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Cover Page Footnote

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Athletic Training Students' Experiences and Perceptions of Exertional Heat Stroke Simulated Encounters: A Qualitative Analysis

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Introduction: Athletic trainers are trained to recognize exertional heat stroke (EHS), which is critical to implementing lifesaving measures. Rectal thermometry is the best practice for recognizing EHS, and the Commission on Accreditation of Athletic Training Education (CAATE) requires students to learn rectal thermometry. Rooted in transformative learning theory, this study explored the perceptions and experiences of athletic training students following simulated EHS encounters with either high-fidelity (HF) simulators or standardized patients (SPs). **Methods:** This was a qualitative study using phenomenological theory. Through semi-structured qualitative interviews, we explored participants' personal experiences and perceptions following their simulation interventions. Participants included sixteen first-year Master of Athletic Training students (HF=8, SP=8; 4 males and 4 females in each group) ages 21-38 (23.69±4.48) who were enrolled in a course discussing exertional heat illnesses. **Data Analysis:** We recorded and transcribed the interviews verbatim. We used qualitative software, Nvivo (Denver, CO), to categorize the data into themes and codes. To ensure trustworthiness, we used member checking and investigator triangulation. **Results:** Three themes emerged from the data: 1) Simulation environment, 2) Mindset shifts, and 3) Perceptions of other simulation types. Participants from both groups described positive learning experiences in a foreign yet low stakes learning environment emphasizing repetition for learning the skill. The HF group shared beneficial aspects of patient-history-taking opportunities. The SP group shared the benefits and applicability of developing a patient-provider relationship through communicating with their SP. Most participants from both groups could immerse themselves in the encounter for a realistic experience. Both groups discussed how their mindset towards EHS and rectal thermometry changed after their encounter. Lastly, both groups agreed their simulation intervention was superior to practicing on a task trainer. **Conclusions:** Instructors of athletic training programs should strive to implement realistic simulated encounters for emergency skills training of athletic training students. A safe space for learning in a low-stakes environment should be fostered. Based on the shared perceived benefits of SP encounters for building provider-patient rapport and feedback opportunities, instructors should consider implementing SPs throughout their curriculum. ***Key Words:*** *disability, interprofessional education, people living with disabilities, self-efficacy*

INTRODUCTION

Exertional heat stroke (EHS) is a life-threatening heat illness resulting in whole-body hyperthermia and central nervous system (CNS) dysfunction. In a recent survey, there were an average of 2.2 heat stroke-related deaths per year from 2015 to 2019.[1] Correct insertion, and a rectal thermometer reading are imperative in recognizing EHS to begin rapid cooling.[2] Exertional heat stroke accounts for 6.6% of conditions in sports worldwide.[3]

An essential skill for athletic trainers is utilizing a rectal thermometer to recognize if a patient's core body temperature reaches 105°F or higher, indicating the presence of EHS. Rectal thermometry is the current gold standard and medical standard of practice for evaluating core body temperature in an EHS emergency.[2,4-6] The severity of EHS is why the

Commission on Accreditation of Athletic Training Education (CAATE) requires athletic training programs to teach the skill of rectal thermometry in their curriculum.[7] The CAATE Standard 70 states athletic training students (ATS) must be prepared to evaluate and manage patients with acute conditions related to the environment, such as heat, including the use of rectal thermometry.[7] While most educators teach rectal thermometry in a classroom setting, ATS also need opportunities to practice rectal thermometry in a more authentic environment. If students do not gain competence in performing rectal thermometry during clinical placements, the CAATE permits augmenting their learning with simulation.[7]

Simulation, the re-creation of something real for skill practice, is widely used in medical education and is rapidly growing in athletic training.[8-17] Three types of simulation are referred to in this study. The first is low-fidelity simulation, which is often completed through a partial-body task trainer. Low-fidelity simulation is commonly utilized in health professions programs to teach clinical skills because task trainers are inexpensive and easy to use.[18] Standardized patients (SPs), another form of simulation, are beneficial for teaching and assessing clinical evaluation, interpersonal skills, and improving students' confidence, but require the SP, a living person, to be trained and experienced in consistently portraying correct signs and symptoms of the specific injury or illness.[17, 19-22] Past studies have found ATS perceived SP encounters to be more effective for patient-client communication compared to only role-playing with a peer.[23] Athletic training students also feel SPs provide beneficial experiences in building self-confidence and clinical skills to prepare for clinical practice.[15,24] However, limited qualitative exploration has investigated ATS' perceptions of utilizing SPs specifically for learning rectal thermometry.[15] The final type of simulation examined in this study, high-fidelity (HF) simulators, are a form of simulation utilizing a computerized, instructor-controlled manikin. High-fidelity simulators are inherently more expensive than low-fidelity task trainers but are widely used across other healthcare professions programs. While HF simulators are popular in health professions education, there is limited published literature to support ATS' perceptions of this form of simulation.[15]

Objective

This study aimed to explore ATS' perceptions and experiences of using simulation techniques to learn rectal thermometry. The following research questions guided the qualitative inquiry: 1) What are ATS' perceptions regarding using simulation techniques when learning to use a rectal thermometer? and 2) What are the experiences of ATS participating in varying types of simulation?

