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EDUCATIONAL TECHNIQUE

Integration and Outcomes of a Hybrid Simulation for Simple Laceration Suturing

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Context: Emergency and immediate care skills are often difficult to practice in real time during clinical education. One immediate care skill requiring advanced training that may not be implemented during clinical education is wound closure via suturing. Simple laceration management with sutures can be advantageous skill for athletic training students to learn and practice; however, deliberate practice with feedback in a realistic manner is necessitated.

Objective: To describe the use of hybrid simulation to practice suturing in professional and postprofessional athletic training programs.

Background: The practice of immediate and emergency skills is predominately classroom based and removes the patient experience. Simulation-based learning has provided athletic training educators an opportunity for skill practice with patient simulators and standardized patients to fill the gap.

Description: The hybrid simulation incorporates the use of a standardized live patient actor with an attached part-task–training simulated arm for suturing in a safe and realistic manner.

Clinical Advantage(s): Incorporating a hybrid simulation encounter for practice of suturing skills requires multitasking and delivery of patient-centered care and promotes proper skill execution while receiving questions and direct feedback from the standardized patient.

Conclusion(s): Suturing should be taught and assessed in a tiered format using part-task trainers such as pig skin and artificial skin pads. After skill development, a hybrid simulation as a summative assessment allows for the educator to evaluate the learners' interpersonal communication and technical skills in a safe manner.

Key Words: Standardized patient, wound closure, injections

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KEY POINTS

- The use of hybrid simulation provided positive experiences for learners to incorporate patient-centered communication and technical skills of suturing and injections.
- Athletic training programs should consider the use of a hybrid simulation for immediate and emergency skills to control for a standardized learning experience on wound care management.
- The skills of suturing and injections should be practiced and assessed in a meaningful way that encourages future skill integration.

INTRODUCTION

The evaluation and management of acute conditions is a key component of the immediate and emergency care domain of athletic training practice. Although many acute patient encounters are considered not severe, there are times when advanced training is necessary to provide emergent care to manage the situation. One example of the unpredictable situations that may arise includes traumatic skin lesions. Typically, most athletic trainers are trained to provide simple wound management, which includes cleaning the wound, debridement, and the application of a dressing that covers and protects the wound.[1–3] However, some wounds, like deeper lacerations, are associated with significant bleeding and potential for underlying tissues to be exposed that require suturing to approximate the torn tissues together.[2,4] The art and science of wound closure using sutures is a relatively new skill in athletic training education. Previously, athletic training practices encouraged that the patient be referred to a physician for the procedure. However, over 6 million Americans report to emergency departments per year for laceration repair.[5] Although physicians and other health care providers are highly skilled practitioners in suturing, there may be instances when primary wound repair via suturing is needed but other providers are not accessible. For example, if an individual has a laceration greater than 5 cm, wound contamination, or diabetes mellitus, then laceration repair in a shorter period is suggested.[6]

Athletic training education has included wound care and wound closure to the educational standards for professional athletic training programs.[7] Although this is not specific to suturing, we believe that acute and emergent conditions, as written in the standard, that may require triaging should include basic wound care (butterfly bandages, sterile dressings, adhesive skin closure) and advanced clinical skills such as suturing if a future patient were to require it regardless of current clinical education experiences.[7] The incorporation of suturing into medical education programs is often through part-task models. Previous research[8] has explored several models such as pig skin, beef tongue, hot dogs, latex gloves, and artificial skin pads for the learners to practice on and determined that the most cost-effective and realistic substitute for human skin is pig skin.

In a recent educational technique, the authors described the multimodal process of incorporating both didactic and laboratory experiences for suturing into athletic training programs.[9] The skills described in the educational technique are predominately classroom based and remove the patient-experience perspective that is often critical to improve skill translation to future patient care. Suturing is not alone in this struggle; many triage and emergency care skills such as airway adjuncts,[10] anaphylaxis,[11] and cardiac compromise[12] are practiced in a safe learning environment with repeated practice during clinicals but very few opportunities for care on a live patient. This is where simulation-based learning has provided athletic training educators an opportunity for skill practice with patient simulators and standardized patients to fill the gap.[13,14]

With the need to develop patient-centered emergency care skills, such as suturing, at both the professional and postprofessional levels, the incorporation of instructional strategies for suturing should be examined from a scaffolding perspective to focus on the preparation but also the future implementation of advanced clinical skills. This educational technique will explore the role of hybrid simulation, which is a scenario using a standardized patient actor in simultaneous combination with a part-task trainer, to bring together part-task trainers with live standardized patients to explore the skill practice and assessment of wound closure via suturing.

TECHNIQUE DESCRIPTION

To highlight the need for wound closure technique development, the athletic training program created a multimodal approach. A total of 31 learners participated in this standardized patient experience, including 7 professional athletic training students and 24 postprofessional athletic training students, all enrolled in a graduate degree program. All learners were concurrently enrolled in the same advanced clinical skills course at the same university. During the semester, the learners were exposed to several clinical skills via didactic and laboratory experiences taught by the course instructor (Z.K.W.) and other guest lecturers. In October 2020, the students engaged in a 3-hour lecture and lab session following the multimodal methods described in the wound closure educational technique.[9] The lesson was scaffolded by allowing practice on fruit (oranges and bananas) for injections and suturing. The learners then practiced the skill on artificial skin pads and were assessed on a realistic arm with more dense tissue that replicated human skin. To complement the classroom learning, the course instructor provided additional readings, supplemental videos, and skill handouts via the learning management system that were available before and after the in-class skill practice. During the 3-hour lecture and lab, the course instructor was accompanied by a family medicine physician with fellowship training in sports medicine on the suturing and injection skills. The students had direct access to both educators throughout the class session. At the end of the lesson, the instructors checked for understanding,

built on their prior knowledge for skill implementation at their sites, and had to demonstrate their skills as a "checkout" of the class.

