

## Simulation Technology & Operations Resource Magazine (STORM)

STORM highlights exemplar work contributing to the advancement of healthcare simulation operations. All submissions are peer reviewed before publication in the STORM special edition of the SSH Simulation Spotlight. With articles covering training, policy & procedure, emerging technologies, and professional development, STORM has everything needed to stay current and well-rounded in the pursuit of simulation operations excellence.

***Special Edition: Proceedings of The International Meeting on Simulation in Healthcare 2026***

*Sponsored by the Society for Simulation in Healthcare Technology Committee*

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# Scaling a Simulation-Based Surgical Airway Workshop for Anesthesia Providers

## Implementation Lessons from a Multi-Center Academic Health System

Charles Lin, MD, MSc<sup>1</sup>; John O'Donnell, DrPH, CRNA<sup>2</sup>

<sup>1</sup>University of Pittsburgh Medical Center, Pittsburgh, PA

<sup>2</sup>University of Pittsburgh School of Nursing, Pittsburgh, PA

**Corresponding Author:** Charles Lin, [linc4@upmc.edu](mailto:linc4@upmc.edu)

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### SUMMARY

Surgical airway management is a rare but critical skill for anesthesia providers, representing the final step in the “cannot ventilate, cannot oxygenate” algorithm. To address gaps in staff clinician training, we developed and scaled a simulation-based, scalpel-bougie front of neck access (SB-FONA) workshop across a large academic health system. Adapted from trainee curricula, the workshop emphasized evidence-based, skills-focused training for practicing anesthesiologists. Guided by the Adapted Implementation Model for Simulation (AIM-SIM) and the Consolidated Framework for Implementation Research (CFIR), the program was implemented across seven University of Pittsburgh Medical Center hospitals. Evaluation focused on implementation outcomes, including acceptability, adoption, appropriateness, feasibility, and fidelity. Although interest in surgical airway training was high (83%), participation was limited by logistical barriers, particularly those related to timing and location. In response, we redesigned the program to enable mobile delivery at local sites, integration into existing departmental meetings, and a dyadic teaching model to reduce instructor burden. Formal knowledge assessments during training were removed to enhance psychological safety, while a final competency check was retained. Equipment was left on site to promote deliberate practice and sustain engagement. Key lessons emphasized the importance of flexible delivery, efficient resource use, clinician-centered design, and iterative feedback. This work demonstrates that implementation science-guided adaptation can support successful, scalable procedural simulation training within complex healthcare systems.

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### BACKGROUND

Three years ago, our team developed a focused surgical airway workshop specifically for staff anesthesia providers. We adapted our training from existing trainee workshops and redesigned it to accommodate the unique needs and time constraints of practicing clinicians. Although anesthesia providers rarely perform surgical airway management, it is a vital, high-stakes skill. It represents the final step in the “Cannot Ventilate, Cannot Intubate” pathway of the American Society of Anesthesiologists’ Difficult Airway Algorithm. Over the past three years, we successfully designed, piloted, implemented, and scaled this simulation-based scalpel-bougie front of neck access (SB-FONA) workshop. Initially tested with trainees, the workshop was subsequently tailored for staff clinicians and has now been implemented across seven hospitals within the University of Pittsburgh Medical Center, a large multi-center academic healthcare system. This paper shares the key lessons we learned in successfully scaling simulation-based training for staff clinicians.

Now, imagine you created a simulation workshop at your hospital. If someone asked you five years later how effective it was, how would you answer? The answer depends on how “effectiveness” is defined. According to the Kirkpatrick Model, effective training occurs in four stages: (1) learners find the experience relevant and engaging, (2) knowledge and skills are acquired, (3) clinical practice

changes as a result, and (4) patient outcomes improve. If outcomes do not improve, the issue could lie in either the quality of the training or the way it was implemented (Kirkpatrick, 1998). The latter—poor implementation despite a well-designed program—is known as a Type III error (Dubrowski, Barwick, & Dubrowski, 2018).

To guide our implementation and scaling efforts, we used the Adapted Implementation Model for Simulation (AIM-SIM). This model, built from existing implementation science frameworks, organizes simulation implementation into three phases: (1) stakeholder engagement and context exploration, (2) pre-implementation planning, and (3) program implementation with ongoing monitoring and evaluation (Dubrowski, Barwick, & Dubrowski, 2018). One key framework within AIM-SIM is the Consolidated Framework for Implementation Research (CFIR), which categorizes the factors that influence implementation success into four domains: (1) characteristics of the intervention, (2) the setting and available resources, (3) the individuals involved, and (4) the implementation process (Damschroder et al., 2009). These domains shape key considerations, including user perception, adaptability, complexity, resource requirements, local culture and climate, implementation readiness, engagement, execution, and evaluation. These CFIR-guided insights informed our approach and became the foundation for the lessons we describe in this report.

## **Lesson 1: Identify Implementation Barriers Unique to Each Site**

Although interest in surgical airway training is high among anesthesia providers, interest alone does not ensure participation. The primary challenge is identifying and addressing implementation barriers that outweigh this interest. Each department, team, and hospital has a unique culture and distinct obstacles that can hinder the adoption of new training programs. Jee et al. described these barriers in a qualitative study on simulation training in emergency departments. They identify both tangible obstacles (e.g., lack of funding, time, and space) and intangible obstacles (e.g., resistance to change, limited engagement, and cultural mindset) (Jee et al., 2023).

Before launching a workshop, it's essential to gauge the level of interest and ensure there is a receptive audience. Surgical airway training is considered essential by anesthesia providers, who agree that airway experts must be proficient in the skill. However, because surgical airway skills are infrequently required, many clinicians may lack the emotional urgency to pursue training, even if they recognize its importance. We initially announced the workshop system-wide and hosted it on weekends at a community hospital. Despite high reported interest, only 24 out of more than 200 anesthesia providers attended. To better understand this discrepancy, we surveyed our department. Among the 83 respondents:

- 83% agreed that surgical airway training is important.
- 77% wanted more training.
- 87% were interested in simulation-based education.
- 75% cited the location of the workshop as a key barrier, and 72% cited timing as a key barrier to attendance.

In response, we adapted our approach. We moved the workshop on-site at each local hospital and scheduled it during monthly departmental meetings, which included both anesthesiologists and certified nurse anesthetists. To shorten the workshop duration, didactic education was completed at home, while live hospital sessions focused on hands-on practice. In total, the expected commitment for attending the workshop at the hospital is less than 10 minutes. This shift in approach exemplifies microlearning—the delivery of educational content in small, focused units—which has been shown to improve procedural performance and knowledge retention (De Gagne et al., 2019). By aligning the workshop with clinicians' schedules and removing barriers to participation, we significantly improved engagement and uptake.

## Lesson 2: Engagement and Motivation – Either It’s There, or It Isn’t

Engagement is the cornerstone of successful implementation and encompasses several key outcomes: acceptability, appropriateness, and feasibility (Proctor et al., 2023). While these elements are closely related, they all depend on one crucial factor—motivation. For trainees, simulation workshops are often required. In contrast, staff clinicians typically engage in refresher training voluntarily. Their participation depends more on personal motivation and a commitment to maintaining clinical competency. However, motivation among staff clinicians can be unpredictable. Behavioral economics research shows that external incentives do not reliably drive participation. In fact, offering incentives like compensation may even undermine intrinsic motivation (Cerasoli, Nicklin, & Ford, 2014). Instead of focusing on incentivizing attendance, efforts should be directed toward removing barriers. Making the workshop more convenient, accessible, and relevant is far more effective in encouraging participation than offering rewards (Cerasoli, Nicklin, & Ford, 2014). When staff feel the training is practical, easy to access, and valuable to their clinical practice, they are more likely to engage, regardless of whether incentives are provided.

## Lesson 3: Adoption – Be Flexible and Inflexible at the Right Times

Be prepared to design, evaluate, and redesign your workshop. Once the workshop demonstrates efficacy, the next set of outcomes to be examined is related to implementation. Implementation outcomes include acceptability, adoption, appropriateness, feasibility, fidelity, implementation cost, penetration, and sustainability (Proctor et al., 2011). Each of these metrics requires assessment. For example, when considering fidelity (accuracy in reproducing the real-life clinical event), which aspect is most critical to retention of knowledge or skill? Is physical fidelity or process fidelity more important? Understanding this allows a tailored approach to curriculum redesign to maximize learning and retention.

In product design terms, the initial version of our workshop was a *Minimally Viable Product (MVP)*—a basic but functional model intended for iterative refinement based on user feedback (Ries, 2011). Like a startup, we approached development by treating clinicians as early adopters and using their input to improve the experience. Once our pilot study demonstrated that the workshop improved technical performance and confidence with the scalpel-bougie front of neck access technique, we modified our workshop according to user preferences. For instance, we learned that staff clinicians did not want to undergo extensive knowledge evaluation, so we limited assessments to a final rigorous test of the SB-FONA skill. We remained committed to our core goal of broadening exposure to effective SB-FONA training, while staying flexible in delivery. Key adaptations from the original MVP included:

1. Dyadic teaching model: Pairs of participants alternate roles as learner and teacher, addressing instructor shortages (Ding et al., 2022).
2. Concise video instruction: A short procedural video meets the time constraints of busy clinicians.
3. On-site equipment: Leaving airway trainers and materials on-site encourages ongoing practice and teaching.
4. Integrated scheduling: Hosting workshops during routine morning conferences improved accessibility.
5. Simplified design: The workshop accommodates tight schedules and local hospital culture while enabling scalability (Damschroder et al., 2009).

## Lesson 4: Resource Constraints – Time is Money, and Space isn’t Cheap

Implementation involves both tangible and intangible costs. These include monetary expenses, scheduling challenges, and user convenience. Through ongoing conversations with

department leaders, we made practical adjustments to reduce barriers and enhance access for busy clinicians.

### **Lesson 5: Staffing Constraints – A Champion Helps but Isn't Enough**

While local champions are valuable, they are not sufficient for sustainable implementation. Faculty turnover and scheduling conflicts often limit their long-term impact. To address this, we moved from an instructor-led model to a dyad teaching approach, which requires no external facilitator (Ding et al., 2022). This model also helps counter the doorway effect—the tendency to forget training after leaving the learning environment (Swallow, Zacks, & Abrams, 2009). By keeping trainers and materials in the clinical setting, we promoted deliberate practice, habit formation, and long-term retention.

### **Lesson 6: Feedback and Evaluation – Communicate and Ask the Right Questions**

Clear communication with stakeholders, including users and those involved in implementation, is critical. Throughout our workshop, ongoing engagement with stakeholders ensured the workshop was convenient and focused to maximize adoption.

Evaluation efforts should focus on meaningful metrics. For example, we found tracking attendance provides more actionable insight than gauging interest alone. When attendance was low, we surveyed faculty to identify barriers and adjust future sessions accordingly. Continuous feedback loops and responsive design helped us refine and expand the program successfully.

### **Final Note: Sustain Your Motivation**

The greatest threat to implementation is not a lack of resources—it is a lack of motivation among participants and project leaders. Maintaining momentum requires a committed team that supports one another through the challenges of achieving long-term change. Epidemiologic studies have previously shown that demonstrating efficacy in a study is easier than demonstrating effectiveness in the real world, creating what is known as the efficacy-effectiveness gap (Cramer-van der Welle et al., 2018; Eichler et al., 2011; Wilson, Hanna, & Booth, 2024). Sustained adherence to the lessons presented in our work has the potential to substantially enhance healthcare professional education and, ultimately, patient outcomes.

**Conflict of interest statement:** The authors have no conflicts of interest to declare.

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# Reimagining Emergency Resternotomy Education

## A Hybrid Approach Using Digital Tools and High-Fidelity Simulation

Nathan Stewart, BSN, RN, CCRN<sup>1</sup>; Jennifer Fuka, BSN, RN, NPD-BC, CCRN-CSC<sup>1</sup>; Cornelia Carley, BSN, RN, CCRN, CMSRN<sup>1</sup>; Kirk Atkinson, CHSOS<sup>1</sup>; Anthony Austin, CHSOS<sup>1</sup>; Jeanne Carey, MEd, RN, CHSE-A<sup>1</sup>

<sup>1</sup>UT Southwestern Medical Center, Dallas, TX

**Corresponding Author:** Nathan Stewart, [Nathan.stewart@utsouthwestern.edu](mailto:Nathan.stewart@utsouthwestern.edu)

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### SUMMARY

Emergency resternotomies in the Cardiovascular Intensive Care Unit (CVICU) are high-stakes events requiring rapid response and precise role execution (Tsiouris et al., 2024). Previously, at our institution, emergency resternotomy training consisted of a didactic session and a simulation. Although the simulation session offered an opportunity for teams to practice chest reopening procedures, the standard manikin lacked anatomical realism.

While this training was helpful, staff feedback and post-simulation evaluations revealed ongoing gaps in role clarity, procedural confidence, and knowledge retention. In response, educators collaborated with the simulation center to develop a high-fidelity open chest manikin featuring realistic thoracic anatomy (Hill et al., 2023). Additionally, an Open Chest Digital Library was created to serve as pre-simulation work, followed by concise, role-based training videos (Stewart et al., 2024). This hybrid approach was integrated into the existing training model, aligning digital learning, structured classroom instruction, and realistic simulation. Early feedback demonstrated improved learner confidence, higher engagement, and increased procedural accuracy during drills. This session will explore the development and implementation of the upgraded training program, challenges encountered, and how combining digital education with high-fidelity simulation can better prepare teams for rare but critical clinical events.

