experience. While the unfamiliar space of the simulation lab increased anxiety, the majority of participants perceived they were safe during the experience. Willow stated that:

> ... it was something kind of new to all of us … it was a safe environment for us to just go in there and be able to evaluate and if we had like a mistake or a question … it was good for us to have that safe environment … it was a little bit different because we were not really used to doing that so it was a little confusing but it was a good experience over all.

The experience of participants in this one study demonstrated that high-fidelity simulation was a favorable learning opportunity, enabling participants to feel they were in a controlled and safe learning environment.

Competence challenge

High-fidelity simulation led participants to feel confident in making decisions and that they had the necessary skills and knowledge to be successful. Initially, participants perceived they did not have the requisite skills to proficiently manage the simulation scenarios. However, at the conclusion of the simulation experience, participants recognized they were in fact competent, skilled athletic training students, supporting emergence of the third theme, competence challenge.

Reassurance

At first, participants perceived their own professional skills as lacking and not yet proficient. By the conclusion of the high-fidelity simulation experience, the majority of participants believed they could perform the skills automatically, supporting the realization of a newfound level of confidence and competence. Olivia stated "reassuring your knowledge and ok … I did really retain this information from class and I know it … It [simulation] was just a confidence boost." Sophie provided further detail on the transition from questioning skills to feeling competent:

> I like the opportunity take what I did learn in the classroom and apply it, in a sense a test … a test of my own knowledge to see if I truly retained what was taught to me. Even if there was a moment where I was confused or did not know what step to take next it proved to me that I did take what I learned in class and can apply in practice and when I am on my own I should be able to [treat patients].

Maise further supported this shared experience by stating "after I looked back and reflected on it [simulation], it was reassuring to know that I was able to repeat the stuff I learned in the classroom and I know more than I thought I did … more confident in my abilities." Participants began the high-fidelity simulation with low self-efficacy in skill competence. As they transitioned through the three scenarios they became consciously aware of their competence regarding skill application. Participants were able to recognize that based on presentation of signs and symptoms and vitals assessment, they could and did perform skills automatically and were able to adjust to changing conditions.

Awareness of knowledge

The high-fidelity simulation experience provided an opportunity for participants to review previously acquired knowledge and skills and evaluate areas of strength and areas needing improvement. Reflecting on the simulation experience drew conscious awareness to skills participants felt less confident performing and that were important to review to cultivate their self-efficacy and confidence. Grace stated that "just going back and reflecting on the things that you did after the scenarios [simulation] were over and then to try and comprehend about what you can do better and what you can work on ..." Several other participants also discussed the value of the simulation experience in that it re-familiarized them with skills and content not always seen in clinical practice and would support competence when they were faced with these or similar situations in future practice. Harper reflected "It was nice to be able to review … stressful situations so that then maybe we will not be as unfamiliar when we see them."

The simulation experience enabled participants in this study to acknowledge certain skills and treatments needing further review. However, the majority of participants perceived that the simulation experience constructively challenged their skills and clinical decision-making. Through this experience, participants gained self-efficacy and confidence in their unconscious competence to treat diverse conditions and felt it was becoming second nature to them.

Communication and collaboration

The final theme, communication and collaboration, emerged from the participants' perceptions that the high-fidelity simulation created opportunities to collaborate with their peers and communicate with patients. The majority of participants in this study commented that the high-fidelity experience encompassed working together with their peers and learning the importance of communication with patients.

Communication with patients

As athletic training programs prepare future athletic trainers, the focus is often on hands on skills, while the soft skills foundational to communication may be overlooked or not practiced. Participants discussed the benefit of practicing communication with patients in a clear and concise manner and adjusting what and how they communicated depending on who they were interacting with, peers or the patient. When placed in a situation which participants may not know or have already established a relationship with the patient, participants reflected on the need to adjust how they communicated and check in or ask the patient if they clearly understood the information being shared with them. Olivia stated that "you had to be able to know how to talk to each other and the patient, that is what I learned a lot and even the group checking with the patient and asking if they are still ok … that communication piece is crucial." Often, the participants found the patient asking more probing questions that the participant may have struggled to answer individually. Sophie mentioned that:

> … when I was trying to explain something to my patient, it [manikin] kept asking me more follow up questions that I wasn't 100% sure that my answer made sense. I did check with the patient to see if that [what I stated] made sense but I also had the chance to turn to one of the classmates and ask them … did you understand that or do you have a better way to explain this to the patient … they were there to reaffirm that I was explaining it properly or a better way to explain.