During class, the learners practiced on artificial skin pads and were notified of access to and availability of suturing supplies for continued practice outside of instruction time. After class, the learners were given a learning assignment to create an infographic on the step-by-step suturing process following the simple interrupted suturing technique. Two weeks after the learning lab in November 2020, the learners had a formal, summative hybrid simulation encounter. The learners were notified that the simulation would address one of the content areas from the semester and that they would be required to practice that skill on a live patient actor, otherwise known as a standardized patient.

Hybrid Simulation Encounter

Patient Case. The hybrid simulation included a live actor portraying a condition. The course instructor hired and trained 2 actors who were college-aged students from the university. The training included an initial meeting to discuss the expectations, a follow-up training session that lasted approximately 2 hours, and a final training session to review the case on the day of the encounters.[15] The patient case that the actors had to learn and portray was that of "Andy," a 22-year-old White male (pronouns: he/him/his) college student and cadet in the Reserve Officers' Training Corps (ROTC). Andy was presenting to the athletic training facility for an open wound sustained on his right forearm during the physical training session that morning as part of ROTC. The live actors were trained to be nervous, pleasant, and inquisitive about the actions the students were doing. The live actor case also includes key characteristics such as:

- Physical exam
  - Noticeable laceration during low crawls; 4 cm long and very deep
  - Grass and blood around the area requiring debridement
  - Mild pain at 3/10 on Numeric Pain Rating Scale
- Past personal history
  - No fear of needles
  - Not a hemophiliac
  - Tetanus vaccination is current
  - No other relevant personal or family medical history

In addition to the live actor, the hybrid simulation used a part-task trainer suture practice arm (3B Scientific; https://www.a3bs.com/suture-practice-arm-1020904-p101-3b-scientific,p_1061_30105.html). The part-task trainer had a light skin tone, meaning the live actors hired as the standardized patients had to have a similar skin tone. The laceration in the patient case was inflicted by the course instructor on the forearm (4 cm long). Stage blood was used around the laceration and inside the wound. Grass and dirt were added on top of the stage blood to replicate the cut occurring during physical training exercises as part of ROTC (Figure 1).

Next, the live actor donned a long-sleeve shirt for ROTC and was instructed to pull his right arm inside the body of the shirt. Paper towel was used to fill the void in the upper arm of the long-sleeve shirt on the right side. After the live actor was dressed, he was instructed to sit in a chair at the end of a treatment table. The part-task trainer suture practice arm was then attached to the long-sleeve T-shirt. The part-task trainer was a forearm only, meaning the long-sleeve shirt was pushed up to expose the laceration but attached to the long-sleeve shirt. This was completed to make it seem more realistic that the part-task trainer was part of the individual sitting in the athletic training facility waiting to be cared for by the learner. Figure 2 is an image of the live actor and part-task trainer setup in the athletic training facility for a patient encounter. The same setup was recreated for each learner before the start of the encounter.

Figure 1. Image of the part-task trainer.

Setup and Scenario

The hybrid simulations occurred in 20-minute increments in 2 athletic training facilities that were wired with a simulation capture system (VALT Software, Intelligent Video Solutions) Each hybrid simulation encounter was digitally recorded through cameras placed around the facility where the experience took place. The cameras allowed the instructor to watch the encounter in real time via a control room with the options to pan and zoom in on the skills being performed and hear the interactions between the student and live actor without being directly present in the room. The athletic training facility was stocked with necessary and unnecessary supplies, meaning that there were items available required for wound closure and other items students had used in class for other advanced clinical skills (ie, phlebotomy needles, intravenous catheters). The supplies available (Figure 3)

Figure 2. Live actor with part-task trainer attached.

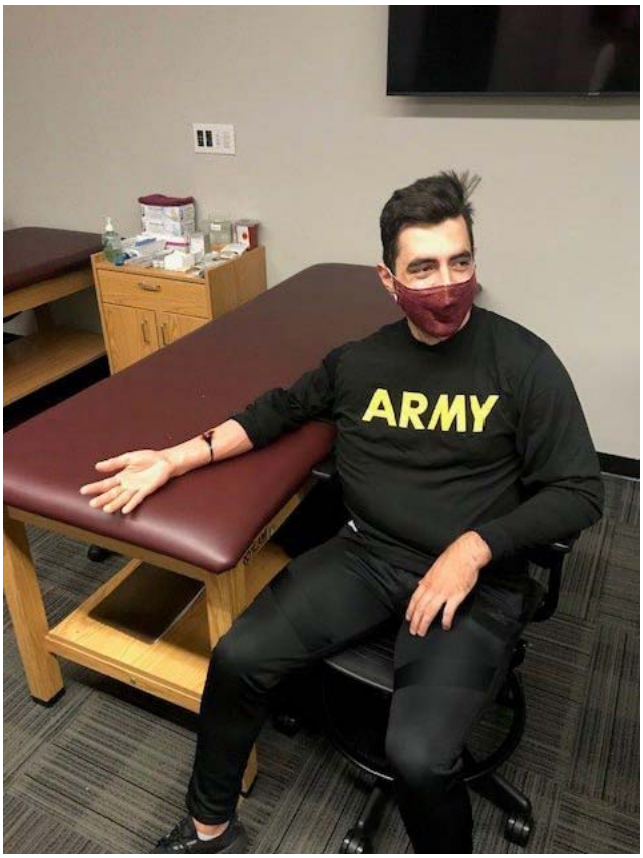
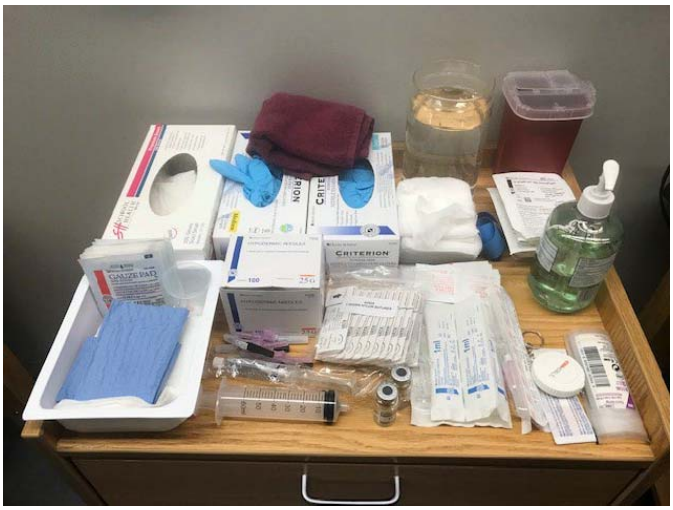