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### INTRODUCTION

Open chest emergencies, including emergency resternotomy and internal cardiac massage, demand rapid, role-specific action. Despite scheduled didactic classes and simulations, inconsistencies in role clarity and team response persisted among critical care nurses and support staff. Existing training relied on a standard manikin with simulated actions, limiting the realism and practice of procedural steps. The goal of this initiative was to enhance the training environment by pairing technology-enabled education with a high-fidelity physical model. This approach reflects current best practices in simulation-based education: layering digital prebriefing, real-time role reinforcement, and realistic scenario enactment.

For the purposes of this manuscript, *learners* are defined as bedside cardiovascular intensive care unit (CVICU) registered nurses and advanced practice providers participating in the training. Educators include nurse professional development specialists and simulation center staff responsible for curriculum design, facilitation, and debriefing. *Nursing leadership* refers to unit-based clinical leaders who supported implementation but did not participate as learners. This manuscript details the systematic redesign of the training program, its components, and early outcomes.

## **METHODS**

### **Needs Assessment and Gap Identification**

Feedback from post-simulation surveys completed by CVICU registered nurses and advanced practice providers, as well as unit-based incident debriefs facilitated by nurse educators and nursing leadership, highlighted gaps in the previous training. This includes recurring gaps in knowledge retention, procedural execution, and role assignment, particularly during code events involving open chest scenarios. In response, a multidisciplinary team consisting of nurse educators, simulation specialists, and nursing leaders convened to evaluate training barriers and redesign the approach.

### **Development of the Open Chest Digital Library**

To prepare learners prior to entering the simulation lab, a series of concise, high-yield educational videos was created. Each video was filmed using clinical-grade equipment, professionally edited for clarity, and reviewed by educators and nursing leadership to ensure clinical accuracy and consistency with institutional protocols. These videos, housed in an accessible digital library, covered key topics such as:

1. What is Cardiac Tamponade and the 6 Roles of the Open Chest Protocol
2. The Emergency Resternotomy Cart
3. Internal Defibrillation
4. How to Get Sterile
5. The Open Chest Simulation Walkthrough
6. Code Documentation Related to the Open Chest Simulation

These modules were developed to promote visual proficiency (Stewart et al., 2024), enhance role comprehension, and support just-in-time learning principles.

### **High-Fidelity Manikin Design**

To develop the high-fidelity open chest manikin, educators and simulation center specialists identified essential features that would replicate an emergency resternotomy scenario with anatomical realism. The team sourced a thoracic cavity model from Strategic Operations, which became the foundation of the build. This model costs around \$60,000 and is a one-time cost. Guided by clinical expertise, a midsternal incision was sawed into the model's sternum, and copper wires were applied to approximate closure. This simulated the reality of post-operative sternotomy wiring.

A silicone heart was positioned strategically within the thoracic cavity so that it was accessible once the sternum was opened using a retractor. The thoracic model was mounted over a standard manikin, and a realistic skin layer was applied over the chest. A six-inch mid-sternal incision was made into the skin layer, then sealed using an adhesive designed to mimic Dermabond.

### **Integration of Revised Training with Existing Curriculum**

#### *Digital Prebriefing*

Learners reviewed video content three to five days before the simulation.

#### *In-Person Didactic Session*

A 90-minute interactive lecture reinforced critical concepts necessary for recognizing and responding to open chest emergencies. The session focused on identifying the clinical signs of cardiac tamponade, reviewing the appropriate steps in the pulseless electrical activity (PEA) arrest

algorithm, delineating each role within the open chest protocol, and reviewing the procedural steps of an emergency re-sternotomy.

### Simulation Scenario

Simulation sessions were conducted in a dedicated, hospital-based simulation center designed to replicate a CVICU patient room, including monitoring equipment, emergency carts, and institutional open chest protocols. Teams engaged in a full-code scenario that progressed into an open chest emergency using the high-fidelity manikin. Briefly, the simulation began with staff recognizing clinical signs consistent with cardiac tamponade, including hypotension and narrow pulse pressure. This led to a PEA arrest, prompting the team to initiate open chest protocol and transition from standard CPR to sterile compressions. Staff were then expected to appropriately prep and drape the patient for re-sternotomy (Dunning et al., 2017).

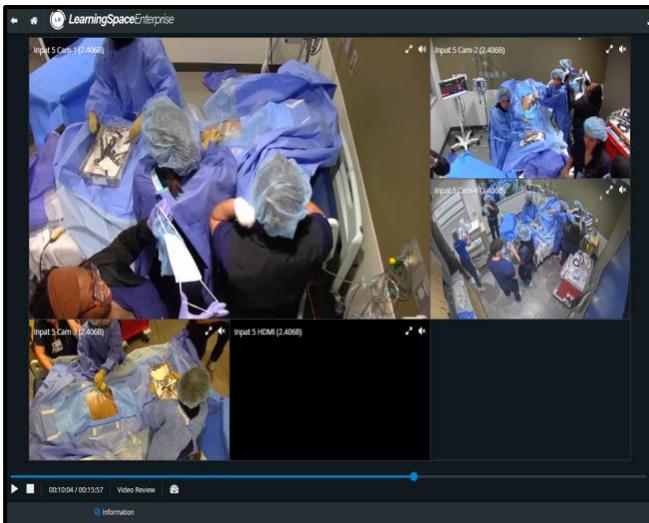
During the simulation, learners were then required to incise the skin layer with a scalpel, cut through the simulated sternal wires, and use the sternal retractor to fully open the chest—ultimately exposing the silicone heart. This approach aimed to provide hands-on experience with each step of an emergency re-sternotomy. The design was informed by best practices in simulation fidelity (Hill et al., 2023) and existing emergency re-sternotomy protocols (Tsiouris et al., 2024).

### Debriefing

Facilitators guided a reflective discussion focused on role clarity, procedural accuracy, and emotional response. Simulation recordings were professionally edited into single-session review videos and shared with learners, along with educator annotations, post-simulation to support continuous learning and reflective practice (Figure 1). After reviewing the recording, each attendee was required to submit three things that went well in the simulation and three things that could be improved upon using the Data Entry section of Learning Space.

**Figure 1**

**A Learning Space Multi-Camera Point of View**



**B High-Fidelity Manikin in Use**



## Evaluation of Revised Training

To evaluate the revised training, we looked at several metrics. The efficacy of the digital prebriefing was assessed using a two-question knowledge check prior to the start of the in-person didactic session. Correct responses on the knowledge check were compared between learners who received digital prebriefing and those who did not. In addition, each simulation session was recorded using multiple cameras from the simulation center. These recordings were reviewed in Learning Space to obtain time to chest opening, defined as the application of the sternal retractor, once PEA arrest was recognized. The time to chest opening was compared to the Society for Thoracic Surgeon goal of 5 minutes and the institutional goal of 10 minutes (Dunning et al., 2017). Qualitative feedback on the new simulation design was collected through open-ended post-activity survey questions. No survey response was excluded from analysis.

## RESULTS

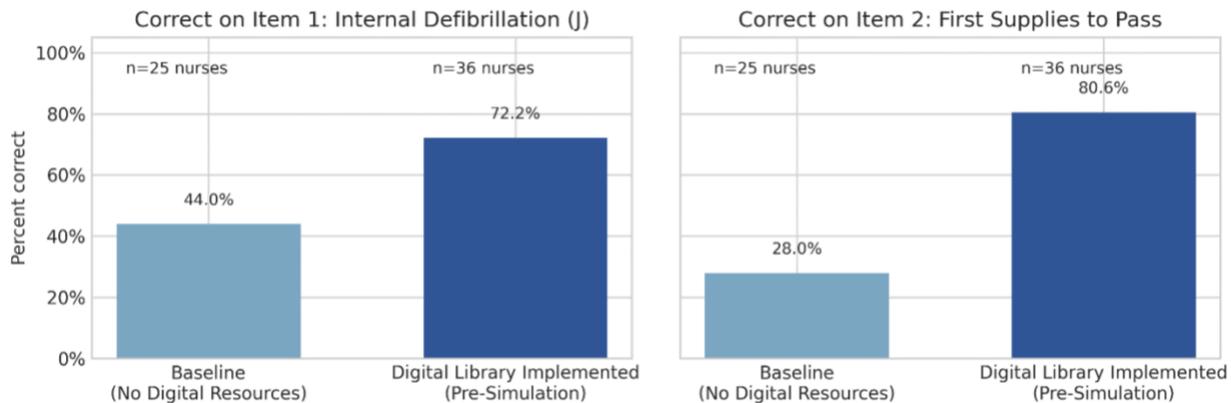
The initial implementation of this enhanced training in 2025 involved 41 learners – 36 registered nurses and 5 advanced practice providers. The learners were divided into 8 groups of 5 to 7 nurses and at least one advanced practice provider to complete the high-fidelity open chest simulation.

### Knowledge Check

The two-question knowledge check prior to in-person didactics demonstrated the impact of digital prebriefing (Figure 2). For internal defibrillation in an open chest scenario, 72.2% of nurses correctly identified 20 joules as the appropriate charge with digital prebriefing, compared to 44.0% without. Similarly, 80.6% of nurses with digital debriefing correctly identified the open chest tray and scalpel as the first supplies to hand to a provider, compared to 28.0% without.

**Figure 2**

*Knowledge Check by Item Before and After Digital Library Implementation*



*Note.* Percent correct on two-question knowledge check with and without digital prebriefing.

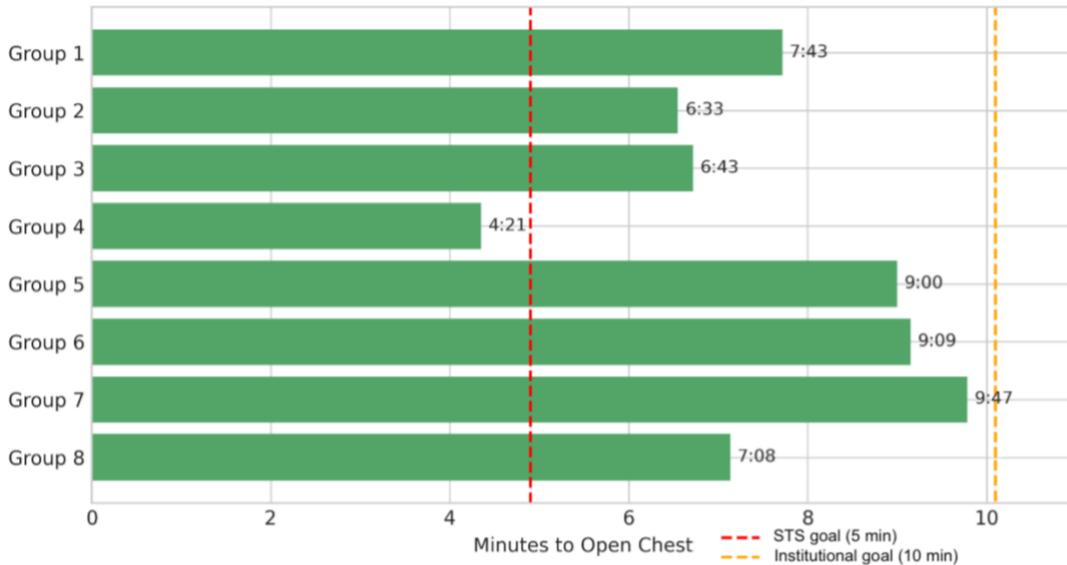
### Time to Chest Opening

The time from recognizing PEA to successful chest opening varied considerably, ranging from four minutes and twenty-one seconds to nine minutes and forty-seven seconds (Figure 3). One group

achieved chest reopening within the Society of Thoracic Surgeons' recommended goal of five minutes (Dunning et al., 2017), while all groups met the institutional goal of ten minutes.

**Figure 3**

*Time from Arrest Recognition to Chest Opening by Group*



*Note.* Minutes to open chest was defined as the time from recognition of PEA arrest to application of the sternal retractor. *STS: Society for Thoracic Surgeons.*

### Learner Feedback

From the qualitative feedback collected after the simulation, comments reflected perceived improvements in preparedness, realism, and role clarity. A small number of learners identified opportunities for improvement, including requests for additional repetition and expanded role-specific practice time. Learners cited the value of digital preparation, enhanced realism of the manikin, and the usefulness of reviewing recorded simulation videos post-session. Simulation educators reported perceiving greater learner engagement and fewer interruptions during scenarios, attributing this to improved preparedness and equipment familiarity.

### DISCUSSION

The combination of digital prebriefing and high-fidelity simulation addressed critical gaps in training by improving realism, repetition, and reflection. Learners exposed to the digital prebriefing had improved scores on knowledge checks before the simulation. This is reflected in their self-reported improved readiness and clearer understanding of responsibilities.