METHODS

Design

The phenomenological theory was the foundation for the design of this qualitative research study, and the simulation encounters followed the transformative learning theory (TLT).[25] Mezirow's TLT postulates that adult learners can critically reflect on their past experiences to determine how they will respond to future experiences.[25] There are ten phases to this theory which were used to structure the simulation educational interventions (Table 1).[25,26] The TLT first introduces the students to a disorienting dilemma. In this study, the dilemma was reading the simulated patient's presenting scenario (Appendix A) and discovering the patient would need core body temperature assessment via rectal thermometry. Table 1 depicts the alignment of the ten phases of the TLT with each event that occurred in the simulation.

Phase	Characteristics	Simulation process
1	Disorienting dilemma	Briefing
2	Self-examination with feelings of guilt or shame	Simulation and debriefing
3	A critical assessment of assumptions	Simulation and debriefing
4	Recognition that the felt disconnect and transformation process is mutual among learners	Simulation and debriefing
5	Exploration of options for new actions	Debriefing
6	Planning a new course of action	Debriefing
7	Acquisition of knowledge and skills for implementing a new plan	Debriefing
8	Provisional trying of new roles	Future experience
9	Building competence and self-confidence in new roles	Future experience
10	Reintegration into one's life with a new perspective	Future experience

Table 1. Alignment of Simulation Intervention with TLT Phases

Setting

The simulation interventions for this study were conducted in athletic training classrooms or simulation laboratories in six athletic training programs in Utah, Ohio, Wisconsin, and Tennessee. Qualitative inquiry was performed through individual teleconference interviews.

Participants

A purposeful sampling strategy was employed to enroll Master of Athletic Training programs in the simulation intervention. Instructors from CAATE-accredited athletic training programs were recruited to implement either a HF or SP encounter into their existing rectal thermometry educational unit. Programs that had access to HF simulators were allocated to the HF simulation group, and the remaining programs were allocated to the SP group. Participant inclusion criteria were first-year Master of Athletic Training students who completed a rectal thermometry simulation. Sixteen first-year Master of Athletic Training students (HF=8, SP=8; 4 males and 4 females in each group), ages 21-38 (23.69±4.48) participated in qualitative interviews.

Data Collection

This study was approved by the primary researcher's institutional review board (IRB) (protocol number: 2022-8) with additional approval from each participating institution's IRB. Once instructors agreed to participate, they were given access to a Google Drive folder with all the EHS educational resources needed for implementing the EHS lesson, simulation, pre-briefing, and debriefing documents. The instructors were trained in the standardized EHS didactic lesson designed by the authors of this study and peer-reviewed by three experts with educational expertise in EHS. The lesson plan included education on EHS recognition and management and concluded with instructor modeling and student practice of rectal thermometry on a low-fidelity task trainer rectum model. Following the lesson, instructors pre-briefed their students for the upcoming simulation encounter. The primary investigator trained the instructors in the pre-briefing procedures standardized for both groups through provided scripts (Appendix B). The pre-briefing was not recorded to allow for anonymity, but the instructors used this session to set the expectations and ground rules for the simulation. Since the simulation educational interventions were designed to be a learning experience rather than an assessment of the students' skills, students were permitted to pause their encounter to ask questions by taking a "time out" as described by Walker et al.[17,19] (Appendix C)

Program instructors implemented their respective simulations using the same standardized EHS patient case designed by the primary researcher and reviewed by four experts. (Appendix B) The EHS encounter involved students evaluating an EHS patient

and performing rectal thermometry on either a HF simulator or a live SP. All HF simulation participants in the same program underwent their encounters simultaneously in a simulation center in separate examination rooms. Athletic training students in the SP group were scheduled over 1-2 class periods in private exam rooms. The SPs were recruited locally to the institutions participating in the study. All SPs were trained by the primary investigator via Zoom teleconferencing (San Jose, California) using the standardized patient case (Appendix B). The primary investigator was taught how to train SPs through a 13-hour, 2-day Standardized Patient Workshop emphasizing the use of SPs in athletic training education. Following the encounters, the SPs were paid through the NATA Research and Education Foundation Grant funding.

In the class meeting following the simulated encounters, students participated in an instructor-led, un-recorded debriefing session following a structured debriefing guide based on the TLT and the best practices of the International Nursing Association of Clinical and Simulation Learning (INACSL)[25,27] (Appendix B). Through a Qualtrics XM survey (Provo, UT), all students who underwent the simulation encounters were invited to participate in a follow-up qualitative interview. Of those willing to be contacted, eight students from each simulation group (n=16) completed a one-on-one interview over Zoom teleconferencing (San Jose, California). All participants orally consented to participate in the study at the beginning of their interview. The primary investigator conducted all interviews utilizing a semi-structured interview guide that had been piloted on five ATS not participating in the study (Table 2). Table 2 lists the qualitative questions that were asked in each interview.