Communication with the patient, learning how to ask appropriate questions and being clear with the patient were critical learning components of this simulation experience for

the participants. Most of the participants in this study mentioned practicing communication with the patient was a key take away from the high-fidelity simulation experience.

Working with peers

Collaborating amongst their peers as they created treatment and intervention plans was a highlight for participants in this study. Several participants commented on the ability to ask questions amongst one another when they were not sure about the next step to take. Rosie stated that she "felt better about not having to be right or missing something … I had two other people with me to help me and just being in a group helped with my confidence and being more comfortable with the situation." Evie also commented on team collaboration during the simulation:

> We were allowed to ask for our classmates to help us set up the oxygen, or take blood pressure while I continued to talk to the patient. That communication piece is something that we do not learn because we are often at sites where we are by ourselves and we talk to a preceptor but talking to our colleague is something that will be a huge part of our careers. Having that ability to ask for help when needed.

Participants in this study appreciated the cooperation that occurred throughout the three simulation scenarios. Communicating with each other, discussing a differential diagnosis and collaborating on evaluation and treatment plans for the patient were valuable experiences supporting professional development.

A unique aspect of high-fidelity simulation, and a contextual factor the participants acknowledged, was that speaking and interacting with the manikin was not comparable to a real patient. However, they gained an appreciation of how important communication is between provider and patient. Participants perceived the high-fidelity simulation experience taught them valuable communication skills and brought awareness to the importance and value of collaborating with other healthcare providers.

Discussion

Clinical education and patient-centered care are at the core of healthcare students' education. The primary mode of teaching clinical skills is often through "see one, do one, teach one." In instances of limited clinical educational experiences and the demands to prepare athletic training students, Coordinators of Clinical Education can seek alternative strategies to meet Commission on Accreditation of Athletic Training Education (CAATE) standards (CAATE). In comparison to other educational training methods, simulation increases student's clinical skills (Harder, 2010). Implementing high-fidelity simulation into professional development offers an educationally valuable alternative to providing

athletic training students with learning opportunities encompassing specific clinical encounters, patient populations or skills, that may not occur in direct patient care settings.

This study investigated graduate athletic training students' perception of high-fidelity simulation. Our study was the first qualitative exploration of graduate students' perceptions of high-fidelity simulation athletic training education. Overall, students in our study perceived high-fidelity simulation as a valuable experience that provided a different learning environment, enabled skills application, enhanced students' self-efficacy and competence and facilitated communication and collaboration opportunities with both peers and patients.

For graduate athletic training students, high-fidelity simulation was a valuable opportunity that enabled them to perform a variety of clinical skills. The students perceived that through high-fidelity simulation they were able to practice, review and apply skills not often seen in clinical educational experiences. Students expressed renewed confidence in transferring the skills and experiences gained during high-fidelity simulation to clinical practice, helping them feel more prepared for encountering similar situations in the future. Facilitating skill practice during this high-fidelity simulation experience led to enhanced confidence and increased self-efficacy. In athletic training education, the teaching, practice and assessment of skills related to traumatic and emergent injuries traditionally occurs in a laboratory setting with simulated patients or as a low-fidelity experience with task trainers such as Laerdal manikins. Miller et al. (2018) investigated the use of high-fidelity simulation versus student simulation and perceived learning needs of students during an emergency care scenario. They found high-fidelity simulation experiences were an effective tool for addressing learning needs and students perceived simulation more favorably for cardiopulmonary resuscitation skills practice than the traditional lab setting. Our qualitative discoveries expand upon and further validate Miller et al.'s (2018) findings as graduate athletic training students in our study were able to reflect on the value and learning needs as they shared their lived experience with high-fidelity simulation.

Through much of the course of athletic training education, pedagogical techniques and skill acquisition is accomplished with peers in a lab setting. Didactic and laboratory time is often spent practicing and rehearsing scenarios. While learning and skill development are requisite objectives, translation of knowledge and skills from the classroom to clinical practice is a foundational goal of healthcare education. In a comparative meta-analysis of effectiveness of traditional clinical education versus simulation-based medical education, McGaghie et al. (2011) concluded simulation-based medical education with deliberate practice was superior to traditional clinical medical education for skills development. With evidence of successful learning outcomes in nursing and medicine, Palmer et al. (2014) suggested that high-fidelity simulation could enhance learning experiences for athletic training students. The researchers developed high-fidelity simulation scenarios with

emphasis on student evaluation and management of general medical conditions. Our qualitative study provides depth of understanding and further support that high-fidelity simulation does promote skills practice. Particularly of skills and interventions not readily available in clinical educational experiences and is a valuable pedagogical tool as programs transition students into proficient and confident clinicians.