In previous iterations of open chest simulations at our institution, time to chest opening typically ranged from eight to ten minutes from arrest recognition, despite requiring fewer procedural steps. The improved times observed in this study suggest enhanced overall performance following implementation of the digital prebriefing and simulation redesign. This improvement may be partly attributed to the psychomotor learning facilitated by physically performing the chest opening with procedurally accurate tools and materials, compared to previous methods that lacked this hands-on component.

The post-simulation review videos allowed for ongoing reflection and the ability to identify improvement opportunities not recognized during live simulation. We have now expanded the use of our institution's Learning Space platform to further enhance the accessibility and customization of post-simulation content. This allows learners to extend the educational impact beyond the initial training day by revisiting recorded scenarios, debrief materials, and related reference videos.

Implementation of the enhanced open chest training program presented several logistical and resource-related challenges. The development of a high-fidelity thoracic cage required a substantial one-time financial investment, estimated at approximately \$60,000. This may present a barrier to adoption for institutions with limited simulation budgets. In addition, coordinating simulation sessions that included advanced practice providers was challenging due to competing clinical demands. Addressing these scheduling constraints required flexibility in session timing and strong collaboration with unit leadership to prioritize participation. Despite these challenges, this initial implementation suggests the educational benefits and improvements in team performance support continued use and expansion of the program.

## Limitations

This initiative has several limitations. The post-activity survey relied primarily on self-reported confidence and perceptions rather than objective performance metrics. Additionally, the small sample size and single-center design limited generalizability. Future iterations will incorporate more robust assessment tools, including structured behavioral checklists and longitudinal follow-up to evaluate skill retention and clinical impact.

## CONCLUSION

By integrating structured digital learning with high-fidelity simulation, this initiative offers a practical and scalable approach to preparing CVICU teams for rare but life-threatening open chest emergencies. The combination of role-based pre-work, anatomically realistic task training, and post-simulation video review supported reported improved preparedness, procedural performance, and team engagement. While the model required initial resource investment and deliberate coordination, its design allows for adaptation across institutions and clinical contexts. Future efforts will focus on expanding this approach to additional high-risk procedures and evaluating long-term skill retention and translation to clinical practice.

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# Current Practice and Needs Assessment of Simulation-Based Medical Education in Medical Education Centers in Thailand

Amnuayporn Apiraksakorn, MD, MMed, CHSE, LLB, BPH<sup>1</sup>; Kittisak Wangsataporn, MD<sup>2</sup>; Suphot Chattinnakorn, MD<sup>2</sup>; Wanna Ardonk, MD<sup>3</sup>; Wasana Hongkan, MD<sup>4</sup>; Tirachat Sewatanon, MD<sup>5</sup>; Adisak Tanpun, MD<sup>2</sup>; Seksun Sribooncharoenchai, MD<sup>4</sup>

<sup>1</sup>Khon Kaen Medical Education Center, Khon Kaen, Thailand

<sup>2</sup>Prapokklao Medical Education Center, Chanthaburi, Thailand

<sup>3</sup>Buddhachinaraj Medical Education Center, Phitsanulok, Thailand

<sup>4</sup>Chonburi Medical Education Center, Chonburi, Thailand

<sup>5</sup>Maharat Nakorn Ratchasima Medical Education Center, Nakorn Ratchasima, Thailand

**Corresponding Author:** Amnuayporn Apiraksakorn, [a.apiraksakorn@cpird.in.th](mailto:a.apiraksakorn@cpird.in.th)

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## SUMMARY

**Introduction:** Simulation-based medical education (SBME) has become an essential component of medical training, offering learners the opportunity to acquire and refine clinical skills in a controlled and safe environment. In 2020, the Thai Medical Council (TMC) revised the procedural skill requirements for the national medical licensing examination, emphasizing competency-based training and assessment. This study aims to evaluate the current SBME practices across Medical Education Centers (MECs) in Thailand in accordance with the updated TMC criteria.

**Methods:** A descriptive cross-sectional study was conducted across all MECs in 2024 in Thailand. Data were collected through an online, self-administered questionnaire covering institutional demographics, policies, staffing, facilities, equipment, and the implementation of procedural competencies based on the 2020 TMC guidelines. Descriptive statistics were used to analyze and report the findings.

**Results:** All 35 MECs (100% response rate) completed the survey, comprising 16 small, 10 medium, and 9 large centers. Of these, 30 MECs (86%) reported having established SBME policies, staff, teaching schedules, simulation center, mannequins, and training equipment. However, only 24 centers (69%) had a simulated patient (SP) bank, and 15 centers (43%) had formal SP training programs. A total of 274 instructors (5%) had received prior training in simulation-based teaching, and only 16 simulation technicians were employed across all centers. The majority of MECs incorporated SBME into instruction for core clinical competencies, with 29 centers (83%) utilizing it for both formative and summative assessments. All centers reported training in key procedures such as basic and advanced life support, endotracheal intubation, defibrillation, intravenous access, and intercostal drainage. Conversely, procedures like nail removal, skin traction, and strengthening exercises were inconsistently taught across institutions.

**Conclusions:** Evaluating the current practice of SBME across Thailand's MECs provides valuable insights into areas needing improvement. Enhancing SBME resources, standardizing training programs, and expanding faculty development are critical steps toward strengthening the quality of medical education and improving clinical preparedness among future healthcare professionals.

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## **INTRODUCTION**

Simulation-based Medical Education (SBME) is widely accepted in the training of medical students and has been shown to enhance learners' development in both simulated and clinical settings (Griswold-Theodorson et al., 2015; McGaghie et al., 2011; McInerney et al., 2022; Steinemann et al., 2011; Stone et al., 2014). Simulation supports the improvement of learners' knowledge, procedural skills, and non-technical skills, including cognitive processes, communication and social interaction, teamwork, and decision-making (Cook et al., 2012; Lamé & Dixon-Woods, 2018; Motola et al., 2013; Paige et al., 2018). At present, SBME is utilized in Thailand for teaching medical students both in medical schools and in medical education centers (MECs) under the Bureau of Medical Doctor and Health Care Professional Production and Development (MPHD). The national survey conducted in 2019-2020 included the SBME in 15 medical schools in Thailand according to the first edition (2002) Thai Medical Council (TMC) criteria (Boonmak et al., 2022). Of these, 6/15 medical schools (40%) did not have simulation centers, and the implementation of SBME in teaching procedural skills ranged from 42% to 99% of the 46 procedures. However, there is a lack of published data examining the current practice in SBME implementation within MECs, which serve as teaching hospitals affiliated with medical schools and operate under distinct contextual conditions. Additionally, the Thai Medical Council revised its competency-based licensing examination criteria in the second edition (2020), reducing the number of required procedural skills from 46 to 30 procedures, and mandating the assessment of 15 procedural skills. To date, there have been no published studies reporting on these developments. This study aims to evaluate the current SBME practices across Medical Education Centers in Thailand in accordance with the updated TMC criteria.

## **METHODS**

A descriptive cross-sectional survey study was performed in all 35 MECs under MPHD, which currently have clinical year medical students in 2024 in Thailand. An online self-administered questionnaire was used to collect data, including demographic data of the simulation center, policies, staffing, facility resources, equipment, and the current practice using SBME in teaching, learning, and assessment of competencies as outlined by the 2020 TMC criteria. The questionnaire is available in Appendix A. The respondents of the online questionnaire were representatives of the MECs, including directors, deputy directors, instructors, or educators involved with SBME. The data were reported in accordance with STROBE guidelines (Von Elm et al., 2007). The categorical data were presented as percentages and frequencies and analyzed using descriptive statistics. Chanthaburi Research Ethics Committee /region 6 has approved this study (COA no. 073/67).

## **RESULTS**

### **Demographic Data**

Thirty-five MEC representatives (100% response rate) responded to the online questionnaire, including 16 small, 10 medium, and 9 large-size centers (Table 1). Thirty MECs (86%) have established clear policies regarding simulation staffing, faculty development plan, SBME teaching schedule, simulation center layout, mannequins, and equipment. However, only 24 MECs (69%) have simulated patient (SP) banks, and 15 MECs (43%) have SP training programs. Across all MEC personnel, only 274 of the 5093 instructors and 79 of the 456 educators had previous simulation training. There were only 16 simulation technicians currently working across all 35 simulation centers, including 8 in small, 4 in medium, and 4 in large-sized MECs (Table 2).

**Table 1**

*Demographic Data of 35 Simulation Centers*

<b>Simulation Center in MECs</b>	<b>Total (n = 35)</b>	<b>Small (n = 16)</b>	<b>Medium (n = 10)</b>	<b>Large (n = 9)</b>
<b>Policy</b>				
Managing system, organizational chart	27 (77%)	11 (69%)	8 (80%)	8 (89%)
Job description of personnel	21 (60%)	11 (69%)	6 (60%)	4 (44%)
Adequate budget	29 (83%)	13 (81%)	9 (90%)	7 (78%)
Faculty development plan in simulation	29 (83%)	14 (88%)	7 (70%)	8 (89%)
Formal SBME teaching schedule	31 (89%)	14 (88%)	8 (80%)	9 (100%)
Simulated patient training system	15 (43%)	6 (38%)	3 (30%)	6 (67%)
Booking system of simulation facilities	30 (86%)	13 (81%)	8 (80%)	9 (100%)
Booking system of simulation equipment	34 (97%)	15 (94%)	10 (100%)	9 (100%)
<b>Simulation center</b>				
Lecture classroom	34 (97%)	16 (100%)	9 (90%)	9 (100%)
Procedural skill class	32 (91%)	15 (94%)	9 (90%)	8 (89%)
High fidelity simulation room	32 (91%)	15 (94%)	8 (80%)	9 (100%)
Observation room	33 (94%)	15 (94%)	9 (90%)	9 (100%)
Debrief room	30 (86%)	14 (88%)	8 (80%)	8 (89%)
Equipment storage room	35 (100%)	16 (100%)	10 (100%)	9 (100%)
<b>Mannequins and Equipment</b>				
Adequate mannequin/equipment	34 (97%)	15 (94%)	10 (100%)	9 (100%)
Storage system for mannequin/equipment	35 (100%)	16 (100%)	10 (100%)	9 (100%)
Simulated patient bank	24 (69%)	11 (69%)	5 (50%)	8 (89%)
Mannequin/equipment list and maintenance system	29 (83%)	13 (81%)	9 (90%)	7 (78%)

Note. Data are shown as n (%).

**Table 2**

*Number of Personnel in 35 Simulation Centers*

	<b>Total (n = 35)</b>	<b>Small (n = 16)</b>	<b>Medium (n = 10)</b>	<b>Large (n = 9)</b>
Number of instructors	5093	2056	1488	1549
Number of instructors trained in simulation	274	49	66	159
Number of educators	456	171	142	143
Number of educators trained in simulation	79	27	30	22
Number of simulation technicians	16	8	4	4

Note. Data are shown as n.

### Current Practice of SBME in MECs

Most MECs (77-97%) utilized SBME for teaching essential competencies, such as medical knowledge, patient care, communication, professionalism, procedural skills, teamwork, decision-making, and patient safety (Table 3). Scenario-based training often involved collaboration with other healthcare professions across 27 MECs (77%). Twenty-nine MECs (83%) reported using SBME in both formative and summative assessments. Twenty-seven MECs (77%) and 15 MECs (43%) reported implementing student and teacher satisfaction evaluation in SBME, respectively. All MECs (100%) reported teaching basic and advanced life support, endotracheal intubation, defibrillation, intravenous access, and intercostal drainage (Table 4). However, certain procedures, such as nail removal, skin traction, and strengthening exercises, were not consistently covered across all centers. SBME was predominantly teaching at both undergraduate (95%) and postgraduate (87%) levels.

**Table 3**

*Current Practice of Simulation-Based Education at Medical Education Centers*

<b>Simulation Center in MECs</b>	<b>Total (n = 35)</b>	<b>Small (n = 16)</b>	<b>Medium (n = 10)</b>	<b>Large (n = 9)</b>
<b>Topics using simulation-based medical education</b>				
Medical knowledge	34 (97%)	15 (94%)	10 (100%)	9 (100%)
Patient care	33 (94%)	15 (94%)	9 (90%)	9 (100%)
Communication skill	31 (89%)	14 (88%)	10 (100%)	7 (78%)
Breaking bad news	30 (86%)	14 (88%)	9 (90%)	7 (78%)
Professionalism	27 (77%)	13 (81%)	7 (70%)	7 (78%)
Leadership	30 (86%)	13 (81%)	9 (90%)	8 (89%)
Procedural skill	32 (91%)	14 (88%)	9 (90%)	9 (100%)
Teamwork	31 (89%)	14 (88%)	9 (90%)	8 (89%)
Decision-making	33 (94%)	15 (94%)	9 (90%)	9 (100%)
Patient safety	32 (91%)	14 (88%)	9 (90%)	9 (100%)
<b>Simulation-based medical education practice</b>				
Place, equipment and document preparation	34 (97%)	16 (100%)	9 (90%)	9 (100%)
Define learning outcomes	34 (97%)	16 (100%)	9 (90%)	9 (100%)
Simulation scenario	33 (94%)	14 (88%)	10 (100%)	9 (100%)
Scenario aligned with objective	32 (91%)	14 (88%)	9 (90%)	9 (100%)
Pre-brief	35 (100%)	16 (100%)	10 (100%)	9 (100%)
Debrief/feedback	35 (100%)	16 (100%)	10 (100%)	9 (100%)
Interprofessional collaboration	27 (77%)	12 (75%)	8 (80%)	7 (78%)
<b>Assessment</b>				
Formative assessment	29 (83%)	12 (75%)	9 (90%)	8 (89%)
Summative assessment	29 (83%)	12 (75%)	10 (100%)	7 (78%)
Student satisfaction evaluation	27 (77%)	12 (75%)	7 (70%)	8 (89%)
Teacher satisfaction evaluation	15 (43%)	6 (38%)	4 (40%)	5 (56%)

Note. Data are shown as n (%).