1	Prior to this course or simulation experience, how have you seen rectal thermometry used? Please tell me about your experience?
2	Tell me what you thought about the simulation experience you just completed.
3	How has the simulation experience affected the likelihood that you will use rectal thermometry on a patient in your future.
4	How did the simulation experience change you as an athletic training student?
5	How do you think your experience with simulation will impact performance in the clinical setting?
6	What advice would you give to future Master of Athletic Training students participating in this simulation encounter?
7	If you could change anything about the simulation experience, what would it be and why?

Table 2. Qualitative Interview Questions

Data Analysis

All interviews were recorded and transcribed verbatim. An iterative sampling and data analysis process continued until there were no additional new themes or codes indicating data saturation was reached. Once the interviews were transcribed, each were de-identified with a pseudonym. The qualitative analysis followed the Qualitative Analysis Guide of Leuven (QUAGOL)[28] method. The analysis included: (a) initial reading of each transcript; (b) thorough re-reading of transcripts; (c) preparing a narrative interview report as a summary of the individual interviews; (d) developing a conceptual interview scheme; (e) continually checking conceptual interview schemes against the previous interviews and comparing to the research questions; and (f) revisiting previous themes to make sure nothing was missed in the coding. The coding process included: (a) a list of concepts from interviews; (b) re-reading interviews; (c) analysis and description of the concepts; (d) tying the data back to the research questions; (e) describing the results to tell the story of participants' experiences. The qualitative analysis software, Nvivo (Denver, CO), was

used to assist with categorizing the data into themes and codes.

Trustworthiness

The interview guide questions were reviewed by three external reviewers trained in qualitative analysis to ensure the trustworthiness of the qualitative data. Member checking was performed by emailing the typed transcripts to each participant to confirm accuracy. A reflexivity journal was also kept throughout the interviewing and analysis process. The primary investigator performed initial coding, and then the typed transcripts and codes were independently reviewed and confirmed by an external expert in qualitative research.

RESULTS

Three themes emerged from the qualitative data: 1) Simulation environment, 2) Mindset shifts, and 3) Perceptions of other simulation types. The simulation environment themes were further divided into codes based on the intervention group. The simulation environment codes identified from the HF and SP groups were: foreign environment, patient communication, realism, and low-stakes. The codes identified under mindset shifts were: before (scared; confused) and after (able to educate; new perspective; plan for future). Perceptions of other simulation types had the codes: between groups and superior to low-fidelity. Each theme was reported in a table with the codes identified and the participants' quotes aligning with the codes (Tables 3-5).

Simulation Environment: High-fidelity Group (Table 3.1)

Foreign Environment

All participants completed the HF simulator encounters in their institutions' nursing simulation lab and described having never seen the manikins before. Amanda commented, "When we first walked in, I was shocked at the manikins because I've never seen them before." Most participants felt the environment provided a beneficial experience despite the foreign environment. For example, Ziggy shared, "I've seen the models on TV, but I've never had to move it or insert a rectal thermometer."

Patient Communication

The participants in the HF group all shared their opportunities to gain a focused history as part of their clinical examination. While the students acted as clinicians, the students portraying the patients sat in the control booth with a headset, answering the questions on behalf of the patient (manikin). Andy spoke about the encounter being more complex than simply performing rectal thermometry. "It wasn't just how to use the rectal thermometer, but the questions we needed to ask the patient." While six participants perceived the patient communication as beneficial, it was challenging for others. Amanda added, "I was confused about how to get the history properly, but that will come with time."

Realism

Seven participants shared a high level of realism felt in the simulation environment. The participants noted a conscious effort to immerse themselves in the simulated environment. Many participants shared how or why they chose to immerse themselves in this alternate reality. Violet understood the bigger picture of practicing for a future real-life situation. She said, "Yes, the manikin is not real, but I felt like I had to practice like it was real because it could be a real-life situation that is life-threatening, so I had to take it seriously." However, one student was not able to see the encounter as realistic. Charlotte shared her disappointment, "It was kind of fake to me. I thought the patients would talk back to us, but we were just reading off a paper."

All participants in the HF group worked in groups of two to three with their HF manikin. While students rotated roles, and each had a turn playing the lead clinician, some participants shared that peer learning negatively impacted the simulation's realism. Jocko explained, "…the person who went first (as a clinician) got the real experience of 'Oh

my gosh, what am I doing?' The person who goes second already knows what they did, so they know how to fix it." These participants felt the environment may have been more authentic if they had a one-on-one encounter.

Low-Stakes

Each HF participant shared that their simulation environment was very learner-focused and low-stakes. All participants felt free to make mistakes, had lower anxiety, did not have the stress of harming a live patient, and could practice multiple times if desired. Every instructor of the enrolled programs modeled rectal thermometry on a low-fidelity task trainer and then allowed the students to practice on the task trainer. Violet mentioned, "Going through the steps of rectal thermometry beforehand made it a lot easier." Three students recalled being allowed multiple practice opportunities on the HF manikin if they needed more practice. The repetition of these encounters reinforced the perception of a low-stakes environment. Bryce reflected, "Once I'd done it, I was like, 'okay, that wasn't bad.'"