The safe and controlled learning space and realism afforded by changing physiologic signs and symptoms during the high-fidelity experience was valuable to graduate athletic training students ongoing clinical development. In these simulated scenarios, students must critically analyze, synthesize information, and make clinical decisions based on changing physiologic signs and symptoms. Altering physiologic information, in real time, cannot be simulated in a standardized human patient. In our study, students were exposed to a variety of scenarios, many of which students had not encountered in clinical experiences. Coupled with the capacity to alter physiologic functions, high-fidelity simulation provides a safe learning environment that can mimic high stress and emergent conditions (Akaike et al., 2012; Lewis et al., 2012; Miller et al. 2018). From their experience with the high-fidelity simulation, the realism and changing vitals were a valuable learning experience for the athletic training students in our study. Additionally, though students experienced a heightened stress response during the simulation scenarios, they perceived they were in a space that was ok to make mistakes and learn without adverse consequences. Failed experiences offer students valuable learning opportunities that lead to review and repetition as they continue to learn and develop proficiency.

Athletic training students in our study all perceived the high-fidelity simulation as a constructive competence challenge. Accessing and applying knowledge and skills gained throughout the educational curriculum to the simulated scenarios promoted enhanced self-efficacy and confidence in clinical practice and decision-making. High-fidelity simulation improves student's confidence (Cant & Cooper, 2010; Fabo et al., 2014; Schoening et al., 2006). Athletic trainers work in diverse environments and at times in high stress situations that require the practitioner to be focused. High-fidelity simulation offers a safe, controlled and supervised learning environment that students can practice and hone skills essential to acute and or emergent situations. While several studies (Cant & Cooper, 2010; Fabo et al., 2014; Schoening et al., 2006) conclude student confidence improves secondary to simulation, research uncovering whether and how confidence translates to clinical practice is relevant.

As athletic training programs graduate proficient healthcare providers, one area recognized as a weakness encompasses communication with patients, family members, coaches and other healthcare providers (Carr & Volberding, 2012). Hobgood et al. (2010) found evidence a significant proportion of adverse events in health care are caused by problems relating to the 'non-technical' skills of communication, teamwork, leadership and

decision-making. Purposefully implementing these important communication skills into athletic training curriculum could help mitigate error as students transition to practice. High-fidelity simulation is an effective method to accomplish affective domain elements, specifically communication (Miller et al., 2018). Graduate athletic training students valued the opportunity high-fidelity simulation afforded to practice communicating with patients and collaborating with peers on care decisions. Students gained insight on adjusting communication when interacting with both patients and their peers. High-fidelity simulation creates realistic clinical scenarios that give students opportunities to practice communication and technical skills with patients and the healthcare team (Harder, 2010; Henning et al., 2017; Miller et al., 2018). Use of high-fidelity manikins can meet the demands of generating representative clinical scenarios that give students opportunities to practice communication, critical thinking, clinical decision-making, and technical skills in a safe, realistic, and controlled learning environment under faculty supervision (Harder, 2010; Henning et al., 2017). All students in this one course at one university stated the experience was positive and believed high-fidelity simulation is an important tool in their ongoing education. Based on our findings and student feedback, we have now implemented a second high-fidelity simulation experience in the students first-year clinical sequence.

Limitations and future research

Limitations of our study included: one college population and the principal investigator was a professor. First, the data for this study was collected from graduate athletic training students in one program. Therefore, the findings may not be generalized to all colleges and athletic training students. The principal investigator was a professor for participants in this study, which could have introduced bias as students may have leaned toward saying what they believed the principal investigator wanted to hear. We also recognize that students who volunteered for the study valued the simulation experience, potentially leaving out voices of those students who did not value the high-fidelity simulation experience. In our qualitative research approach, we attempted to bracket and remove inherent bias through informal member checks, prolonged engagement and investigator triangulation. Each investigator independently analyzed the data and then completed multiple consensus meetings to ensure consistent use of codes and categories and an accurate reflection of the participants' perspective of the experience. Future research should consider a mixed methods analysis and the impact of high-fidelity simulation investigating effectiveness, self-efficacy, confidence and learning outcome measures as compared to other clinical educational experiences.