**Table 4**

*Current Practice of Simulation-Based Medical Education in Teaching Basic Procedural Skills in Medical Education Centers in Thailand*

<b>Basic Procedural Skills</b>	<b>Total (n = 35)</b>	<b>Small (n = 16)</b>	<b>Medium (n = 10)</b>	<b>Large (n = 9)</b>
Basic life support*	35 (100%)	16 (100%)	10 (100%)	9 (100%)
Patient care	35 (100%)	16 (100%)	10 (100%)	9 (100%)
Amniotomy	28 (80%)	15 (94%)	6 (60%)	7 (78%)
Anterior nasal packing*	34 (97%)	16 (100%)	9 (90%)	9 (100%)
Aspiration of skin, subcutaneous tissues	30 (86%)	15 (94%)	7 (70%)	8 (89%)
Capillary puncture	29 (83%)	15 (94%)	7 (70%)	7 (78%)
Defibrillation*	35 (100%)	16 (100%)	10 (100%)	9 (100%)
Endotracheal intubation*	35 (100%)	16 (100%)	10 (100%)	9 (100%)
Episiotomy	31 (89%)	15 (94%)	8 (80%)	8 (89%)
External splinting/slab*	34 (97%)	16 (100%)	9 (90%)	9 (100%)
FAST Ultrasound in trauma	31 (89%)	15 (94%)	8 (80%)	8 (89%)
First aid management of injured patient	29 (83%)	13 (87%)	8 (80%)	8 (89%)
Incision and drainage*	34 (97%)	16 (100%)	9 (90%)	9 (100%)
Needle aspiration of pneumothorax*	34 (97%)	16 (100%)	9 (90%)	9 (100%)
Injection	34 (97%)	16 (100%)	10 (100%)	8 (89%)
Intravenous fluid infusion*	35 (100%)	16 (100%)	10 (100%)	9 (100%)
Intercostal drainage	35 (100%)	16 (100%)	10 (100%)	9 (100%)
Local infiltration/digital nerve block	28 (80%)	15 (94%)	7 (70%)	6 (67%)
Lumbar puncture	32 (91%)	16 (100%)	9 (90%)	7 (78%)
Nasogastric intubation/Gastric lavage*	34 (97%)	16 (100%)	9 (90%)	9 (100%)
Neonatal resuscitation*	34 (97%)	16 (100%)	9 (90%)	9 (100%)
Normal labor*	34 (97%)	16 (100%)	9 (90%)	9 (100%)
PAP smear*	34 (97%)	16 (100%)	9 (90%)	9 (100%)
Radial arterial puncture for arterial blood gas	30 (86%)	16 (100%)	7 (70%)	7 (78%)
Removal of nail or nail fold	24 (69%)	16 (100%)	4 (40%)	4 (44%)
Skin traction of limbs	26 (74%)	14 (88%)	7 (70%)	5 (56%)
Strengthening and stretching exercise	23 (66%)	14 (88%)	4 (40%)	5 (56%)
Stump bandaging	32 (91%)	16 (100%)	9 (90%)	7 (78%)
Suture*	35 (100%)	16 (100%)	10 (100%)	9 (100%)
Urethral catheterization*	34 (97%)	16 (100%)	9 (90%)	9 (100%)
Vaginal packing	29 (83%)	15 (94%)	8 (80%)	6 (67%)
Venipuncture	33 (94%)	16 (100%)	9 (90%)	8 (89%)
Wound dressing*	34 (97%)	16 (100%)	9 (90%)	9 (100%)

Note. Data are shown as n (%).

## DISCUSSION

This study represents the current nationwide practice of simulation-based medical education across all Medical Education Centers in Thailand following the Thai Medical Council's 2020 competency revisions. The findings indicate that, although most centers have established policies, personnel, and facilities to support SBME, certain procedural skills require more comprehensive coverage to ensure students achieve the required competencies prior to graduation. Challenges related to SP banks, SP training systems, and training instructors and simulation technicians underscore the need for sustained institutional and national support for SBME.

This investigation was conducted within the context of the 2020 revision of the Medical Council of Thailand's licensing examination criteria. Compared with previous research, such as the Boonmak et al. (2020) study of 15 medical schools (only nine of which had simulation centers), this study provides a more comprehensive and updated perspective on the integration of simulation in clinical education. The findings demonstrate that most simulation centers are now equipped with adequate policies, personnel, facilities, and equipment to support simulation-based instruction, contrasting with earlier studies that reported insufficient funding (Bouthors et al., 2022; Elendu et al., 2024; Forristal et al., 2020; Lawaetz et al., 2023; Sawaya et al., 2021; Seethamraju et al., 2021) and resource-related barriers (Campbell et al., 2022; Lawaetz et al., 2023; Sawaya et al., 2021; Tranel et al., 2021). Nonetheless, small- and medium-sized centers frequently lack structured registries and formal training programs for standardized patients, indicating a need for system development. This is consistent with prior reports of technician shortages in 93% of Thai medical schools (Boonmak et al., 2022). In addition, a nationwide shortage of trained simulation educators (Campbell et al., 2022; Lawaetz et al., 2023; Sawaya et al., 2021; Tranel et al., 2021) and technicians persists (Ismail et al., 2024; Tellefson et al., 2025). The effectiveness of SBME relies on multidisciplinary teams, with simulation technicians playing a critical supporting role (Ismail et al., 2024; Tellefson et al., 2025). In response, Thailand has initiated the development of professional and qualification standards for simulation technicians within the health services sector to define nationally and internationally recognized competency levels, which is expected to increase interest in this profession.

SBME is now widely implemented across curricula in accordance with TMC standards, including the assessment of 15 procedural skills. This aligns with global evidence that simulation enhances both technical and non-technical competencies, such as clinical reasoning, communication, teamwork, and decision-making (Cook et al., 2012; Lamé & Dixon-Woods, 2018; Motola et al., 2013; Paige et al., 2018). Simulation-based learning has also been shown to improve procedural skill confidence (Nestel et al., 2011) and prevent skill decay (Higgins et al., 2020). All Medical Council competency domains—medical knowledge, patient care, communication, professionalism, leadership, procedural skills, teamwork, decision-making, and patient safety—are addressed through simulation (McGaghie et al., 2011). However, gaps remain in the teaching of several basic procedural skills required for graduation, including nail or nail fold removal, skin traction of limbs, and strengthening or stretching exercises. These deficiencies highlight priority areas for curriculum enhancement and further investment in simulation-based training across Thailand's medical education system.

A major strength of this study is that it represents the first nationwide assessment of SBME practices across all 35 medical simulation centers under the Ministry of Public Health using the updated 2020 TMC criteria. A key limitation is the reliance on self-reported data regarding SBME availability. The quality of SBME should therefore be continuously monitored and standardized to meet TMC requirements. Although the findings are most directly applicable to MEC settings, which differ from university-based medical schools, they provide important insights for national planning. Future studies should include a national survey combined with on-site evaluations to ensure quality and guide systematic improvement of SBME in all Thai medical simulation centers.

## CONCLUSION

Evaluating the current practice of SBME across Thailand's MECs provides valuable insights into areas needing improvement. Enhancing SBME resources, standardizing training programs, and expanding faculty development are critical steps toward strengthening the quality of medical education and improving clinical preparedness among future healthcare professionals.

**Conflict of interest statement:** The authors have no conflicts of interest to declare.

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**Appendix A:** Current Practice and Needs Assessment of SBME in MEC Questionnaire:

<https://forms.gle/DFQtYQWV1e2hJBZ7A>

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# Simulation Scenario for Nursing Teleconsultation in Well-Child Care

## Validation of a Rapid Cycle Deliberate Practice Approach

William C. Meschial, RN, PhD<sup>1</sup>; Grasiela F. Busnello, RN, PhD<sup>1</sup>; Lucineia Ferraz, RN, MS<sup>1</sup>; Alice M. Nespolo, RN, PhD<sup>2</sup>; Jouhanna C. Menegaz, RN, PhD<sup>1</sup>; Denise A. A. Zocche, RN, PhD<sup>1</sup>; Luciene M. S. Andrade, RN, PhD<sup>2</sup>

<sup>1</sup>Universidade do Estado de Santa Catarina, Chapecó, SC, Brazil

<sup>2</sup>Universidade Federal de Mato Grosso, Sinop, MT, Brazil

**Corresponding Author:** William Campo Meschial, [williameschial@yahoo.com.br](mailto:williameschial@yahoo.com.br)

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### SUMMARY

**Introduction:** Teleconsultation has solidified its role as an essential pillar in contemporary nursing, especially in well-child care, and demands effective training. However, the inherent complexity of teleconsultation competencies can hinder students' initial mastery when using traditional simulation scenarios.

**Methods:** This methodological study constructed and validated a Rapid Cycle Deliberate Practice (RCDP) scenario for simulation-based education in pediatric nursing teleconsultation. The RCDP was designed with three progressively complex scenarios, involving a professional actress and a realistic infant mannequin. Content validation was conducted by nine expert nurses following International Nursing Association for Clinical and Simulation Learning (INACSL) guidelines and analyzed using the Content Validity Index (CVI).

**Results:** Analysis of the RCDP scenario yielded an overall CVI of 0.98, with six out of seven sections achieving a CVI greater than 0.90. The specialists' expertise (88.88% with master's degrees, 100% with publication/research experience) corroborated the suitability of the content and the sequential approach. Incorporated suggestions and a pilot test further evaluated its applicability and initial effectiveness.

**Conclusions:** The design and content validation of this RCDP scenario offer an innovative and effective method for the gradual development of complex teleconsultation skills. This study suggests fragmenting training into progressively complex cycles optimizes competency acquisition and enhances the preparedness of future professionals for remote care.

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### INTRODUCTION

Telehealth has played a significant role in transforming both access to and quality of healthcare services worldwide. The exponential acceleration of Information and Communication Technologies (ICTs) has not only enabled remote care but also facilitated its integration into routine healthcare practices in countries with diverse socioeconomic contexts, such as the United States, Canada, and Saudi Arabia (Arnaert et al., 2022; Baalharith et al., 2022; Belber et al., 2021; Groom et al., 2021; Paloski et al., 2020). In Brazil, this evolution has been accompanied by fundamental regulatory advancements, notably the promulgation of Law No. 14,510/2022, which authorizes and regulates telehealth practice for all healthcare professionals, and Ministry of Health Ordinance No. 3,232/2024, which establishes the SUS Digital Program. These initiatives not only legitimize the expansion of telehealth but also point to a structural redefinition in the provision of care within the Unified Health System (SUS).

In this landscape, nursing teleconsultation plays a strategic role. Nurses, based on established protocols, can conduct remote consultations aimed at providing quality care, encompassing everything from initial assessment to telemonitoring and prevention (Lima et al., 2022). Child healthcare, which requires continuous monitoring of growth and development, has particularly benefited from teleconsultation. By overcoming barriers to in-person visits, telehealth offers a promising way to reduce infant morbidity and mortality and improve adherence to scheduled consultations (Zluhlan et al., 2023).

The increasing integration of teleconsultation into clinical practice makes it imperative for educational institutions to train nurses who can engage in this modality. Simulation-based education has become a consolidated pedagogical tool for developing clinical and non-clinical skills, preparing students for real-world practice in a safe environment (Pereira et al., 2021; Teles et al., 2020). Its application enhances communication, clinical reasoning, and decision-making (Escudero et al., 2022; Nadler et al., 2022).

However, simulation scenarios addressing teleconsultation, especially in complex areas like child healthcare, often require students to simultaneously manage multiple problems and make real-time decisions. This complexity can be excessively challenging for novice learners, compromising the effectiveness of the teaching-learning process (Escudero et al., 2022).

To optimize the learning of complex skills, Rapid Cycle Deliberate Practice (RCDP) emerges as a promising pedagogical approach. RCDP involves the repetition of tasks in short cycles, with immediate feedback and micro-debriefings, allowing learners to correct errors and progressively consolidate learning (Hunt et al., 2014; Peng & Schertzer, 2023). Recent scoping and systematic reviews associate RCDP with improved performance, knowledge retention, and self-confidence in simulation, particularly in life support training and clinical judgment development (Abelairas-Gómez et al., 2024; Assalin et al., 2023; De Souza et al., 2023; Ingalsbe et al., 2024).

Despite the growing number of publications on RCDP, most studies are conducted in hospital settings, especially resuscitation and invasive procedures, in high-income countries, and predominantly with physicians. There is a clear gap regarding the applicability of the approach in primary care contexts, in middle-income countries like Brazil, and with nursing students (Abelairas-Gómez et al., 2024; Assalin et al., 2023). The insufficient research on rapid cycle simulation for non-procedural situations, such as nursing teleconsultation in child healthcare, reinforces the relevance and originality of the present study.