Code	Quotes
Foreign environment	Amanda: "When we first walked in, I was shocked at the manikins because I've never seen them before."
	Ziggy: "I've seen the models (high-fidelity manikins) on TV, but I've never had to move it or insert a rectal thermometer. It was cool we had this. I've never experienced that."
Patient communication	Amanda: "I was confused about how to get the history properly, but that will come with time."
	Andy: "It wasn't just how to use the rectal thermometer, but the questions we needed to ask the patient."
Realism	Eden: "Interacting with the manikin, having to move them, get through the clothing, asking questions, assessing, and performing the task-that's what made it more real for me."
	Violet: "Yes, the manikin is not real, but I felt like I had to practice it like it was real because it could be a real life situation that is life threatening so I had to take it seriously."
	Charlotte: "It was kind of fake to me. I thought the patients would talk back to us but we were just reading off a paper."
	Violet: "Something that was maybe a negative was we did groups of three, so one person just watched while the other two were the patient and clinician."
	Jocko: "When you're the clinician, there's a helper, and there's a person that's the patient. But the person who went first got the real experience of 'Oh my gosh, what am I doing?' The person who goes second already knows what they did so they know how to fix it."
Low-stakes	Violet: "Going through the steps of rectal thermometry beforehand made it a lot easier"
	Amanda: "Practicing on high-fidelity manikins instead of an actual patient for the first time helped because I knew I was doing stuff right without having to jeopardize having an actual person sit there in front of me. It was good for me because it wasn't a complete emergency."
	Bryce: "Once I'd done it, I was like 'okay, that wasn't bad. And then we did it a couple more times just to make sure this is how you do it. Doing it more made it a lot easier."

Table 3.1 Simulation Environment: High-fidelity Group

Simulation Environment: Standardized Patient Group (Table 3.2)

Foreign Environment

Like the HF group, every participant in the SP

group described the SP encounter as a foreign environment. Six participants had never experienced a SP encounter, and two had never performed an invasive procedure such as rectal thermometry on a SP. Nicholas noted, "This was our first actual SP. We've never done that before." While this was a foreign environment, the participants felt it was a beneficial experience. Stella shared, "Funny enough, that was our first SP, so now I feel pretty comfortable going and talking with a patient or a standardized patient."

Patient Communication

While the participants in the HF group conducted a patient history, the participants in the SP group were able to develop their patient communication further. These participants shared they also took time talking with their SP. Misty shared, "Just talking to (the SP) settled her down, and I was kind of teaching her what (rectal thermometry) actually was. Talking (the SP) through it and letting her ask questions opened my eyes and made me feel more confident." Skystorm was even able to put herself in her patient's shoes. "I was able to walk them through it in a way that if I ever had to have something like that done on me, I'd want them to walk through it like that for me."

Realism

As with the HF group, all the SP participants felt they had a realistic encounter but again

Code	**Quotes**
Foreign environment	Nicholas: "This was our first actual SP. We've never done that before."
	Stella: "Funny enough, that was our first SP, so now I feel pretty comfortable going and talking with a patient or a standardized patient."
Patient communication	Skystorm: "I was able to walk them through it in a way that if I ever had to have something like that done on me, I'd want them to walk through it like that for me."
	Misty: "Just talking to (the SP) settled her down and I was kind of teaching her what (rectal thermometry) actually was. Talking (the SP) through it and letting her ask questions opened my eyes and made me feel more confident."
Realism	Skystorm: "I saw the patient as if it was not a simulation, but as if it were a real-life situation and then attempted to act accordingly to if it were a real life situation. That was just the choice on my part."
	Tina: "When I was there, I was like 'you're definitely Jamie.' The whole background of a different state, the weather, it's September 7th, we're at a race. That set the scene."
	Skystorm: "I pictured that the standardized patient was actually an eighteen-year-old young female who was dealing with heat stroke issues."
Low-stakes	Jordan: "We had a (low-fidelity) manikin in class and every day after class, I'd go over and practice. We spent a good amount of time in class going over the steps and I just tried to make it as real as possible.
	Stella: "Knowing that they utilized their pauses too, and that no one's going to be 100% confident the first time they do it (was) nice group solidarity."
	Misty: "During our debrief, she (the SP) said explaining the procedure to her really kept her calm. I feel like that's a positive to know what they need and they are more than someone with EHS, they are a person first."

	Lilly: "The environment made me feel more comfortable. I like the low-stakes part of it."

Table 3.2 Simulation Environment: Standardized Patient Group

shared their intentional immersion into that alternate reality. Skystorm shared that she "saw the patient as if it was not a simulation, but as if it were a real-life situation." And that it was "a choice on my part." Tina provided additional insight in that the details of the presenting scenario helped immerse her into that reality. "The whole background of a different state, the weather, it's September 7th, we're at a race. That set the scene."

Low-Stakes

Much like the HF group, the participants in the SP group also felt they were in a low-stakes, safe learning environment. Jordan focused on perfecting the skill of rectal thermometry so that when the encounter came, he could concentrate on interacting with the patient as a human and not be stressed about getting the procedure correct. "We had a (task trainer) manikin in class, and every day after class, I'd go over and practice." Some participants shared having their instructor in the room provided a low-anxiety environment. Others appreciated being able to pause the encounter if needed. Stella reflected on the additional value of knowing her classmates used their pauses like she did, "Knowing that they utilized their pauses too and that no one's going to be 100% confident the first time they do it (was) nice group solidarity."