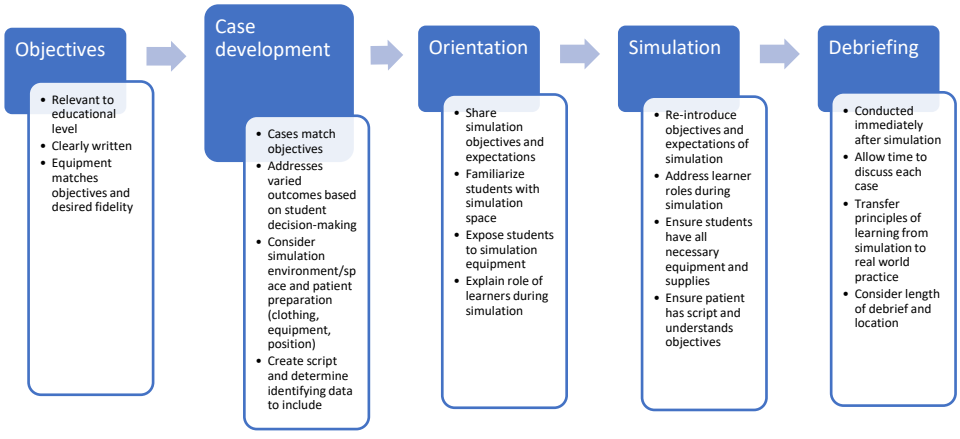
Suggestions for implementing simulation

Programs considering high-fidelity simulation as an adjunct to clinical education should consider cost and added technology. Aligning with other educational programs can afford opportunities for teaching and equipment collaboration. These collaborations may also include ways programs can foster interprofessional knowledge acquisition and skill development. For those looking to implement simulation into their curriculum, some key things to consider are objectives, case development, orientation, simulation day and debriefing (Table 5).

Objectives

Faculty investigating how to integrate simulation into their curriculum must first establish objectives. Just as with didactic content, objectives should guide the process of simulation development. The objectives should be appropriate and relevant to the educational level of the students. Clear understanding of objectives will help the program determine such things as the appropriate fidelity or simulator to purchase, the number of simulations to place within the curriculum, and what case scenarios will best accomplish the desired outcome. Programs may find they are able to accomplish objectives with less time and expense than initially planned.

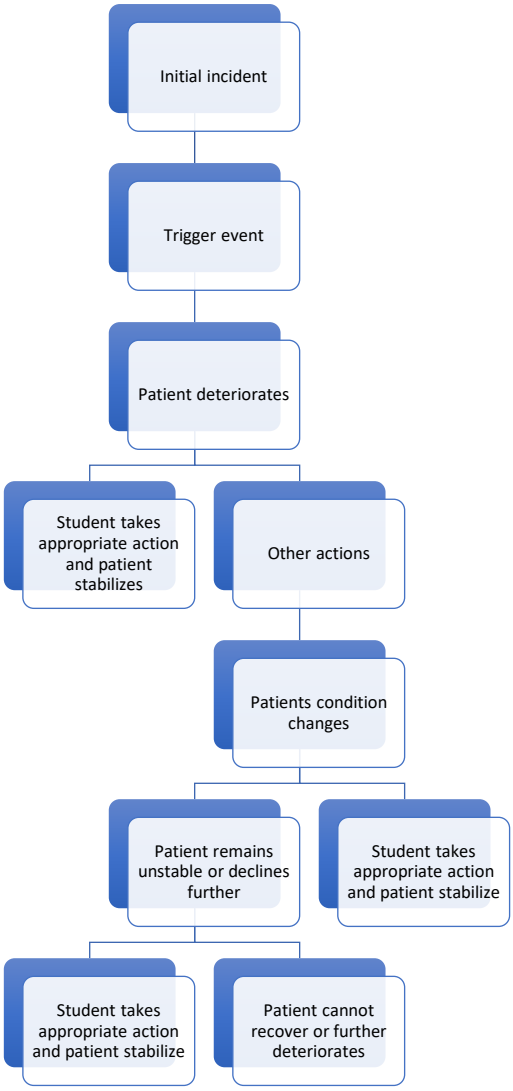
Table 5 Guidelines for simulation



Case development

After determining objectives, cases or scenarios can be created. Athletic training and other faculty could begin with real-life cases that would be seen in real-world patients. If developing simulation across the curriculum, the cases could be increasingly complex and include accreditation standards. It may be helpful to design a flowchart to illustrate triggers or outcomes if the student chooses a particular course of action (Table 6). This visual diagram can be helpful to think of all the possible pathways depending on the student's actions and what might occur in situations where the students do not take appropriate actions.

Table 6 Scenario structure



Once you have your overall scenario, a script of the patient's case should be developed (Table 7). This patient script should include an introduction which may be given to students prior to beginning simulation. This introduction should include patient identifying data, chief complaint and any physical considerations. Providing this prior to entering the simulation space can allow students time to think about information they wish to collect. Other important aspects of scripting the case relates to physical and environmental considerations. The script should detail information about position of the simulator (floor or sitting on a bed or chair, etc.), clothing (gown, civilian clothes, athletic attire etc.) and specific props that may be needed for the scenario (helmet, glasses, drugs etc.).