This study aims to fill this gap by detailing the construction and content validation of an RCDP scenario for simulation-based education in pediatric nursing teleconsultation, with the goal of offering a rigorous and effective pedagogical tool that optimizes the acquisition of competencies by future nurses in this constantly evolving field.

## **METHODS**

This study employs a methodological approach for the construction and validation of a scenario for simulation-based education in pediatric nursing teleconsultation, utilizing the framework of Rapid Cycle Deliberate Practice (RCDP). Methodological studies are crucial in nursing as they involve the development, validation, and evaluation of instruments and methods that ensure reliable and applicable results (Polit & Beck, 2018).

### **Study Protocol**

The study was conducted in two phases: 1) the development of the scenario in RCDP format and its assessment instruments; and 2) the content validation of this scenario by experts.

## **Phase 1: Development of the Rapid Cycle Deliberate Practice Scenario**

The scenario's conception was based on an analysis of documents from the Brazilian Ministry of Health (Basic Care Notebook – Child Health, Child Health Card, Nursing Teleconsultation Guidance Guide) and an extensive review of the scientific literature on teleconsultation in child healthcare.

The central focus of this phase was the transition from a traditional simulation scenario to the RCDP format. Although the original scenario demonstrated robustness in initial validation, expert feedback highlighted the complexity of a single comprehensive scenario for novice learners. This insight guided the restructuring towards RCDP, an ideal strategy for segmenting the learning of complex skills into short, focused repetitions with immediate feedback (Hunt et al., 2014).

The RCDP scenario was designed to include three cycles of increasing complexity, addressing specific competencies of nursing teleconsultation in child healthcare:

- **Cycle 1:** Focus on fundamental communication, rapport building, and obtaining consent.
- **Cycle 2:** Directed collection of medical history, identification of main complaints, and development of an initial assessment.
- **Cycle 3:** Incorporation of complex aspects, such as detailed guidance on eating habits and sleep, identification of warning signs (e.g., dental caries), and the need for interdisciplinary referrals (e.g., nutritionist, dentist).

### *Teleconsultation Scenario*

A detailed clinical case of a 2-year-old patient, Enzo Andrey (fictitious name), accompanied by his mother, was used. To ensure high fidelity, a professional actress played the mother, and a reborn baby doll represented the child. To operationalize the pilot test, a pediatrics professor from another institution played the role of the mother in a simulated home environment, with the 'reborn baby' representing the child. The student participant engaged in the teleconsultation from an isolated computer cabin, mimicking a clinical telehealth environment. Microsoft Teams served as the communication platform.

After the briefing, the student operated independently in the cabin, while peers observed remotely from a separate classroom. The supervising instructor monitored the simulated encounter on Teams, providing feedback with the camera off, activating it solely for interventions. The debriefing occurred in the classroom with the student, the instructor, and the observing peer students, and the professor-actress joined remotely. This scenario was organized into sections based on INACSL recommendations: Preparation, Briefing, Overview, Scenario, Scenario Design/Progression, Debriefing, and Evaluation.

Learning objectives for each RCDP cycle were formulated based on Bloom's Taxonomy and the SMART (Specific, Measurable, Achievable, Relevant, Time-bound) criteria. A performance assessment instrument, in the form of a checklist, was developed to accompany the scenario, enabling observers to track participants' expected actions in each cycle.

## **Phase 2: Content Validation of the Rapid Cycle Deliberate Practice Scenario**

To evaluate the content validity of this scenario, we sought out specialists in child healthcare, simulation-based education, and/or telehealth. Following literature recommendations, we aimed to recruit between 6 and 20 specialists (Carreiro et al., 2021). Potential experts were identified using the advisors' contact network, complemented by the Snowball Technique. To be eligible, participants were required to be nurses who scored a minimum of 5 points on Lattes curricula, according to adapted Fehring criteria (Fehring, 1987), and completed the evaluation within the designated deadline.

Eligible specialists were contacted via email with a formal invitation to participate. Participants completed a sociodemographic and professional characterization instrument and questions related to

the adapted Fehring criteria. After providing electronic informed consent, specialists evaluated the RCDP scenario (PDF). The research is part of a project approved by the university's Research Ethics Committee Involving Human Beings. All participants provided free and informed consent, electronically signed.

Content validity of the scenario and each of its seven sections was evaluated using a four-point Likert scale for each item, where: (1) Item not relevant/representative; (2) Item needs major revision; (3) Item needs minor revision; (4) Item relevant/representative. Justifications and suggestions were optional.

### *Data Analysis*

Quantitative data were organized in Microsoft Excel and statistically processed in SPSS, version 28.0. Content validity was assessed using the Content Validity Index (CVI), calculated as the proportion of specialists who assigned a score of 3 or 4 to each item, section, and the global CVI. A CVI  $\geq 0.80$  was considered acceptable, with a preference for values above 0.90 in high complexity (Polit et al., 2007). Qualitative comments were analyzed individually for the incorporation of suggestions.

### **Pilot Testing**

Following expert evaluation of content validity and incorporation of changes, a pilot test of the RCDP scenario was conducted with nursing students as described above. The main objective of this test was to evaluate the practical applicability of the scenario in the educational environment and its initial effectiveness in promoting the development of skills in child healthcare teleconsultation.

## **RESULTS**

The scenario was meticulously developed with three cycles of increasing complexity, aiming for progressive improvement of students' skills. The final version of the validated scenario, with its detailed sections, learning objectives for each cycle, and the performance checklist, is available (Appendix A).

### **Characterization of Specialists**

The content validity of the scenario was evaluated by nine nurse specialists, rigorously selected using adapted Fehring criteria. The scores of these specialists, ranging from 7 to 14 points (mean  $9.4 \pm 3.84$ ), attested to their extensive experience. Of the nine specialists, eight held a master's degree, and two held a doctorate (one with an additional post-doctorate). Five master's theses and one doctoral dissertation focused on telehealth, child health, or simulation. Importantly, 100% of the specialists had already published or conducted research in these areas, with 55.56% having experience in more than one of the three disciplines. All specialists had at least one year of experience in the relevant areas.

Regarding sociodemographic characteristics, the majority (77.78%) were female, with an average age of 36.9 years. The average time since graduation was 13.89 years ( $\pm 7.67$ ), and the average time of experience in the study areas was 6.0 years ( $\pm 3.81$ ). The most prevalent area of experience was simulation (88.89%), followed by child health (44.44%). These data reinforce the qualification and appropriate profile of the expert panel.

### **Content Validity of the RCDP Scenario**

The global CVI of the scenario reached a remarkable 0.98, indicating excellent content validity. Similarly, six of the seven individual sections obtained a CVI greater than 0.90. The only section with

a slightly lower, but still high, CVI was the Debriefing section, with 0.89. These scores demonstrate strong expert consensus on the relevance and appropriateness of the RCDP scenario components for the proposed training.

The qualitative suggestions from the specialists were carefully analyzed, resulting in significant adjustments to enhance the final version of the RCDP scenario. Notable accepted suggestions include:

- **Estimated Time:** The total duration of the simulation was revised, being reduced from two hours to one hour, a crucial adjustment to ensure pedagogical feasibility and engagement.
- **Professional Competencies:** Inclusion of "time management," recognizing its importance in teleconsultation.
- **Clinical Case:** Addition of information about the patient being an only child, contextualizing the family interaction.
- **Performance Checklist:** Inclusion of an item on "guidance on screen time use for age," relevant in contemporary child health.
- **Debriefing:** The recommendation to specify a debriefing methodology, such as GIBBS, was incorporated, providing greater methodological rigor.

Some expert suggestions were not incorporated to preserve the scenario's clarity and fidelity. These included adding excessive objectives to the Overview section and substantially reducing information in the actress's script, both of which could have compromised the scenario's effectiveness for novice learners. The final validated version of the RCDP scenario reflects this iterative refinement process, balancing expert feedback with pedagogical considerations.

## **Pilot Test**

Initial observations from pilot testing with nursing students supported the scenario's practical applicability. The Microsoft Teams platform proved stable, enabling fluid communication. Minor adaptations enhanced interaction fidelity and replicability, like explicit guidance for 'reborn baby' camera positioning.

Students reported high satisfaction with the progressively complex virtual scenarios and debriefing. However, students perceived the real-time RCDP corrections delivered online as disruptive to their thought processes and line of reasoning. They suggested delivering coaching interventions as feedback at the end of each cycle, alongside a comprehensive final debriefing to integrate all learning points.

## **DISCUSSION**

The validation of simulation-based education scenarios is a crucial step to ensure pedagogical effectiveness and clinical relevance. This study achieved a global CVI of 0.98 for a Rapid Cycle Deliberate Practice (RCDP) scenario focused on nursing teleconsultation in child healthcare. With six of seven scenario sections obtaining a CVI greater than 0.90, these results support the content validity and methodological rigor of the scenario's construction. This aligns with the premise that simulation effectiveness is linked to its organization and quality of design (Santana et al., 2021).

The RCDP approach stands out by incorporating principles of progressive mastery and repetition guided by immediate feedback—characteristics reported as superior in several recent studies when compared to traditional simulation (De Souza et al., 2023; Peng & Schertzer, 2023). International scoping and systematic reviews reinforce its potential for significant gains in the learning of communication skills, clinical judgment, leadership, and procedures, in addition to positively impacting student confidence and safety (Abelairas-Gómez et al., 2024; Assalin et al., 2023; Ingalsbe et al., 2024). Key differentiators include scenario fragmentation, micro-focused instructor intervention, a low-risk environment for errors, and immediate application of feedback. All these elements favor mastery of complex competencies, reducing cognitive overload (Peng & Schertzer, 2023).

However, most investigations focus on hospital settings, BLS/ALS training, and physician education (Abelairas-Gómez et al., 2024; Assalin et al., 2023), with limited exploration in primary care nursing practices and health promotion, such as teleconsultation in child healthcare. Our study addresses this gap by developing and establishing content validity for an RCDP scenario in this underexplored domain, responding to calls for expanding the contexts of rapid cycle simulation.

The qualified expert panel and the iterative refinement methodology contribute to the validity and replicability potential of the scenario (Nascimento et al., 2021). Successive adjustments, such as detailing the debriefing method, including time management, and adapting competencies to the Brazilian reality, make the instrument more robust for both national and international contexts.

This study addresses an identified gap by developing and establishing content validity for an RCDP scenario tailored to teleconsultation in child healthcare. The Brazilian context – characterized by geographic barriers, healthcare access disparities, and the need for innovative training approaches – suggests this model may have applicability in other middle-income countries facing similar challenges.

## Limitations

This study has several limitations. Longitudinal research is needed to evaluate the sustained effects of RCDP on clinical competence, particularly in domains where mastery depends on complex reasoning and digital health communication skills (Abelairas-Gómez et al., 2024). Future studies should compare RCDP effectiveness across different learner profiles and institutional contexts, as intensive scenario fragmentation may not benefit all learners equally (Peng & Schertzer, 2023). Additionally, research is needed to assess RCDP's impact on actual clinical practice using objective measures, to test adapted versions of the method, and to explore integration of technologies such as virtual reality to enhance remote care training (Abelairas-Gómez et al., 2024; De Souza et al., 2023). In addition, student insights on how to improve the delivery of feedback as part of the RCDP will inform a subsequent study evaluating the scenario's practical impact on student satisfaction, self-confidence, and competencies.

## CONCLUSION

This study addresses a significant gap in the literature by constructing and validating a Rapid Cycle Deliberate Practice scenario for pediatric nursing teleconsultation training. Expert validation yielded a global Content Validity Index of 0.98, supporting the scenario's content validity and appropriateness for educational use. This scenario provides a structured, progressive approach to developing teleconsultation skills and may contribute to preparing nurses for the increasing demand for remote pediatric care.

**Conflict of interest statement:** The authors have no conflicts of interest to declare.

**Appendix A:** *Final version of the validated scenario.* Link: <https://docs.google.com/document/d/1cpRXzi-H0hbbFib2oQ43GfiyBMNqp1iF/edit?usp=sharing&oid=105749295989435703169&rtpof=true&sd=true>

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# Design, Development, Implementation, and Evaluation of Healthcare Simulation Experiences for Elementary Students to Expose Them to Future Rural Healthcare Careers

Kevin R. Glover, PhD<sup>1</sup>; Katherine Layton, MD<sup>2</sup>; Kristen A. Briggs, MEd<sup>3</sup>; Josee Wiedel, MSN<sup>4</sup>; Christina Harper, PhD<sup>5</sup>; Rachel N. Burton, MS<sup>1</sup>; Zack Tyndall, MBA<sup>1</sup>; Kathryn Fiddler, DNP<sup>6</sup>

<sup>1</sup>Richard A. Henson Medical Simulation Center, Salisbury University, Salisbury, MD

<sup>2</sup>Undergraduate Medical Education, TidalHealth Peninsula Regional, Salisbury, MD

<sup>3</sup>Thinking and Doing Program, Wicomico County Public Schools, Salisbury, MD

<sup>4</sup>Women's & Children's Division, TidalHealth Peninsula Regional, Salisbury, MD

<sup>5</sup>Outdoor Education Leadership, Salisbury University, Salisbury, MD

<sup>6</sup>Population Health, TidalHealth Peninsula Regional, Salisbury, MD

**Corresponding Author:** Kevin Glover, [krglover@salisbury.edu](mailto:krglover@salisbury.edu)

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## ABSTRACT

**Introduction:** Exposing rural elementary school students to healthcare careers has been advocated as an important workforce development initiative for decades. However, descriptions of such educational initiatives are scarce, and little is known about the development, implementation, and evaluation of such programs.