A low-stakes aspect of the SP group that did not arise in the HF group was the feedback the participants received from their SPs. Nicholas benefitted from both positive and constructive feedback following his encounter. "He (the SP) said he was very comfortable, I did the procedure perfectly, and the only thing I need to work on is my communication and eye contact."

Mindset Shifts (Table 4)

Before

Participants from the HF and SP group all felt nervous or scared before their encounters. Looking back, Violet (HF group) shared, "Talking about it, but not really knowing…how to actually do it was the scary part." Three others also described confusion due to minimal knowledge of proper recognition and

Theme	Code	Quotes
Before	Scared	Violet (HF): "Talking about it, but not really knowing…how to actually do it was the scary part."
		Misty (SP): "When we first started talking about (the) rectal thermometer I really didn't know what it was, I was like Okay, what kind of thermometer is this like I was kind of like scared I was like whoa whoa whoa."
	Confused	Lilly (SP): "I never thought you would take a rectal temperature if someone got EHS. I always thought you would just send them to the ER and try and cool him down."
		Bryce (HF): "I wasn't really prepared to do it and really didn't know like what to do if it ever popped up."
After	Able to educate	Eden (HF): " I (can) educate the athletes and coaches on proper ways to hydrate and acclimate themselves to heat."
	New perspective	Jordan (SP): "I've performed one of the most invasive procedures. It sets up the rest of my education to be like 'I can do a SCAT-5 because I can do rectal thermometry.'"

	Plan for future	Tina (SP): "After I was like, 'why was I nervous? I got this next time for sure.'"

Table 4. Mindset Shifts

care of EHS before participating in the EHS simulation. Lilly (SP group) pointed out, "I never thought you would take a rectal temperature if someone got EHS. I always thought you would just send them to the ER and try and cool him down."

After

After participants finished their respective simulation encounters, they shared the procedure wasn't as bad as they'd thought. Tina (SP group) noted, "After I was like, 'why was I nervous? I got this next time for sure.'" Participants also felt mentally prepared to educate coaches and athletes in a future heat emergency. When considering her future clinical setting, Eden (HF group) commented, "I (can) educate the athletes and coaches on proper ways to hydrate and acclimate themselves to heat." Other participants even saw their simulation encounter as a reference point for future patient encounters. Jordan (SP group) declared, "I've performed one of the most invasive procedures. It sets up the rest of my education to be like, 'I can do a SCAT-5 (sport concussion assessment tool—5th edition) because I can do rectal thermometry."

Perceptions of other Simulation Types

Between Groups

While the participants were not questioned about their perceptions of the other simulation group, each group reflected on the alternative simulation type. Five of the HF group participants wished they could have practiced on a live human, whereas two voiced being glad they were not practicing on a live human their first time in an EHS encounter. One student shared, "I personally would rather have done it on the live patient. I think there would be more benefit for us as the students to know that this is how you're going to have to do it in the field." (Charlotte)

Only two participants from the SP group shared their thoughts regarding the HF group. These two participants perceived practicing on the SP was more beneficial than a HF manikin. Lilly mentioned, "The positive was being able to perform it (rectal thermometry) on a live person because it's not the same as on one of the manikins. It's a completely different situation."

Superior to Low-Fidelity

While some HF participants were disappointed in not having a live SP encounter, participants in both groups agreed their form of simulation encounter (HF or SP) was more beneficial than just practicing on the low-fidelity task trainer. Bryce (HF group) shared, "Having it (high-fidelity manikin) respond, you gotta be able to react, whereas the low-fidelity, you have nothing, you just have to perform it, I guess." Ryan provided similar perceptions saying, "I prefer using the SP over a (low-fidelity) manikin because you're getting that actual person and learning how that actual person is going to respond.

Theme	Code	Quotes
Perceptions of other simulation types	Between groups	Charlotte (HF): "I personally would rather have done it on the live patient. I think there would be more benefit for us as the students to know that this is how you're going to have to do it in the field."
		Lilly (SP): "The positive was being able to perform it (rectal thermometry) on a live person because it's not the same as on one of the manikins. It's a completely different situation."
	Superior to low-fidelity	Bryce (HF): "Having it (high-fidelity manikin) respond, you gotta be able to react, whereas the low-fidelity, you have nothing, you just have to perform it I guess."
		Ryan (SP): "I prefer using the SP over a (low-

		fidelity) manikin because you're getting that actual person and learning how that actual person is going to respond."

Table 5. Perceptions of other Simulation Types

DISCUSSION

This study aimed to explore ATS' experiences and perceptions of using different simulation techniques for learning rectal thermometry insertion. Two research questions directed the qualitative inquiry: 1) What are ATS' perceptions regarding using simulation techniques when learning to use a rectal thermometer? and 2) What are the experiences of ATS participating in varying types of simulation?