Figure 3. Supplies provided for the hybrid simulation.



included, but were not limited to, sutures, suturing tools, festered drape, a sharps container, demi-doses of lidocaine and fentanyl, alcohol swabs, gloves, saline, gauze pads, and other Steri-Strips.

Three days before the hybrid simulation encounter, all students received a prebrief email containing a video explaining expectations, location, setup, learning objectives, rubrics, and a brief introduction to the case. On the day of the encounter, the learners were specifically introduced to the scenario, which was posted on the door outside of the athletic training facility where the experience occurred. The learners were escorted to the room and instructed to read the case and objectives and enter the room. After the end of all encounters, a debrief was held virtually 8 to 12 hours after the experience. The debrief was modeled on a structured diamond debrief model and led by the course instructor.[16]

Measures

Presemester Survey. Before the start of the class in fall 2020, the course instructor sent a presemester survey exploring the proposed concepts for the advanced clinical skills course. The students were asked if they had (1) been educated on the topic in school or at a conference, (2) observed another health care provider do the skill, (3) completed the skill under the supervision of a preceptor, and (4) performed the skill as a certified athletic trainer. In addition, each student was asked to rank the importance (5-point Likert scale) of athletic trainers knowing and being able to perform the skill, as well as their current confidence in performing the skill (0–100, with 100 being *completely confident*).

Patient and Instructor Feedback. During the encounter, several measures were collected, including a patient satisfaction tool and 2 instructor evaluations. The patient satisfaction tool was completed by the live actor immediately after the hybrid simulation encounter. The live actors were trained on the assessment tool by the course instructor that a 3 (average) was the minimally competent baseline and that scores of 4 and 5 were for exceptional care whereas 1 and 2 were for underperforming care. Items on the tool focused on how the actor felt treated, respected, and cared for during the encounter.

The 2 instructor evaluations included a skill checklist[17] and overall patient experience rubric.[18] The skill checklist was created by the course instructor and content validated by the research team. It included 36 items scored as *performed* or *did not perform*, like a dichotomous yes/no checklist.[19] The items included general patient care (n = 9; gloves, handwashing, asking about allergies), preparation and provision of the injection (n = 14), wound care via suturing (n = 9), and patient education (n = 4). The overall patient experience rubric was 32 items scored on a 5-point Likert scale (1 = *poor*, 2 = *below average*, 3 = *average*, 4 = *above average*, 5 = *excellent*) in 4 domains including communication and interpersonal skills (n = 14 items), data gathering and evaluative skills (n = 6 items), patient education (n = 6 items), and overall performance (n = 6 items). Both instructor evaluation tools were completed by 2 members of the faculty and 2 teaching assistants for the course per room, meaning each student had 2 evaluators watching and providing feedback for their encounter. The data presented would demonstrate if the student performed or did not perform the skill effectively or sufficiently, or if the instructors were split on the student's performance.

Debrief and Student Reflection. Finally, the learners were tasked with completing 2 reflections after the debrief. The first reflection was an online self-assessment assessing their performance of the same 10 questions asked to the live actor on the patient satisfaction tool. Next, the student completed a 19-item evaluation focused on the prebriefing, hybrid encounter, and debriefing using a 5-point Likert scale

Table 1. Previous Knowledge and Skill Exposure

	Overall (n = 31)		Professional Students (n = 7)		Postprofessional Students (n = 24)	
Skill	Yes	No	Yes	No	Yes	No
Patient-centered care						
Educated on the topic	30	1	7	0	23	1
Observed another HCP	30	1	7	0	23	1
Completed under supervision	28	3	7	0	21	3
Performed skill as an AT	10	21	N/A	N/A	10	14
Suturing						
Educated on the topic	12	19	5	2	7	17
Observed another HCP	14	17	4	3	10	14
Completed under supervision	1	30	0	7	1	23
Performed skill as an AT	0	31	N/A	N/A	0	24
Injections						
Educated on the topic	3	28	1	6	2	22
Observed another HCP	14	17	4	3	10	14
Completed under supervision	2	29	0	7	2	22
Performed skill as an AT	0	31	N/A	N/A	0	24

Abbreviations: AT, athletic trainer; HCP, health care provider; N/A, not applicable.

(1 = *strongly disagree*, 5 = *strongly agree*). Then, questions from the presemester survey were integrated again on the self-assessment focused on the importance of and the student's confidence in suturing and providing injections. Finally, the student's second reflection was a written response to 6 prompts focused on the hybrid simulation encounter.

OUTCOMES

After the end of the semester after all grades were submitted, the course instructor applied for use of retrospective data collected via the outcome measures relative to the hybrid simulation that was stored in the learning management system. The institutional review board at University of South Carolina deemed the study exempt.