**Methods:** A rural interdisciplinary team used an iterative instructional design process to develop, implement, and evaluate five 1-hour immersive healthcare simulation activities at a university medical simulation center. The activities were designed to help augment the local school district's "Medical Marvels" curricular unit for 314 third, fourth, and fifth-grade gifted and talented students.

**Results:** A qualitative analysis of student thank you notes received after the program (n = 249) revealed that the words "enjoy" (n = 131), "fun" (n = 120), "interesting" (n = 81), "cool" (n = 69), "loved" (n = 47), "amazing" (n = 20), and "awesome" (n = 12) were associated with "learn", "learned", or "learning" (n = 415).

**Conclusions:** Early socialization of underexposed youth in the health sciences can have a substantial impact on their decision to pursue a health professional career, resulting in an increased pipeline of clinical practitioners returning to their local rural communities. The thank you notes received after the "Medical Marvels" activities indicated that the program was well received and may have been a transformational experience for some students.

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## INTRODUCTION

Declining student interest in the sciences is a concern for economically disadvantaged rural communities that are challenged with recruiting and sustaining an adequate healthcare workforce (Bunce et al., 2009; Daniels et al., 2007; Valla & Williams, 2012). Communities with health professional shortages have higher rates of chronic conditions and shorter life expectancy due to inadequate access to medical and hospital services (Daniels et al., 2007). It has been suggested that people with rural roots who also do part of their health professional training in rural areas are more likely to select rural work locations (Daniels et al., 2007; MacQueen et al., 2017). Early socialization of underexposed youth in the health sciences can have a substantial impact on their decision to pursue a career in the health professions, resulting in an increased pipeline of clinical practitioners back into

their local rural communities (Bunce et al., 2009; Valla & Williams, 2012). However, even though exposing rural elementary school students to healthcare careers has been advocated as an important workforce development initiative for decades, descriptions of such educational initiatives are scarce, and little is known about the prevalence and design of such programs (Institute of Medicine, 2005; Jopson et al., 2020). In a scoping review, Jopson et al. (2020) could only identify five publications that described healthcare pathway programs for K-5 students in the US between 1970 and 2017.

## **METHODS**

### **Program Design and Implementation**

A hands-on experiential healthcare learning program was iteratively designed and developed over a six-month period by an interdisciplinary team. The development team included a university-based simulation center director (Instructional Designer), a technology coordinator (Paramedic), a standardized patient coordinator (Exercise Physiologist), four elementary public-school teachers, a pediatric hospitalist, a VP of Public Health, a clinical nurse educator from the local community hospital, and a university faculty member specializing in outdoor leadership.

The program was then implemented by a rural university's medical simulation center to help augment a local school district's "Medical Marvels" curricular unit for 314 students enrolled in the gifted and talented elementary school program. The school district is in a federally designated health professional shortage area.

### **Experiential Learning Program**

During the 5-day simulation-based program, groups of 12 to 15 students rotated through five 1-hour immersive activities. Prior to participating in the experiential learning program, parental consent was received, as well as permission to use participating students' photos, videos, and voices for education or marketing purposes. In each activity, students identified, treated, and discussed the probable cause of various disease states using different simulation-based technologies. The five sessions are described below.

In the respiratory session, students worked with a standardized patient wearing a prosthetic lung auscultation simulator to explore the potential causes of emphysema. Then, they walked through treating a pediatric patient hospitalized due to an asthma exacerbation using a robotic pediatric manikin. After initiating a nebulizer treatment, students questioned the simulated grandmother to determine the cause of the asthma attack.

In the virtual anatomy lab session, students explored, identified, and dissected the organs of the digestive and urinary systems on virtual cadavers.

The combined cardiovascular and nervous system session focused on exploring the symptomatic differences between angina and a stroke using a robotic patient manikin.

In the simulated wilderness activity, students learned how to treat a variety of musculoskeletal injuries simulated by standardized patients. This included using found materials in nature to create splints and slings, as well as how to apply direct pressure to control a bleed.

In the simulated kitchen session, students learned how to recognize anaphylaxis and use an Epi-Pen on a pediatric robotic patient manikin. They also learned how to identify potential hazards to children and ways to prevent accidents by using electrical outlet covers and cabinet locks. Finally, students learned how to recognize the signs and symptoms of a choking infant and practiced properly dislodging the obstruction with an infant task trainer.

In addition to the formal simulation activities aligned with the school district's curriculum, a broader range of health sciences career pathways was discussed, such as certified healthcare simulation educator, instructional designer, and health simulation operations manager. To reinforce

the diversity of careers in simulation-based health sciences, students received a 52-card deck after each day's activities, with each card showcasing a different profession (Figure 1).

Figure 1

52-Cards of Health Science Careers



## RESULTS

### Student Demographics

A total of 290 students from 12 elementary schools participated in the program, with 128 in third grade (44%), 95 in fourth grade (33%), and 67 in fifth grade (23%). The group was 56% male and 44% female. According to school district demographic data, participants identified as White (62%), Asian (12%), Black (9%), Mixed Race (9%), and Hispanic (8%) (*Wicomico County Public Elementary School Demographics*, n.d.). Twenty-four students from the original cohort of 314 (7.6%) did not participate due to opting out, absence on the day of the program, or no longer being enrolled in the district's gifted program.

### Facilitator Demographics

Thirty-two facilitators led the program activities. The majority were female (75%, n=24), predominantly White with one Black facilitator. Male facilitators (25%, n=7) included six White, one Black, and one Hispanic individual. Facilitators came from diverse professional backgrounds: six nurses, five elementary school teachers, five simulation experts, four university faculty members, four standardized patients, two medical doctors, two exercise science students, one physical therapy student, and one respiratory therapy student.

## Thank-you Note Analysis

After the program, 249 (86%) students who participated in the program voluntarily sent thank-you notes to the Simulation Center. The text from these notes, except for any identifying information, was transcribed into NVivo Plus software and analyzed by a single researcher (K.R.G.).

The first cycle of analysis distilled the data into core topical units using deductive and inductive values that emerge during transcription. Codes were added, modified, and/or eliminated as data was analyzed. This first cycle revealed that the most predominant descriptive words “enjoy” ( $n = 131$ ), “fun” ( $n = 120$ ), “interesting” ( $n = 81$ ), “cool” ( $n = 69$ ), “loved” ( $n = 47$ ), “amazing” ( $n = 20$ ), and “awesome” ( $n = 12$ ) were associated with “learn”, “learned”, or “learning” ( $n = 415$ , 86%).

The second cycle of analysis used axial coding that synthesized the data from the first cycle coding into broader, more encompassing categories aligned with the descriptive words associated with learning. These dominant themes included high physical and psychological fidelity of the experiences, active learning methodology, and relevant and relatable activities. For example, one student stated, “Thank you for helping us learn more about the medical field and allowing us the opportunity to have a hands-on experience...I learned how to do a splint and what a splint even is. I also learned how to help a choking baby and what to do in that situation. I am glad I was able to practice this on one of the manikin babies, so I will know what to do if I am ever in this situation.”

In their thank-you notes, students mentioned their favorite program sessions 541 times by name. The wilderness session was mentioned most frequently ( $n = 143$ , 26%), followed by the simulated kitchen ( $n = 116$ , 21%), respiratory system ( $n = 107$ , 20%), digestive and urinary anatomy session ( $n = 95$ , 18%), and cardiovascular and nervous systems ( $n = 80$ , 15%).

## DISCUSSION

Twenty-five years ago, Moreno and Tharp (1999) stated that the largest leak in the rural medical careers pipeline is located next to the intake valve (Moreno & Tharp, 1999). Sixteen years ago, the National Rural Health Association (2006) suggested that a longitudinal pipeline exposing rural youth to healthcare career possibilities begins in elementary school. More recently, in an exploratory mixed-method study, Jopson et al. (2020) reviewed 965 relevant abstracts that described US programs that encouraged rural K-16 students to pursue healthcare careers. Of those, the authors reviewed 175 full-text articles, which resulted in 39 that met their inclusion criteria for data to be extracted for descriptive analysis. Their analysis could only identify five publications that described healthcare pathway programs for K-5 students in the US between 1970 and 2017, none of which described hands-on, simulation-based, experiential learning (Jopson et al., 2020).

We believe that this is the first article describing the development and implementation of an interdisciplinary, simulation-based program aimed at immersing rural elementary students in 5 relatable healthcare activities that were linked to a local school district’s “Medical Marvels” curriculum. The analysis of unsolicited student feedback represents some initial evidence that the implementation of the program was well received, and the findings are an important contribution to the literature related to the recruitment of healthcare providers in underserved rural areas. The program will be repeated in 2027 for the next cohort of third through fifth-grade learners, and plans are in place to include a more robust outcomes analysis of pre-post measures of changes in awareness, interest, knowledge, or intent to pursue healthcare careers. Further, we are actively pursuing a way to follow each cohort of grade 3-5 students through scaffolded grade 6-9 and 10-12 simulation-based programs to longitudinally assess grade 3-12 student retention and individual undergraduate enrollment focused on a healthcare career path.

## CONCLUSIONS

The “Medical Marvels” simulation-based experience was designed to be an enjoyable, hands-on, inquiry-based, immersive healthcare experience for underexposed third through fifth-grade students in a rural area. The program took place in a relevant and relatable context with diverse healthcare clinical professional mentors and faculty facilitators from the students’ local community. Early socialization of underexposed rural students to health sciences can influence their decision to pursue a healthcare career. The findings will be used to continually improve the development of future simulation-based healthcare workforce pipeline initiatives.

**Conflict of interest statement:** The authors have no conflicts of interest to declare.

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# Collaborative Care in Action: Early Reflections from a Simulation Event on Complex Pain Management

Heather Adams PhD, LAT, ATC, CHSE<sup>1</sup>; John Kiesel PT, DPT, PhD, CHSE<sup>1</sup>; Brandi Andreae OTD, MS, OTR, CHSE<sup>1</sup>; Kailee Burdick DNP, RN, CNE, CHSE<sup>2</sup>; Chelsea Elwood DMS, MS, PA-C<sup>1</sup>; JoEllen Henson DHSc, MSW, LSW, MEd<sup>3</sup>; Laura Livingston BSN, RN, CHSE<sup>2</sup>; Nicole Mix PT, DPT, PhD, CHSE<sup>1</sup>

<sup>1</sup>Department of Applied Medicine and Rehabilitation, Indiana State University, Terre Haute, IN

<sup>2</sup>Rural Health Innovation Collaborative Simulation Center, Terre Haute, IN

<sup>3</sup>Department of Social Work, Indiana State University, Terre Haute, IN

**Corresponding Author:** Heather Adams, [heather.adams@indstate.edu](mailto:heather.adams@indstate.edu)

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## ABSTRACT

Chronic pain remains a public health concern, often requiring coordinated, interdisciplinary care for effective management. Despite the prevalence of pain, prelicensure healthcare education has a limited focus on preparing learners to manage pain via interprofessional collaboration. This manuscript describes the design, implementation, and early reflections from a simulation-based interprofessional education (IPE) event focused on interdisciplinary pain care. The event involved 95 students from five health professions who worked in interdisciplinary teams (IDT) to manage a simulated patient experiencing chronic pain following a work-related injury and surgical intervention.

Grounded in constructivist and social learning theories, the simulation employed an interdisciplinary pain clinic model, incorporating structured prebriefing, profession-specific assessment simulations, a collaborative care conference, and a student-led debrief. Learning objectives for the event emphasized interprofessional competencies related to communication, understanding roles, and patient-centered care. Learner active participation and peer observation were used as instructional methods to maximize learning while addressing common resource constraints.

Students reported that the event enhanced their understanding of collaborative care and the specific roles of different professions in pain management. Feedback emphasized the effectiveness of the realistic environment, including the use of SP methodology, in preparing them for the complexities of managing chronic pain. The high-fidelity, interdisciplinary pain clinic model facilitated meaningful participation in collaborative pain management. Its scalable and practical design demonstrates the potential for broader adoption in healthcare education to foster interprofessional collaboration and prepare learners for best practice clinical pain care.

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## INTRODUCTION

Chronic pain is a costly public health burden in the United States and globally (Rice et al., 2015). As many as 24.3% of U.S. adults report experiencing chronic pain in the past 3 months, making pain the most common reason for seeking medical care (Lucas & Sohi, 2024; St Sauver et al., 2012; United States Department of Health and Human Services, 2025). The complex, multidimensional nature of chronic pain often leads to unmet needs among those most affected (Cohen et al., 2021), including treatment for mental health disorders, opioid medication management, and support with social integration (Baker et al., 2024; Bannon et al., 2021; De La Rosa et al., 2024). The current U.S. healthcare system can lead to fragmented care, placing individuals with chronic pain at increased risk of mismanagement. This risk is especially pronounced in rural and non-metropolitan

areas, where access to healthcare professionals is limited, despite a higher prevalence of disabling chronic pain (Lucas & Sohi, 2024; Thomas et al., 2024).