Simulation Environment

Athletic training students from both simulation groups described aspects of the simulation intervention as new experiences. Given that all participants were first-year master's students, it was unsurprising that the HF or SP encounters were novel to most. However, despite this being a foreign experience for these students, the HF and SP group participants described this environment as a low-stakes, student-centered, safe space for learning. These participants also felt like the simulation allowed them the freedom to make mistakes before they entered a live clinical setting. Participants in both groups appreciated getting to repeat the rectal thermometry steps on a task trainer before their encounter if they felt unsure of their skills. The additional practice allowed the students to feel more confident in the steps of rectal thermometry before interacting with their simulated patient.

One unique aspect of the low-stakes environment that the SP group described was being able to use the time-in, time-out approach. The ability to take a time-out or "pause" allowed the students to view the simulation experience as a safe and formative learning opportunity, not a high-stress test environment. Previous literature agrees that students appreciate the low-stakes, non-threatening educational environment SPs can provide.[16,22] While the HF group had this same "pause" option, the participants did not mention using the pauses in their encounters. In contrast to the HF group, when the SP group participants reflected on their post-simulation debriefing session, they felt group solidarity when they discovered many of their peers also used their "pauses."

Another benefit only the SP group participants noted was the opportunity to receive feedback from their SP. The SPs informed the students that they felt comfortable during the encounter because the ATS communicated well with them. The feedback from the SPs was reassuring to the ATS, allowing them to feel more confident in their skills. Increased student confidence following the SP encounters is a commonly reported benefit of utilizing SPs in athletic training education.[20,23] The participants in the SP group also discussed areas of improvement from their SP feedback, such as making eye contact with the SP or improving their communication skills, which is a documented benefit of utilizing SPs.[23]

Both groups described different aspects of their simulation environment that allowed for patient communication. While the HF group only focused on taking a patient history, the SP group achieved an additional level of communication. The added communication benefit of SPs in this study was similar to the improved patient communication and soft skills documented in previous literature.[22,24] Participants in the SP group reflected on how they could build a rapport with their SP, develop a patient-provider relationship, and even educate their SP on EHS and rectal thermometry. The participants in the SP group were able to exhibit empathy for their SP as if they were actual patients with a life-threatening condition. Knowing this was a sensitive procedure, the SP participants

benefitted from the students verbally describing the steps of rectal thermometry to their SP during the encounter.

The literature on simulation in athletic training indicates that SPs can provide a realistic encounter that improves ATS' self-confidence for future practice.[16,20,22,29] Most participants felt their simulation encounter was realistic enough to prepare them for clinical practice. Regardless of the simulation group, participants who felt their encounter was realistic voiced an intentional immersion into the simulated environment. While all the participants in the SP group who shared perceptions of realism had positive views, some still saw ways to improve the realism by having the patient out on a field and treating them with cold-water immersion. Many of the HF participants also perceived a beneficial experience, but one could not see the encounter as realistic. A factor negatively impacting the realism of the HF group was the group-learning atmosphere. While it was helpful for the students to learn from peers, and previous literature reports many perceived benefits of peer learning, the HF participants felt it took away from the encounter's authenticity.[20]

Mindset Shifts

Participants from both groups felt nervous before their simulated encounter since this was a new environment. Before their simulation encounters, all participants were scared and confused about how to perform rectal thermometry. Participants shared their previous views on the recognition and management of EHS and how they differed from the gold standard. After the encounters, participants from both groups shared feeling relieved and thinking it wasn't as bad as they originally thought. High-fidelity and SP participants also mentioned a new understanding of rectal thermometry as the gold standard for recognizing EHS. Furthermore, these students felt more equipped to utilize rectal thermometry and manage EHS in the future. The findings in the current study agree with a previous pilot study where students felt more prepared to perform rectal thermometry on actual patients after participating in a series of simulations.[15] Participants in this study and those interviewed by Peisachovich et al.[23] shared aspects of planning for future patients, or SP encounters, through critical thinking and self-reflection. The SP and HF participants both felt empowered to educate their future athletes and coaches on EHS prevention.

Perceptions of other Simulation Types

Few qualitative studies explore the impact of HF simulation or SP encounters. Interestingly, five of the eight participants in the HF group wished they had the chance to practice rectal thermometry on a live SP instead. There is not yet literature comparing the perceptions of students participating in HF versus SP encounters, but other studies have compared different simulation methods. A study in 2018, while a quantitative design, utilized a questionnaire to explore ATS' perceptions of HF manikin simulation versus student role-playing in class.[30] This study found that HF manikin simulators were superior for cognitive and psychomotor skills.[30] A qualitative study comparing SP encounters to student role-playing found similar results: SP encounters were a more desirable form of learning than student role-play.[23] The results of this study indicate that HF simulators and SP encounters are more favorable forms of learning rectal thermometry than low-fidelity task trainer practice alone. While some of the HF participants felt their simulation encounter was not as authentic as an SP encounter might have been, this potential benefit should be examined in future studies.