Presemester Survey

Overall, the learners had had varying experiences learning about, observing, and practicing the skills of patient-centered care, suturing, and injections (Table 1). In addition, the learners noted that it was extremely important for the athletic trainer to know and be able to provide patient-centered care (4.97 of 5) but saw the skills of suturing (3.35 of 5) and injections (3.16 of 5) as moderately important. Finally, at preintervention the learners were not confident in performing skills such as preparing injections (mean = 22.41 ± 24.45 of 100), moderately confident delivering health care strategies that accounted for health literacy and the social determinants of health (ie, patient-centered care; mean = 52.58 ± 19.50 of 100), and had the highest confidence in evaluating and managing patients with wounds (mean = 71.61 ± 19.53 of 100).

Patient and Instructor Feedback

Patient Satisfaction (Live Actor Feedback). On the patient satisfaction tool, the live actors considered that the learners were 3.72 of 5 (above average) on overall professionalism. Notably, the learners performed the highest on "showing interest in you as a person; not acting bored or ignoring what you have to say" (mean = 4.09 of 5) whereas "discussing options with you; asking your opinion; offering choices and letting help decide what to do; asking what you think before telling you what to do" was the lowest performance at 3.47 of 5; however, it was still above the 3 average the live actors were trained to rate as the baseline of competent health care services. The full results of the patient satisfaction tool can be found in Table 2.

Skill Checklist (Instructor Feedback). When reviewing the specific skills completed during the hybrid simulation, the learners performed poorly on handwashing before suturing (n = 24 of 31 did not perform, 77.4%), cleaning the top of the lidocaine vial before inserting the needle (n = 25 of 31 did not perform, 80.6%), and discussing vaccine status, blood disorders, etc, with the patient (n = 25 of 31 did not perform, 80.6%). Contrastingly, all students (100%) wore gloves and inverted the vial of lidocaine. A full list of the skills assessed during the hybrid simulation encounter is presented in Table 3. Figure 4 demonstrates examples of the learners performing the associated tasks during the encounter.

Overall Patient Experience (Instructor Feedback). Table 4 provides an overview of the clinical skills performed by the total student group and split by level of learner. Overall, most skills were at or above the 3.0 out of 5 (average) level, which was the goal of the rubrics.

Debrief and Student Reflection

After the debrief, the learners ranked how well they believed they had treated their patient using the same tool as the live actor patient satisfaction tool. On the patient satisfaction tool, the learners considered themselves above average on overall professionalism (mean = 3.45 of 5). The highest-ranked performance score was "treating them like they are on the same level; never 'talking down' to them or treating them like a child" (mean = 4.06 of 5). This same skill was ranked fourth by the live actors. Unlike the live actors, the learners ranked

Table 2. Live Actor (Standardized Patient) Satisfaction

How was the athletic training student's performance at...	Mean (of 5)	Mode
1. Telling you everything; being truthful, up-front, and frank; not keeping things from you that you should know	3.59	3
2. Greeting you warmly; calling you by the name you prefer; being friendly, never crabby or rude	3.91	3
3. Treating you like you are on the same level; never "talking down" to you or treating you like a child	3.78	3
4. Letting you tell your story; listening carefully; asking thoughtful questions; not interrupting you while you are talking	3.84	3
5. Showing interest in you as a person; not acting bored or ignoring what you have to say	4.09	5
6. Discussing options with you; asking your opinion; offering choices and letting you help decide what to do; asking what you think before telling you what to do	3.47	3
7. Encouraging you to ask questions; answering them clearly; never avoiding your questions or lecturing you	3.72	3
8. Explaining what you need to know about your problems, how and why they occurred, and what to expect next	3.63	3
9. Using words you can understand when explaining your problems and treatment; explaining any technical medical terms in plain language	3.69	3
10. Overall professionalism	3.72	3

"showing interest in them as a person; not acting bored or ignoring what they have to say" as the third best skill they performed, with an average score of 3.90 out of 5. Similar to what the patients reported, learners scored themselves lowest on "discussing options with them; asking their opinion; offering choices and letting them help decide what to do; asking what they think before telling them what to do" (mean = 2.62 of 5). The complete results of the learners' ranking of their performance are available in Table 5.

After the hybrid encounter, learners noted that they "had an opportunity to apply [their] knowledge and skills from classroom and clinical learning," felt that they had been "challenged in my thinking, reasoning, and judgment skills," and that the "experience with the standardized patient was valuable and contributed to my learning." All the results from the postexperience standardized patient reflection can be found in Table 6. Finally, the questions from the presemester survey were integrated again into the self-assessment focused on the importance and confidence in suturing and providing injections. At postdebrief, the learners reported that it was extremely important for the athletic trainer to know and be able to provide patient-centered care (4.77 of 5) but continued to feel that the skills of suturing (3.10 of 5) and injections (3.06 of 5) were only moderately important. At postdebrief, the learners were more confident in preparing and providing injections (mean = 54.19 ± 19.64 of 100; 31-point increase from presemester) and showed similar confidence with evaluating and managing patients with wounds (mean = 70.65 ± 18.65 of 100; 1 point decrease from presemester). Specific to the encounter, the students were asked about their confidence in selecting, performing, and accuracy of the performance for 10 subskills of the hybrid simulation. Overall, students had above 50% confidence in all 10 skills, with wearing gloves (94.8/100), using the sharps container (90.0/100), and handwashing (90.0/100) as the highest. Students ranked their confidence at 65.8/100 in performing the simple interrupted suture technique and 72.9/100 in creating a sterile environment. Finally, examples of student reflections to the 6 prompts focused on the hybrid simulation encounter are provided in Table 7. We believe these data reflect a knowledge gap.