Despite frequently encountering patients in pain, healthcare providers remain underprepared to manage it, according to a 2011 U.S. Institute of Medicine report (Institute of Medicine, 2011). Effective care for individuals with chronic pain requires a range of knowledge and skills, including a collaborative, interprofessional approach to assessment and treatment planning. However, prelicensure healthcare education often lacks instruction on the value of interdisciplinary teamwork, as training programs remain siloed, particularly in professional schools (Hodgson et al., 2019). Improving the pain education delivered to prelicensure healthcare students is one recommended strategy to address pain as a public health priority by augmenting provider preparedness (National Institutes of Health & Institute of Medicine, 2022).

Although recommended interprofessional pain education curricula and core competencies exist, their integration into prelicensure training remains limited. Simulation-based education offers a promising strategy to bridge this gap and enhance interprofessional learning in pain management (Fishman et al., 2013; Gordon et al., 2018; International Association for the Study of Pain, 2018). It provides a safe, immersive environment for learners from diverse healthcare backgrounds to engage in realistic, team-based clinical scenarios (Al-Elq, 2010; Armstrong et al., 2024; Durham & Alden, 2008). Research supports the use of interprofessional curricula to improve students' attitudes and understanding of collaborative roles (Saragih et al., 2024; Spaulding et al., 2019).

However, scaling simulation for large interprofessional cohorts presents challenges, particularly due to the significant resources required. As a result, pain-focused interprofessional education (IPE) events often rely on paper-based case discussions rather than high-fidelity simulations due to resource limitations (Garwood et al., 2022; Institute of Medicine, 2015; Langford et al., 2019; Watt-Watson et al., 2018). Overcoming these barriers is essential to fully leverage simulation's potential in preparing future healthcare professionals to manage the complexities of chronic pain.

In response to the challenges of implementation of interprofessional simulations, the following interdisciplinary simulation event was designed and rooted in social and constructivist learning theories. This manuscript outlines the structure of the IPE event, which used a complex chronic pain case to provide a realistic context for practicing interprofessional collaboration within an interdisciplinary pain clinic setting.

While the formal learning objectives for this event centered on developing interprofessional collaborative practice competencies, the chronic pain case was deliberately chosen as the vehicle for this experience. Chronic pain inherently requires integrated, team-based care, making it an ideal context for students to observe and discuss how different healthcare professions approach assessment, treatment, and patient management. Although providing optimal pain management itself was not a direct objective, the scenario organically promoted learning in this area by exposing students to the diverse perspectives and decision-making process involved in chronic pain care.

## **EVENT PLANING AND DESIGN**

Planning for the simulation event began roughly 10 months before the scheduled event date, with faculty and simulation center staff meeting monthly to organize and develop the event. The simulation event was designed to manage a simulated patient (SP) with chronic pain using an interdisciplinary pain clinic model. Simulation staff and faculty from occupational therapy (OT), physical therapy (PT), athletic training (AT), physician assistant studies (PA), and social work (SW) collaboratively developed the case. The case involved a patient experiencing chronic pain following a worksite injury and subsequent surgical procedure. Physical limitations, disruptions to daily activities, household tasks, and work, symptoms of mood disorder, and a history of substance abuse were incorporated into the patient case. The simulated patient was a firefighter, necessitating high

functional capabilities to return to unrestricted duty. The complexity of the case encouraged students to collaborate and determine each team member's contribution to the holistic care plan.

The event was designed with the following learning objectives in mind, ensuring a comprehensive approach to interprofessional education in pain management. The event's learning objectives focused on interprofessional collaborative practice, and the chronic pain scenario served as the context for applying these competencies in a realistic, team-based case.

1. Work with individuals of other professions to maintain a climate of mutual respect and shared values.
2. Use the knowledge of one's own role and those of other professions to appropriately assess and address the health needs of patients and to promote and advance the health of populations.
3. Communicate with patients, families, communities, and professionals in health and other fields in a responsive and responsible manner that supports a team approach to the promotion and maintenance of health and the prevention and treatment of disease.
4. Apply relationship-building values and the principles of team dynamics to perform effectively in different team roles to plan, deliver, and evaluate patient/population-centered care and population health programs and policies that are safe, timely, efficient, effective, and equitable.

## **FORMATION OF INTERDISCIPLINARY TEAMS**

A total of 95 students from five health professions participated in this interprofessional collaborative care simulated learning event. The participants included 20 OT, 32 PT, 6 AT, 28 PA, and 9 SW students. All students had prior simulation and clinical experiences.

Prior to the event, students were divided into six interdisciplinary teams (IDT), ensuring representation from all professions in each group. Each group had approximately 15 students. Three IDTs were scheduled to engage in the interprofessional learning event each day. Each student was required to participate in the event for eight hours in a single day. This approach allowed the team to leverage available resources effectively, although it necessitated two days of facilitation.

## **RESOURCE AND PERSONNEL NEEDS**

The simulation event was held at a local healthcare education center, which included a simulated clinic space and several classrooms. Each exam room was equipped with cameras and microphones for remote viewing, allowing students to observe in real-time from a classroom.

A total of six individuals facilitated the event each day, including three faculty members and three simulation staff. One faculty member and one simulation staff member were assigned to each of the three IDT rooms. Additionally, three simulated patients (SPs) participated daily, with one SP assigned to each IDT. Each SP discussed their needs and challenges as outlined in the case notes with their assigned IDT. With additional resources, expanding the number of facilitators could introduce more diverse perspectives and further enrich the student learning experience.

## **SIMULATION EVENT TIMELINE**

An overview of the day's timeline is provided in Appendix A. All faculty facilitators were provided with this timeline to ensure consistency across rooms. Below you will find more detailed descriptions of each session.

### **Student Arrival and Prebriefing**

Upon arrival, students were divided into classrooms based on IDT group assignments. They completed a 60-minute prebrief session, which included introductions and a group discussion about

each discipline's roles and responsibilities, with a focus on each profession's perspective on pain management. Facilitators provided objectives and instructions at the beginning of the prebrief session, but students were tasked with leading the discussion based on their assigned tasks.

### **Morning Simulation Sessions**

Following the prebrief group discussion, facilitators briefed all students on the simulation schedule and objectives for the assessment simulations. The facilitators then randomly selected one student from each discipline to participate in the assigned assessment simulations, informing selected students just before the start of each simulation (see the schedule below). Time limitations for all assessment simulations were determined based on faculty guidance and established best practices. Non-selected students observed remotely from the classroom with the rest of their IDT. Students were encouraged to engage in a collaborative discussion with their IDT and utilize the information obtained from each assessment to strategize subsequent encounters with the SP. The IDT also collaborated for ten minutes prior to the AT, PT, and OT simulation to develop a logical plan for their co-evaluation. Below is the simulation schedule:

1. PA Assessment (1 PA student) – 20 minutes
2. SW Assessment (1 SW student) – 60 minutes
3. AT, PT, OT Co-Assessment (1 AT, 1 PT, 1 OT student) – 75 minutes

### **Afternoon Collaborative Care Conference**

After lunch, students met in their IDT for a 60-minute collaborative care conference. Facilitators provided objectives for the conference around establishing goals related to pain management, improved function, quality of life, and creating a well-defined plan of care that incorporated all disciplines. Students independently facilitated their group discussion after receiving verbal objectives. The video conferencing platform Zoom was utilized in each classroom, allowing facilitators to observe the IDT's discussion from a separate room.

### **Care Plan Presentation, Debrief, and Assessment**

At the end of the care conference, one student from each discipline was randomly selected to present their IDT's plan of care to the SP, with preference given to those who had not participated in the assessment simulations. This simulation took place in a conference room and was recorded, allowing non-participating students to observe from the classroom. Faculty watched remotely, in a separate space from the students.

The day concluded with a 60-minute group debrief amongst each IDT. The session was guided by an adapted version of an interprofessional debriefing guide developed by the University of Kansas Medical Center (University of Kansas Medical Center, n.d.). To promote open dialogue and interprofessional engagement, students were instructed to sit in a circle and avoid sitting next to peers from their own discipline. After receiving session objectives, discussion instructions, and a debriefing question guide, students were encouraged to facilitate the conversation independently, with faculty and staff available for support if needed. This session emphasized the importance of interprofessional collaborative practice, including teamwork, effective communication, and understanding the roles and responsibilities of different healthcare professionals. Additionally, the debrief discussion covered approaches to managing chronic pain, with a focus on mental health, quality of life, and substance use concerns.

Following the debrief session, both quantitative and qualitative data were collected through a post-event survey that assessed learning outcomes and student perceptions of the simulation event. Qualitative comments and feedback were positive, noting improved clarity of professional roles, stronger appreciation for team-based decision-making, and improved confidence in communicating

within an interdisciplinary pain-management context. Data collection is planned to continue with a subsequent cohort, and quantitative analysis will be conducted after all data is gathered, with results to be reported in future manuscripts.

## **DISCUSSION OF EDUCATIONAL ADVANTAGE**

The simulation-based learning event was designed to provide healthcare students with a realistic opportunity to collaboratively evaluate and plan treatment for a patient experiencing chronic pain. To support this goal, the simulation design incorporated simulated patients as the selected modality, enhancing authenticity and reinforcing learning objectives focused on compassionate care and empathy. The event structure included a prebrief, the simulation activity, and student-led debriefings, providing a comprehensive learning experience. The event was grounded in a simulated interdisciplinary pain clinic, a best-practice clinical model to treat complex pain (Gatchel et al., 2014). This model aligns with current standards in clinical care and provides an ideal context for fostering interprofessional communication and collaboration, skills that are often underdeveloped in traditional healthcare education (Hodgson et al., 2019). Given that many students have limited exposure to this model during their clinical training, the event served as a valuable supplement to their educational experience.

General feedback from students supported the use of the interdisciplinary pain clinic model for the simulation event. Students found the patient case and setting realistic and appreciated the safe environment that encouraged peer engagement. Students viewed the experience as distinct from other IPE simulations or clinical opportunities, highlighting the relevance of this event to real-world practice.

The educational event design was informed by constructivist learning theory and Bandura's social learning theory, emphasizing learning through experience, observation, and reflection (Bandura, 1976; Dieckmann, 2009; Taylor & Hamdy, 2013). To address common challenges in interprofessional simulation, particularly scalability and resource limitations, not all students participated directly in the simulation. Instead, some students observed their peers, enabling them to model effective behaviors and critically reflect on team dynamics, communication strategies, and clinical decision-making. The simulation structure preserved the educational value of the experience while enabling broader participation without requiring extra resources.

During the debrief, faculty identified a consistent theme- students valued the opportunity to witness how other professionals approach patient care, especially during initial assessments. The interprofessional event enhanced students' understanding of the capabilities and limitations of various disciplines and fostered greater respect for the roles each profession plays in collaborative care. Student reflections on their assigned roles, either as active participants or observers, varied. Some students expressed a preference for direct engagement with the SP, while others valued the observer role, appreciating its lower-pressure environment, which allowed them to focus more deeply on team dynamics, interprofessional communication, and clinical reasoning without the added demands of a performance-based role.

The interprofessional simulation event provided significant educational value in bringing together students from five healthcare disciplines to manage an individual with chronic pain. Students engaged in collaborative learning, fostering their understanding of each profession's contributions to care while developing teamwork, communication, empathy, and patient-centered care skills. This event has several limitations, including being conducted at a single site with students from only one university. In addition, the event lacked representation from psychologists, a common inclusion in interdisciplinary pain clinics (Brecht et al., 2020). Despite these limitations, the event highlighted the value and importance of interdisciplinary approaches to managing chronic pain. The absence of certain disciplines, including psychology and nutrition/wellness, emerged as a key discussion point during the debrief, particularly when considering additional professional perspectives that could enhance patient care.

The simulation provided a high-fidelity learning environment, allowing students an opportunity to experience the nuances and challenges of collaborative pain management in a controlled setting. The simulation-based event design is scalable and practical, relying primarily on standard simulation equipment and faculty coordination. It effectively delivers educational outcomes that are difficult to achieve through traditional didactic methods. The simulation-based event demonstrates potential for adaptation across various healthcare education programs to support collaborative management of patients with multifaceted pain. The success of this interprofessional education event in fostering authentic collaboration and enthusiasm supports its continued implementation and expansion as an effective instructional strategy to prepare future healthcare providers for the collaborative realities of best practice clinical pain management.