Integration of Results with the Transformative Learning Theory (TLT)

The simulation interventions and the debriefing session aligned with the TLT to allow students to critically reflect on their encounters to guide future actions. The alignment of the TLT and simulation events can be found in Table 1. Before the simulation

encounter, faculty instructors briefed the students on the presenting EHS scenario (Appendix A). The presenting scenario and the foreign environment that participants described provided a "disorienting dilemma" in alignment with phase 1 of the TLT.[25,26] Phases 2-3 of the TLT highlight reflecting on the simulation experience. During the participants' recollection of their mindset before their encounters, they shared this critical self-reflection of how they felt about performing rectal thermometry. After the simulation encounters, participants were again able to reflect and plan for a potential future experience treating an EHS patient. Phase 4 of the TLT was reached through the instructor-led group debriefing when the participants discovered they shared a similar low-stakes learning environment where mistakes were seen as learning opportunities.[25,26] The sense of group solidarity occurred when participants realized they shared a mutual experience of utilizing their "pauses" to ask their instructor questions during the simulation. Under TLT phases 5-10, the participants described a mindset transformation after their simulation as they determined how they would act in a future, autonomous environment.[25,26]

Limitations

This qualitative study explored the perceptions of first-year ATS at a single time point following one simulation encounter rather than multiple encounters over time. Hence, the long-term impact of self-confidence is unknown. Additionally, the generalizability of this study is low since participants were recruited from only six CAATE-accredited programs. A more extensive representation of programs could have further clarified the ATS' perceived benefits of different simulation types. Although the lesson plan for an EHS patient case was standardized, each instructor's teaching personality and philosophy may have altered some participants' experiences. Some participants shared their instructor was very excited to teach rectal thermometry, so the instructor's enthusiasm may have impacted their students' perceptions. Lastly, the education intervention was implemented on first-year Master of Athletic Training students. These students were all in their program's first or second semester and may not practice rectal thermometry again during their formal education. Thus, it is unclear how their current intentions to use rectal thermometry will become a reality once they are credentialed clinicians.

Future Research

Future researchers may repeat this qualitative study on a different sample from athletic training programs in other areas of the country to explore if perceptions and experiences are comparable to what was found in this study. Future research may also explore the long-term impact of this educational intervention on these participants' use of rectal thermometry in three to five years.

CONCLUSION

Athletic training educators must prepare students to practice as competent and confident clinicians. Participants shared feeling nervous about practicing rectal thermometry before the simulation, but after simulated encounters, they felt more at ease. Authentic practice opportunities with emergency diagnostic skills, such as rectal thermometry, may help prepare students to utilize best practices in the future. Whether using HF simulators or SPs, instructors should strive to implement realistic, simulated encounters for emergency care skills. Regardless of the simulation type, educators should also foster a safe, low-stakes environment so students can feel free to make mistakes and learn from them. Lastly, while HF and SPs can provide a safe learning environment, the SP encounters may allow for additional benefits of building provider-patient communication and providing beneficial feedback.

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Appendix A: Presenting Scenario

Patient Name: Jamie Boyle

Setting: College cross country course in Utah. It is a hot September day. It is 11am, weather is sunny, 89 degrees and 71% humidity.

Complaint: 19-year-old cross country runner is found running in the wrong direction around the 4k mark of a collegiate race stumbling and holding their head complaining about feeling dizzy and nauseous.

> You will have 15 minutes to complete a focused history and physical examination of the patient. You will need to discuss your findings with the patient, take their rectal temperature, and state what your initial treatment would be for this case (which may or may not include referral).

After you have completed your examination of the patient, please step outside of the Examination Room.

Appendix B: Standardized Case Training Information for SP Encounter and HF Simulatior

Case Name	Exertional Heat Stroke: Jaime Boyle
Presentation	Dress in running attire (shorts and short sleeve running shirt) and running shoes.
Presenting Situation	Patient is found running taking the wrong trail despite marked signs during a cross country race at the 4k mark. The patient is running in a veering back and forth pattern. It is September; it is 11am, weather is sunny, 89 degrees and 71% humidity. When approached, patient is combative and irrational; refuses to stop running and is angry and violent when personnel stop him/her. When asked about the race, the runner is confused and does not recall being in a race yet insists on needing to continue running.
Psychological Profile	Experiencing stress with beginning college; history of clinical depression (diagnosed 2 years ago)
Patient behavior	Confused; disoriented; irrational and angry
Opening Statement	I have to keep running. Why are you making me stop?! Leave me alone!
History of Present Injury/Illness	No previous diagnosed heat related illness but had a heat syncope episode in practice 3 days prior. Did not seek medical attention and has been dehydrated since. Has not hydrated well since moving here 10 days ago. 10 minutes into a 6k race, legs started not feeling good/malaise. Found running in the wrong direction on the cross country course around the 4k mark. Spectators reported seeing the runner vomit. This is the first race of the season. I am from Alaska and just moved here 10 days ago. Alaska is sea level and cold. Utah is 4,500 ft and hot. In high school, ran about 20-30 miles per week. Since coming here last week, coach has increased my weekly running goal to 40-50 miles per week. I've been typically running early mornings/late night when it's not hot. This is my first collegiate race. While I was used to running hills in Alaska, it's so much higher elevation here that the hills feel a lot more difficult I am on anti-depressants I only drank coffee for breakfast My parents used to go to every meet in high school and bring everything I needed but now I'm too far away. My head hurts, I feel dizzy and nauseous.