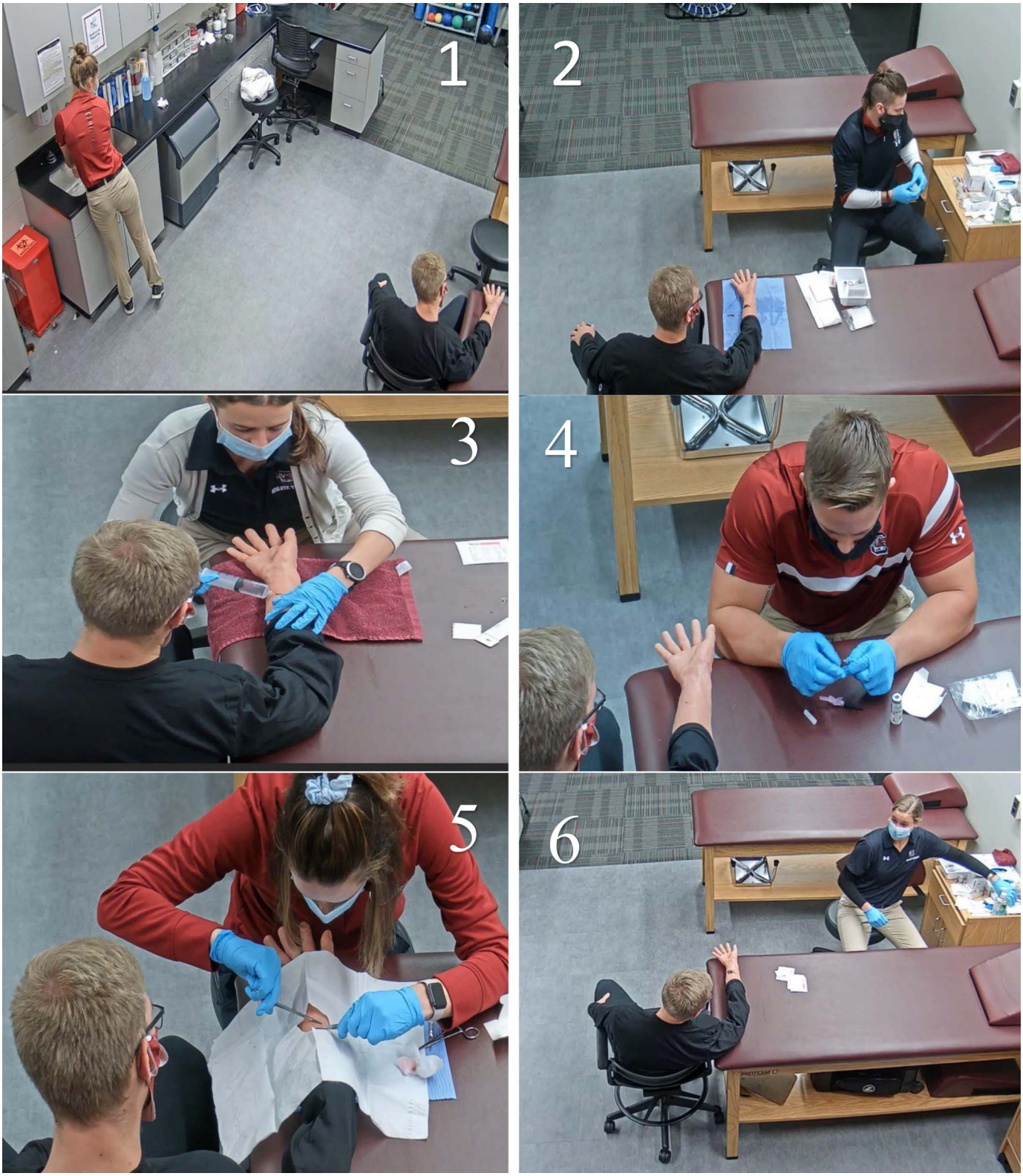
CLINICAL EDUCATION ADVANTAGES

Standardized patient encounters have been deemed effective at improving assessment skills, providing direct feedback, and having long-term benefits for clinical practice.[20,21] In alignment with other health care professions, athletic training programs should continue to use more simulation-based mastery training.[22] The training of suturing and injection skills should be integrated throughout multiple sessions rather than a one-time course. The ability for the students to practice under supervised feedback, then be assessed later in the semester, mimics training in other emergency care skills; however, our results align with previous research that identified that learners struggle to replicate the skills even as early as 1 month after training sessions.[23] Skill fade, or the decline in proficiency over a period of nonuse, occurs typically after greater than 6 months to 1 year without using a learned skill[24]; however, other research has indicated that decay can occur as early as 2 weeks after skill acquisition.[25] Our instructional technique assessed the learners 2 weeks after their in-class lecture and lab session. Although we would presume the learners would maintain their knowledge, the lack of integration of the skill into clinical practice may affect their ability to retain the skill performance, as for other emergency care skills such as airway management.[26] The timing of this technique emphasizes the need for continued skill practice for new and advanced skills regardless of learner level (professional or postprofessional) and previous educational training. Moreover, our data from the educational technique also depict an overconfidence in one's perceived behaviors compared with one's actual behaviors. In the athletic training literature, we have several studies to support that a knowledge gap exists between one's perceived and actual knowledge on topics such as airway adjuncts[27] and spine boarding.[28] Our data add to this cognitive bias, referred to as the Dunning-Kruger effect,[29] in which one overestimates one's abilities from a lack of self-awareness. The learners had