The script also needs to include physiological parameters and level of consciousness. As you move through the script you should also consider how long the patient will remain in a particular stage before their medical condition starts to further degrade prior to students providing the appropriate treatment. This is a necessary consideration for determining overall length of time of case and progression. The script should also include additional paperwork, images or audio that may be relevant for the particular case.

Orientation

The orientation is an important piece to the whole simulation experience with the purpose of dispelling any fears associated with simulators. Orientation should occur prior to the planned simulation experience. Students should be introduced to: the type(s) of simulation

Table 7 General script for case development

Introduction	Information is provided to the student prior to them entering the room
Identifying data	Name, age, gender, height, weight
Chief complaint	Why the patient is being seen
Physical considerations	Where is the patient, exam room, gym, etc., what are they wearing
Case: Information is provided to the simulation coordinator. This information details the case and what they will speak and physiologically respond to as the students ask questions, or through the physical assessment of the simulator	
Props	Any special items needed for the scenario
History of present illness	Detail on onset, duration, severity, location, associated symptoms
Previous medical history	Past medical history, surgeries, medications, allergies
Family history	Heritable illness, any unusual illness among relatives
Social history	Smoking, alcohol and other drug use, sexual activity
Review of systems	Questions regarding organ system to discover dysfunction and disease
Physical exam	Vital signs and any important physical findings
Differential diagnosis	3-4
Treatment & interventions (to include referral)	Based on the condition what the student should be providing for treatment

experience; what the simulator can do; how the simulation will be facilitated; and given the opportunity to interact with and become familiar with the simulator. The purpose of this introductory day can be twofold: exposure and buy-in. First, if the students are not familiar with the simulator and simulation, the first time seeing and experiencing it can be alarming. Having an orientation helps the student develop familiarity and confidence with the equipment. While simulation is an altered reality or degree of realism, with the equipment, supplies, sounds, and settings of each scenario selected in an attempt to mimic real situations, the students need to buy-in to the simulation experience. The orientation can be used to increase student buy-in and gain emotional engagement by detailing the role of the learner, expectations, and the purpose of the simulation.

Simulation day

On the day of the simulation, students should be reintroduced to objectives and expectations of the simulation experience. If students are taking on different roles within the simulation, make sure to clearly explain. Ensure that students have all equipment and supplies necessary for the experience. All patients, faculty and staff should be informed and educated on the script and have a clear understanding of the objectives. Provide the students an opening case or introduction as necessary for each case. During simulation a faculty member may be physically present in the room or watching from a distance, ready to assist in the educational experience.

Debriefing

At the conclusion of a simulation experience, debriefing should take place. Debriefing is an important element in simulation that allows the opportunity to validate student actions throughout the simulation experience. Research (Cantrell, 2008; Johnston et al., 2017; Rudolph et al., 2008) emphasizes the usefulness of debriefing in terms of emotional release after simulated exercises. The goal of debriefing is to allow time for students to reflect on positive aspects of the scenario and what they might change during their next simulation. Debriefing immediately after simulation enables the simulation facilitator to guide students in transferring principles of learning from simulation to real world practice.

Conclusion

Presently, research investigating high-fidelity simulation and student learning is scarce in athletic training education. This pilot study adds to the growing literature on high-fidelity simulation in athletic training. Our study further supports high-fidelity simulation as a valuable tool when learning and practicing communication with peers and patients as athletic training students acquire important affective skills that include informing and communicating with patients. High fidelity provides realism in simulated patient care

scenarios and supports students' development of confidence and self-efficacy. Integrating simulation (whether -low, -medium, or -high) into athletic training and other allied health education programs can enhance clinical skills learning and practice of skills that are not frequently seen in clinical educational settings. As a program, and based on our findings, we have now added another high-fidelity simulation experience in the first-year sequence of clinical education. Future research is still needed to explore high-fidelity simulation and assess skill acquisition, and pre-, post-test knowledge and transference to clinical patient care.

Abbreviations

CAATE: Commission on Accreditation of Athletic Training Education.

Authors' contributions

Conceptualization: Dana Bates; Methodology: Dana Bates; Formal analysis and investigation: Dana Bates, Jessica Moore; Writing - original draft preparation: Dana Bates, Jessica Moore; Writing and editing: Dana Bates, Jessica Moore.

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Declarations

Competing interests

The authors declare that they have no competing interests.

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