Past Medical History	Moderate Clinical Depression
Social History	Just moved to Utah from Alaska 10 days ago. Not many friends yet. Roommate who is a non-athlete. **Eating/Drinking Habits:** Emerging; formerly reliant on parents providing food. Not consuming enough sodium in diet. Not hydrating well since moving to Utah. **Exercise:** Running 40-50 miles per week currently **Sleeping Habits:** 8-9 hours a night until 10 days ago, down to 6-7 due to adjusting to college **Stress:** New team and school. Trying to manage studying and maintaining top running position on the team. I am in the top 7 even as a freshman. **Tobacco and Illegal Drug use:** no **Alcohol:** on occasion **PSYCHOSOCIAL HISTORY:** **Educational Background:** high school; 4.0 student **Marital Status:** single **Living situation:** From Alaska but just moved to Utah 10 days ago where it is much hotter and 4,500 ft elevation. Living in the dorms **Hobbies/Interests:** Running, putting puzzles together
Family Medical History	Father is a functional alcoholic Mother has moderate clinical depression but has always found a way to be involved with the kids. 1 Brother: college senior cross country/distance runner at Oregon 1 Sister: 16 year old in high school/dancer No personal or family sudden cardiac arrest history or diabetic history
Physical Exam Findings	Red, hot, profusely sweaty skin **VITAL SIGNS:** Blood Pressure: 90/70; Pulse: 180; strong; Respiration: 32; Temperature: 106; Urine Specific Gravity: 1.032; Blood Glucose Level: 90
Special Instructions	Patient has Exertional heat stroke and rectal thermometry needs to be taken to confirm. Patient will be combative, irrational, and crying.
Questions to ask	Why won't you let me keep running?
Safe phrase if you need to STOP the simulation at ANY time for ANY reason	"How much longer will this take? I have a plane to catch"

Appendix B: Pre-Briefing and Debriefing Guide

Introduction:

Simulations are regularly used in medical education as a form of active learning.[1] Debriefing is part of the International Nursing Association for Clinical Simulation and Learning (INACSL) standards of best practice for conducting simulations.[2] Debriefing is successful for facilitating and promoting self-reflection of learners.[1] It is also identified as an essential part of the simulation experience as a whole.[3] Mezirow's transformative learning theory (TLT) uses critical reflection following a personal experience as a means for learning and changing one's future actions.[4] The following debriefing guide will be based off questions developed by Yun-Jeong et al,[3] designed to align with Mezirow's TLT. Debriefing based off Mezirow's framework is found to be effective for improving students' problem-solving skills, critical thinking, and clinical judgment.[3] Furthermore, it is postulated that debriefing can improve students' self-confidence.[3]

Prebriefing:

- The goal of this brief is to set the ground rules and expectations and explain the format of the simulation.
    - Explain the time-in, time-out method
    - This is a safe place for you to learn and make mistakes
- Discuss the presenting scenario
- Field any questions about the presenting scenario and patient encounter

Debrief: Completed following the SP Encounter or HF Simulation Manikin

- **Debriefing**: *Facilitator, remind the participants:* "This is a safe place to discuss our feelings and experiences related to the simulation. It is expected that you will respect others' opinions, ideas, and feelings as well."

Questions/prompts for the facilitator:
"My role as debriefer will be leading the post-simulated experience. The debriefing will be conducted in 3 parts. During part 1, we will discuss the details of how you felt during the simulation. During part 2, I will clarify and rephrase what happened in the simulation.

In part 3, we will summarize the key learning points."	
	Questions/prompts for the facilitator:
Introductory information	"The purpose of this debrief is to reflect on our experiences during this simulation and critically think about how this may impact your future patient encounters of this nature."
	"Remember, this is a learning environment, and we want everyone to succeed. We will maintain confidentiality and privacy. While this debrief is being recorded for research purposes, your identity will not be revealed; a pseudonym will be assigned to your name. Please be respectful of each other and do not interrupt each other. Everyone will have a turn to share their feelings."
Content reflection	"Let's first reflect on the experience itself. Share your feelings and talk to me about how you felt after the simulation."
	"Let's recap what happened during the simulation scenario." "Describe what happened"
	"What went well?" "What did not go well?"
	"What can you do to change what you felt did not go well?"
Process reflection	**If applicable:* "I noticed that some of you did A in B situation. Can you tell me why?"
	**If applicable:* "Another way to handle A is C. If you had done C, how would that change B?"
	"Has anyone experienced this in real life?" "What did you do to handle the situation and why?"
Premise reflection	"How can you use the information we have just discussed in this specific clinical situation in the future?"
	"Now that you've had time to process the simulation, how do you feel?"
	"What is one thing you could take away from this simulation and use in your future clinical practice?"

Wrap up	"Today we learned about the use and application of rectal thermometry in a simulated environment. Thank you for sharing your thoughts and personal feelings from this simulation experience."

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