Table 3. Skill Checklist

Skill/Step	Did Not Perform, No. (%)	Performed, No. (%)	Instructor Split, No. (%)
General patient care			
1. Cleans hands using hand sanitizer in front of the patient	24 (77.4)	7 (22.6)	0 (0)
2. Dons gloves	0 (0)	31 (100.0)	0 (0)
3. Uses gauze pads to stop the bleeding	10 (32.3)	18 (58.1)	3 (9.7)
4. Irrigates the wound using saline via syringe	12 (38.7)	17 (54.8)	2 (6.5)
5. Removes debris, as necessary, from the wound	0 (0)	30 (96.8)	1 (3.2)
6. Chooses to suture the patient versus Steri-Strip for the type/size of wound	0 (0)	30 (96.8)	1 (3.2)
7. Creates a sterile field for the intervention	5 (16.1)	26 (83.9)	0 (0.00)
8. Asks the patient about allergies to medications or supplies being used	16 (51.6)	11 (35.5)	4 (12.9)
9. Selects the correct vial of medication (lidocaine)	0 (0)	30 (96.8)	1 (3.2)
Preparation and provision of the injection			
1. Places hypodermic withdrawal needle on syringe	1 (3.2)	28 (90.3)	2 (6.5)
2. Cleans vial top with an alcohol prep pad	25 (80.6)	5 (16.1)	1 (3.2)
3. Inverts the vial and insert the needle through rubber stopper	0 (0)	31 (100.0)	0 (0)
4. Expels the air in the syringe and release the plunger, keeping the tip of the needle within the medication	5 (16.1)	25 (80.6)	1 (3.2)
5. Withdraws the appropriate amount of medication	0 (0)	30 (96.8)	1 (3.2)
6. Withdraws the needle, expel any air in the syringe, and confirm the appropriate amount of medication is in the syringe	2 (6.5)	27 (87.1)	2 (6.5)
7. Recaps the needle using the one-handed method	11 (35.5)	13 (41.9)	7 (22.6)
8. Changes syringe needle	18 (58.1)	13 (41.9)	0 (0)
9. Explains procedure to the patient	4 (12.9)	22 (71.0)	5 (16.1)
10. Using aseptic technique, cleanses the injection area with an alcohol prep pad	15 (48.4)	12 (38.7)	4 (12.9)
11. Inserts needle at 45° angle on the side of laceration	0 (0)	29 (93.5)	2 (6.5)
12. Repeats injection at multiple sites on both sides of the laceration	4 (12.9)	25 (80.6)	2 (6.5)
13. Disposes of the syringe and needle in the sharps container ensuring to NOT cross the patient's or student's body with the open needle. Sharps container should be on the side of the clinician where it can be safely disposed of	10 (32.3)	15 (48.4)	6 (19.3)
14. Monitors response	6 (19.4)	21 (67.7)	4 (12.9)
Wound care via suturing			
1. Selects appropriate tools (needle driver in the dominant hand)	1 (3.2)	30 (96.8)	0 (0)
2. Pulls suture out of the package completely grasping it with the needle driver	0 (0)	29 (93.5)	2 (6.5)
3. Positions the needle at 90° to the surface of the skin and push through the tissue	0 (0)	30 (96.8)	1 (3.2)
4. Pulls the tip of the needle through the skin and picks up on other side of the wound with forceps	2 (6.5)	28 (90.3)	1 (3.2)
5. Wraps the suture around the closed needle driver 2 times, pulls both ends to tie the first knot	3 (9.7)	27 (87.1)	1 (3.2)
6. Alternating 1× around knots for 5–6 total throws	5 (16.1)	24 (77.4)	2 (6.5)
7. Suture insertion sites are an appropriate distance away from the wound	6 (19.4)	24 (77.4)	1 (3.2)
8. Approximates, not strangulates, the wound with the sutures	5 (16.1)	24 (77.4)	2 (6.5)
9. Sutures are distributed appropriately across the wound for spacing and appropriate number of sutures select for the length of wound (2–3 max)	7 (22.6)	21 (67.7)	3 (9.7)
Patient education			
1. Discusses vaccines, blood disorders, etc.	25 (80.6)	4 (12.9)	2 (6.5)
2. Consider referring to physician for antibiotics	24 (77.4)	5 (16.1)	2 (6.5)
3. Explains to keep wound clean and dry	6 (19.4)	22 (71.0)	3 (9.6)
4. Discusses timeline for suture removal	8 (25.8)	19 (61.3)	4 (12.9)

Figure 4. Images of the hybrid simulation encounter skills. The pictures show (1) handwashing, (2) preparing supplies, (3) debridement with saline, (4) preparing the injection, (5) suturing, and (6) patient education being performed by the learners.



90% confidence in their abilities to wash their hands, yet only 23% completed the task during the encounter. We suggest that educators use this finding during the debrief to explore metacognition, or thinking about one's thinking, to understand how and where students' awareness and control of their prior knowledge and actual decisions did not align.

Other clinical skills that have been taught using hybrid simulation to allow students to learn and practice the clinical procedure in a realistic manner with both technical skills and interpersonal communication include cardiac auscultation,[30] ectopic pregnancy,[31] laparoscopic suturing,[32] emergency birth,[33,34] and urinary catheterization.[35] The hybrid simula-

Table 4. Overall Encounter Rating by Instructor

	Overall (n = 31), Mean ± SD	Professional Learners (n = 7), Mean ± SD	Postprofessional Learners (n = 24), Mean ± SD
Communication and interpersonal skills			
The practitioner established a personal connection.	3.5 ± 0.7	3.4 ± 0.7	3.6 ± 0.7
The practitioner asked open-ended questions appropriately.	3.4 ± 0.5	3.4 ± 0.6	3.5 ± 0.5
The practitioner asked closed-ended question appropriately.	3.4 ± 0.6	3.4 ± 0.6	3.4 ± 0.6
The practitioner actively listened using nonverbal techniques (eg, head nods, eye contact).	3.3 ± 0.5	3.3 ± 0.6	3.3 ± 0.6
The practitioner actively listened using verbal techniques (eg, verbal prompting, words of encouragement).	3.2 ± 0.6	3.1 ± 0.6	3.3 ± 0.7
The practitioner avoided medical jargon and used concise language that was understandable.	3.5 ± 0.6	3.4 ± 0.5	3.5 ± 0.6
The practitioner accurately summarized the information he/she gained during the interaction.	3.0 ± 0.6	3.1 ± 0.6	3.0 ± 0.6
The practitioner asked questions only one at a time.	3.3 ± 0.6	3.1 ± 0.8	3.4 ± 0.5
The practitioner avoided interrupting while the patient was talking.	3.5 ± 0.6	3.5 ± 0.6	3.5 ± 0.6
The practitioner asked follow-up questions about contextual factors (eg, family history, culture, society, gender, age).	2.9 ± 0.7	2.9 ± 0.9	2.9 ± 0.7
The practitioner used a nonjudgmental approach to communication and interaction.	3.5 ± 0.5	3.5 ± 0.5	3.5 ± 0.5
The practitioner expressed concern, sympathy, and/or compassion.	3.5 ± 0.6	3.4 ± 0.6	3.5 ± 0.6
The practitioner allowed and/or encouraged the patient to ask questions.	3.2 ± 0.6	3.0 ± 0.3	3.0 ± 0.7
The practitioner responded to patient questions appropriately.	3.5 ± 0.8	3.6 ± 1.0	3.5 ± 0.8
Data gathering and evaluative skills			
The practitioner conducted a thorough medical history.	3.0 ± 0.5	3.1 ± 0.3	3.0 ± 0.5
The practitioner conducted a thorough personal history.	3.1 ± 0.9	2.9 ± 0.8	3.1 ± 0.9
The examination considered work, life, school, etc.	3.1 ± 0.8	2.9 ± 0.7	3.1 ± 0.8
The practitioner inspected the injured area.	3.5 ± 0.7	3.4 ± 0.6	3.6 ± 0.7
The practitioner considered patient comfort in the examination.	3.3 ± 0.7	3.4 ± 0.9	3.3 ± 0.7
The examination was organized.	3.2 ± 0.8	3.2 ± 1.0	3.2 ± 0.8
Patient education			
The practitioner was able to communicate a differential and/or a definitive diagnosis to the patient in an understandable way.	3.2 ± 0.4	3.2 ± 0.5	3.2 ± 0.4
The practitioner provided appropriate immediate treatment.	3.5 ± 0.8	3.6 ± 0.9	3.4 ± 0.7
The practitioner discussed and incorporated the patient into short- and long-term goals.	2.9 ± 0.8	2.9 ± 0.8	3.0 ± 0.8
The practitioner provided a detailed home care plan for the patient.	3.2 ± 0.9	3.1 ± 0.9	3.2 ± 0.9
The practitioner communicated the plans/next steps in an organized way.	3.2 ± 0.7	3.4 ± 0.5	3.2 ± 0.7
The practitioner used supporting materials (examples and explanations) to help communicate the condition and plan.	2.9 ± 0.4	3.0 ± 0.5	2.9 ± 0.4
Overall performance			
Care is based on continuous healing relationships.	3.3 ± 0.5	3.3 ± 0.5	3.3 ± 0.5
Care is customized according to patient needs and values.	3.4 ± 0.5	3.3 ± 0.4	3.4 ± 0.6
The patient is the source of control.	3.4 ± 0.7	3.4 ± 0.7	3.3 ± 0.7
Knowledge is shared, and information flows freely.	3.5 ± 0.7	3.5 ± 0.7	3.5 ± 0.7
Information was made available to the patients to allow them to make decisions about care.	3.4 ± 0.7	3.4 ± 0.8	3.4 ± 0.7
Decision-making is evidence based.	3.5 ± 0.7	3.5 ± 0.8	3.5 ± 0.6

Table 5. Student Self-Perceived Performance

How was your performance at	Mean (of 5)	Mode
11. Telling them everything; being truthful, upfront, and frank; not keeping things from them that they should know	3.48	3
12. Greeting them warmly; calling them by the name they prefer; being friendly, never crabby, or rude	3.94	4
13. Treating them like they are on the same level; never "talking down" to them or treating them like a child	4.06	4
14. Letting them tell their story; listening carefully; asking thoughtful questions; not interrupting them while they are talking	3.65	4
15. Showing interest in them as a person; not acting bored or ignoring what they have to say	3.90	4
16. Discussing options with them; asking their opinion; offering choices and letting help decide what to do; asking what they think before telling them what to do	2.62	2
17. Encouraging them to ask questions; answering them clearly; never avoiding their questions or lecturing them	3.49	3
18. Explaining what they need to know about their problems, how and why they occurred, and what to expect next	3.00	3
19. Using words they can understand when explaining their problems and treatment; explaining any technical medical terms in plain language	3.65	3
20. Overall professionalism	3.45	3

Table 6. Student Reflection on the Hybrid Simulation Experience (N = 31)

	Mean (of 5)	Mode
The purpose, objectives, and expectations of the simulation were clear.	4.22	4
There was enough information provided at the beginning of the simulation to provide direction and encouragement.	3.97	4
I felt supported in the learning process.	3.68	4
I felt empowered to make clinical decisions.	3.94	4
I developed a better understanding of the wounds and wound care in the scenario.	4.19	4
I developed a better understanding of the injections in the scenario.	4.10	4
I developed a better understanding of how to prioritize my assessment and interventions.[a]	4.17	4
I gained experience in communicating with patients, family, and/or health care team members.	4.32	4
I had an opportunity to apply my knowledge and skills from classroom and clinical learning.	4.55	5
I had an opportunity to practice my clinical decision-making skills.	4.26	5
I was challenged in my thinking, reasoning, and judgment skills.	4.39	5
The debriefing process provided an opportunity to verbalize my feelings before focusing on the scenario.[a]	4.07	4
Debriefing provided an opportunity to reflect on my performance during the simulation.[a]	4.23	4
Debriefing provided an opportunity to discuss decision-making and clinical judgment.[a]	4.20	4
Debriefing included helpful feedback to help improve my performance.	4.10	4
I feel better prepared to recognize and respond to changes in my real patient's condition(s).	3.97	4
The human standardized patient (SP) with which I worked portrayed the patient in an accurate and believable way.	4.22	4
The SP provided feedback that was both positive and helpful to me.	4.00	4
My experience with the SP was valuable and contributed to my learning.	4.35	4

[a] N = 30.

Table 7. Open-Ended Responses on Student Reflections

Question/Prompt	Selected Student Responses
What did you learn about yourself that was meaningful during the SP encounter and debrief?	• I learned I was able to complete a skill I learned only 3 weeks ago with confidence. At first, I was a little nervous but once I knew what I needed to do and started finding all the items I needed I felt more confident. I know I can take this same mentality and apply to it to my own practice and clinical setting. • During the standardized patient encounter and debrief I learned that I was more confident in my suturing skills once I got over the initial suture. I also learned that I need to be better at keeping conversation while I am working, I found myself stopping to answer questions and had a hard time multitasking. • I learned that there are still aspects of my eval and history taking that needs improvement, so that I can better learn more about the patient and what possible interventions I can provide.
How did the SP encounter and debrief influence your confidence with advanced clinical skills?	• During the encounter my confidence was very low because I was so shocked that suture was the skill that we were being testing on and I knew I was not prepared. I knew I was missing little steps on top of being worried about how to organize my evaluation properly and not looking completely incompetent. Looking back on the SP encounter, it has improved my confidence because I am able to look at my mistakes and learn from them. I know what not to do. I know what I need to do as a clinician to provide better patient care and patient education moving forward. It has also tested my awareness in a safe environment what I need to be better prepared for in the clinical setting that can be translated into other skills, not just suturing. • I felt confident going into the scenario, once I realized that I needed to suture, that I could suture, but once I started doing the injection and actually preparing the sutures, I began to doubt myself. I began to perform the scenario and then I realized I could not remember the proper way, but I kept going so as to not frighten the patient. I feel more confident now, but I do feel like I need to review and practice more. • It increased my confidence due to showing me that I can use these skills in a practical setting and actually utilize them with almost a real patient.
What do you believe will be the most challenging aspect of implementing the advanced clinical skills during the SP encounter and debrief?	• The most challenging aspect will be knowing exactly when and when not to suture. Assuming my physician lets me. For this wound it was easy to know, but for some that are 50/50 with whether or not to suture, those will be hard to determine. • The most challenging aspect is probably just the availability of the supplies at my clinical site. Another barrier is the fact that we have physicians that are readily available to perform these types of skills, which patients and/or coaches may be more comfortable with. We have to get them to realize that we are proficient in these skills and can perform them if necessary. • I think the most challenging aspect of implementing the advanced clinical skills is simply not having the materials and needs necessary to practice these skills even if our overseeing physician allows it. My current clinical site is a small, private NAIA university with a small and limited budget. If a patient were to come to the athletic training facility with the same laceration as the patient during the SP encounter, we would be able to manage the bleeding and cover the wound; however, we would have to send them to urgent care or the emergency room in order to have the wound closed. I would like to be able to handle as many injuries as we can in house, but with our budget and supplies available, sometimes we simply cannot.
What concepts can you take and apply to your clinical practice from the SP encounter and debrief?	• I learned a lot about the importance of multitasking from this encounter. I had to be attentive to the patient and what he was saying/asking but also focused on the skill at hand. Being able to successfully complete multiple skills at once will definitely be useful and applicable at my clinical site. • The initial wound care and patient-centered care that we practiced during the SP are things that I can implement in my clinical practice immediately. • The concept I can apply and currently apply at my clinical site is wound care and treatment. Since July, I have practiced wound care nearly every day, from blisters and calluses to drilling holes for blood and toenail removal for ingrown toenails. Although I was quite nervous during the encounter, I am quite proficient in telling my patients how to take care of their wound, when to come back, what to look out for, and etc.

Table 7. Continued

Question/Prompt	Selected Student Responses
How can you translate what you learned from the SP encounter and debrief to other patients immediately even *without* the advanced clinical skill supplies at your clinical site?	• The topic of patient-centered care can directly be translated to other patients immediately. Treating the patient first is oftentimes overlooked when dealing with injuries, especially ones that require immediate assistance or when working a site and dealing with a large volume of patients at one time. • I can be more aware of cleanliness, patient-centered care (providing choices), and remembering to ask about general medical history (not only orthopaedic). • I can translate patient-centered care and better wound care into my clinical practice. I have not had much practice with any wound care during my clinical experience, so it was nice getting more practice.

Abbreviations: NAIA, National Association of Intercollegiate Athletics; SP, standardized patient.

tion brings the patient into the equation with getting options for care, being involved in the decision, and the emotional reaction to the consultation. Like our educational technique, previous researchers have explored the use of suturing pads attached to standardized patients.[35,36] We believe the learner outcomes in our instructional technique demonstrate that the athletic training students were focused on patient education and interpersonal skills, meaning they were integrating the standardized live patient actor into the scenario. Care and empathy must be displayed by the learners, which forces them to focus on not only the technical skills but also the patient-centered care principles such as physical comfort, respect for preferences, and education. However, data gathering and content checklist areas were mixed, with suturing skills being performed correctly more often than injection skills. Continued practice of the advanced clinical skills during clinical education could circumvent the findings. However, for a didactic experience, the hybrid simulation for suturing provides the most realistic experience for suturing possible before performing on a patient. Future research should explore using this educational technique as an original research study using validated outcome measures and comparison simulation groups to explore learning outcomes and student feedback that will support hybrid simulations as an equal or better alternative to part-task trainer suturing practice.

CONCLUSIONS

The incorporation of a hybrid simulation encounter for practice of suturing and injection skills required the learners to demonstrate their ability to multitask and deliver patient-centered care and promoted proper skill execution. Additionally, the learners received direct feedback from the standardized patient and the instructors related to the satisfaction of the patient experience and competence in wound care skills, respectively. After skill development, the use of a hybrid simulation as a formative assessment allowed the educator to evaluate the learners' interpersonal communication and technical skills in a safe manner. The instructional technique described is translatable among learner levels (professional and postprofessional) and other emergency care skills.

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