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## Appendix A

### Simulation Day Schedule

<b>Time</b>	<b>Tasks</b>
<b>7:30 AM</b>	<b>Faculty Facilitators Arrive</b> Sim staff reviews each facilitator's responsibilities and room assignments.
<b>7:45 AM</b>	<b>Students Arrive</b> Sim center staff checks students in and directs them to their assigned classroom.
<b>8:00-9:00 AM</b>	<b>Pre-Work</b> Students work within their assigned IDT to complete pre-work activities. <ul style="list-style-type: none"> <li>• Student introductions</li> <li>• Introduction to interdisciplinary pain clinic setting</li> <li>• Discussion of profession, responsibilities, and each discipline's contributions to chronic pain management.</li> </ul>
<b>9:00-9:15 AM</b>	<b>Prebriefing</b> Facilitators read the simulation and observer prebriefing scripts to students.
<b>9:15-9:35 AM</b>	<b>PA Assessment</b> One (1) PA student from each IDT randomly selected to engage directly with SP to complete an intake assessment.
<b>9:35-10:35 AM</b>	<b>Social Work</b> One (1) SW student from each IDT randomly selected to engage directly with SP to complete an intake assessment.
<b>10:35 AM-12:00 PM</b>	<b>Co-Evaluation</b> One (1) PT, one (1) OT, and one (1) AT student from each IDT randomly selected to engage directly with SP to complete an intake assessment collaboratively. Students engaged in simulation had 10 minutes to formulate an evaluation plan and 75 minutes with the SP.
<b>12:00-1:00 PM</b>	<b>LUNCH</b>
<b>1:00-2:00 PM</b>	<b>Care Conference</b> Each IDT works collaboratively to develop goals and care plan that will be presented to the patient.
<b>2:00-2:30 PM</b>	<b>Plan of Care Presentation</b> One (1) student from each discipline (PA, SW, PT, OT, AT) in each IDT randomly selected to engage directly with SP to present their plan of care for the patient, based on intake information collected from the assessments completed in the morning.
<b>2:30-3:30 PM</b>	<b>Debrief</b> Students engage in debrief with the other students assigned to their IDT.
<b>3:30-4:00 PM</b>	<b>Event Survey/Evaluation</b>

*Note.* AT = athletic training; IDT = interdisciplinary team; OT = occupational therapy; PA= physician assistant; PT = physical therapy; Sim = simulation; SP = simulated patient; SW = social work.

# Disaster Day Interprofessional Simulation

## A Special Report on an IPE Disaster Day Event Simulation Analysis at Florida Gulf Coast University

Joseph P. Buhain, EdD, MBA, RRT, FAARC, CHSOS, CMSP, NREMTB  
Florida Gulf Coast University, Fort Myers, FL

**Corresponding Author:** Joseph P. Buhain, [jbuhain@fgcu.edu](mailto:jbuhain@fgcu.edu)

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### SUMMARY

**Background:** The increasing frequency of mass casualty events and the growing complexity of healthcare systems underscore the need for interprofessional education (IPE) and simulation-based training. The purpose of this manuscript was to showcase interprofessional simulation on a diverse, large-scale collaboration on trauma care, while assessing ICCAS pre- and post-survey strategies.

**Methods:** The simulation was guided by the Interprofessional Education Collaborative (IPEC) core competencies of values/ethics, roles/responsibilities, communication, and teamwork. Students engaged in triage, trauma management, mental health first aid, epidemiological surveillance, and rehabilitation planning, while graduate-level participants assumed leadership roles aligned with advanced accreditation standards.

**Results:** Pre- and post-event assessments demonstrated significant gains, including a 35% increase in self-reported disaster response confidence, a 40% improvement in interprofessional communication, and a 30% increase in accurate triage decision-making. Observational data confirmed enhanced collaboration and efficiency, with stabilization times reduced by 25%.

**Conclusion:** This report highlights the effectiveness of hybrid and high-fidelity simulation in disaster preparedness, the value of community and agency partnerships, and the importance of embedding IPE into both undergraduate and graduate curricula. FGCU's Disaster Day demonstrates a best-practice model for experiential, interprofessional learning that strengthens healthcare workforce readiness and community resilience. While this special report provides a comprehensive description of FGCU's Disaster Day Interprofessional Simulation, the overarching scholarly purpose of the manuscript is to evaluate simulation design, execution fidelity, educational outcomes, and comparative institutional effectiveness.

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### INTRODUCTION

The nature of modern healthcare demands a workforce capable of operating under pressure, across disciplines, and in highly unpredictable environments. Interprofessional education (IPE) has emerged as a key strategy in fostering collaborative, team-based healthcare, particularly in times of crisis. One of the most effective formats for implementing IPE is through disaster simulations, which provide real-time, immersive learning environments where students engage in problem-solving, communication, triage, and critical thinking.

This special report explores the interprofessional simulation model implemented by Florida Gulf Coast University (FGCU), specifically its Disaster Day event. Held annually by the Marieb College of Health & Human Services programs, the simulation integrates a hybrid of healthcare and performing arts disciplines to mimic real-world emergency scenarios. The event's success highlights the importance of simulation education in curriculum development for both undergraduate and graduate health programs.

The design was implemented by Diania Tsenekos, Director of Emergency Management, and Dr. Joseph Buhain, Director of IPE at FGCU. The thought process was to create an IPE event unlike any other in southwest Florida, where medical providers and health and human service students can work together in a simulated disaster event. Subject matter expert, Dr. Elizabeth Swann, Director of Simulation at Nova University, contributed to developing the IPEC standards of training for this first event, led by Dr. Joseph Buhain, the Director of Interprofessional Simulation and Emerging Technology.

## **METHODS**

### **Study Design**

The study design for FGCU's 2024 Disaster Day Interprofessional Simulation is best classified as a mixed-methods program evaluation. While the manuscript includes descriptive elements detailing the planning and execution of the event, its primary purpose is to assess educational outcomes and interprofessional collaboration through structured data collection and analysis. This evaluation integrates both quantitative and qualitative methodologies to measure the effectiveness of simulation-based learning in disaster preparedness. Evaluators reviewed the effectiveness of the event and simulation through a measured analysis form. Students were provided with an IRB-approved ICCAS pre- and post-simulation evaluation sheet. A Net Promoter Score (NPS) is a widely used metric that measures customer loyalty and satisfaction with a product, service, or organization. The NPS was used to evaluate how valuable the students found the event.

This manuscript focuses on program evaluation to contribute meaningfully to simulation scholarship by offering evidence-based insights into curriculum design, competency development, and interprofessional education in high-stakes healthcare scenarios. Program evaluation was performed with a combination of quantitative data from pre- and post-event competency surveys, observational rubrics and performance metrics, as well as qualitative insights from structured debriefings and reflective journals. The study does not test a hypothesis in the traditional sense of experimental research, nor is it purely narrative; instead, it systematically evaluates the impact of a complex educational intervention using established learning frameworks such as Kolb's Experiential Learning Cycle, Kirkpatrick's Four-Level Evaluation Model, Bloom's Taxonomy, and Miller's Pyramid of Clinical Competence (Bloom, 1956; Kirkpatrick, 1994; Kolb, 1984; Miller, 1990).

### **Disaster Day Simulation Development**

#### *Defining IPE and Its Importance*

Interprofessional education occurs when students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes (World Health Organization, 2010). In the U.S., the Interprofessional Education Collaborative (IPEC) is crucial in defining interprofessional education within the context of simulation-based disaster training because it provides a clear framework for the competencies that are essential for effective teamwork in healthcare. The IPEC Core Competencies—which include values/ethics for interprofessional practice, roles/responsibilities, communication, and teamwork—are foundational to disaster preparedness training, ensuring that healthcare professionals can collaborate effectively in high-stress situations (IPEC, 2016).

The simulation sought to reinforce the importance of interprofessional collaboration in disaster response, where effective teamwork can directly impact patient outcomes and overall community resilience. Using this framework, students gain a holistic understanding of their roles within a broader healthcare team, aligning their training with the real-world demands of emergency response scenarios.

### *Integrated Learning Frameworks*

The simulation was grounded in Kolb's Experiential Learning Cycle, which provided a framework for engaging students in concrete experience (disaster scenarios), reflective observation (debriefs), abstract conceptualization (protocol review), and active experimentation (real-time decision-making). This cyclical model supported the iterative nature of simulation-based learning and allowed students to internalize lessons through direct engagement and reflection (Kolb, 1984).

Educational objectives were scaffolded using Bloom's Taxonomy, which categorized learning across cognitive, affective, and psychomotor domains. In the cognitive domain, demonstration of knowledge was reflected in students' application of disaster protocols, triage algorithms, and interdisciplinary care plans. Learning objectives from the affective domain focused on students exhibiting empathy, ethical decision-making, and cultural competence, particularly when interacting with standardized patients portraying diverse backgrounds. The psychomotor domain was reflected in performing hands-on procedures such as CPR, airway management, and patient transfers, reinforcing technical proficiency in high-pressure environments (Bloom, 1956; Anderson & Krathwohl, 2001).

To assess clinical competence, the study also employed Miller's Pyramid of Clinical Competence, which evaluates progression from foundational knowledge to real-world performance. Students first demonstrated that they "know" disaster protocols and IPEC competencies through preparatory modules. They then showed they "know how" by applying this knowledge in tabletop exercises and scenario planning. During the simulation, students "showed how" by performing clinical tasks in a controlled environment. Graduate-level participants reached the "does" level by leading interdisciplinary teams and making autonomous decisions under simulated crisis conditions (Miller, 1990).

These integrated learning frameworks ensured that the simulation was not only pedagogically sound but also aligned with accreditation standards and competency-based education models. The use of Bloom's Taxonomy, Miller's Pyramid, and Kirkpatrick's Model provided a robust structure for evaluating both individual and team-based learning outcomes, reinforcing the value of experiential, interprofessional simulation in preparing students for real-world healthcare emergencies.

### *Simulation Objectives*

The Interprofessional Education Collaborative (IPEC) objectives are essential to Disaster Day simulations because they align the learning experience with the real-world competencies needed for collaborative healthcare. The simulation reinforces the four IPEC core competencies—values/ethics, roles/responsibilities, communication, and teamwork—by placing students in high-pressure, interdisciplinary scenarios where they must work together to assess, treat, and support patients. This hands-on practice helps students internalize these competencies, improving their readiness to function in diverse, team-based clinical environments (Figure 1).

*(continued on next page)*

**Figure 1**

*Recreational Field Disaster Simulation*



*Note.* Simulation training can occur both in and out of the hospital. Events such as Disaster Day provide a variety of IPE groups the ability to work together and deliver an appropriate assessment, movement, and care of patient transfer.

Disaster Day was designed with several key objectives aimed at enhancing students' preparedness for real-world healthcare emergencies. The event sought to enhance interprofessional collaboration by bringing together students from various disciplines, fostering teamwork and communication across different healthcare roles. It also aimed to improve triage and emergency management skills, allowing students to practice prioritizing care in a fast-paced, high-stress environment. The simulation provided invaluable real-world exposure to mass casualty protocols, giving students the opportunity to experience firsthand the complexities of managing a large-scale disaster. Additionally, the event was intended to assess students' knowledge of job action sheets and incident command systems, ensuring they understood the protocols for organizing and responding to emergencies effectively within a structured, coordinated system.

*Simulation Modalities in Disaster Day*

Simulation-based education allows learners to engage in realistic clinical situations without risk to patients. High-fidelity mannequins, virtual reality (VR), standardized patients, and hybrid models enhance engagement and skill development. The Disaster Day simulation included high-fidelity manikins and standardized patients (Figure 2).

## **Figure 2**

### *CPR – Hands On*



*Note.* During the interventional crisis, high-fidelity mannequins were utilized for the safety of SPs. Students received airway, breathing, and circulatory training in a high-stakes simulation after hands-on skills were provided earlier during the day.

In addition to Marieb College students and faculty, actors from the Bower School of Music and Arts supported the simulation under the direction of Dr. Dan Bacalzo, Associate Professor and Program Coordinator of Directing & Theatre Production. Service Learning Organizations, led by Mrs. Jamie Wilson and Mr. Justin Fitzgerald, helped elicit volunteer support and participation in the simulation. Their involvement also enabled the inclusion of students with disabilities and ESL learners as actors, creating a more realistic and educationally rich environment for all participants by promoting diversity awareness, helping peers develop culturally competent communication skills, and better preparing future healthcare workers to work with patients of varied abilities and backgrounds (Figure 3).

### **Figure 3**

#### *Situational Review and Assessment*



*Note.* Participants worked in an intense triage environment while practicing communication, awareness, respect, and ethical care.

#### *Student Participation and Simulation Roles*

The Disaster Day simulation was designed around IPEC competencies by bringing together students from nursing, social work, physical therapy, and physician assistant programs. This ensured that students not only learn the technical skills related to their specific roles but also understand how to work collaboratively, respect each other's expertise, and make collective decisions in real-time crisis situations.

During FGCU's Disaster Day simulation, each program within the Marieb College of Health & Human Services played vital, discipline-specific roles that reflected real-world emergency response scenarios.

Nursing students, including nurse practitioners and nurse anesthesia students, handled triage, trauma stabilization, medication administration, and airway management. Physician assistant students led diagnostic and treatment efforts within interdisciplinary teams. Social work and counseling students provided mental health first aid, grief support, and trauma-informed care. Public health students focused on epidemiological surveillance, health communication, and community risk management. Clinical laboratory science students simulated specimen analysis and diagnostic testing to support treatment protocols. Occupational therapy and physical therapy students evaluated injuries, facilitated safe patient movement, and supported rehabilitation planning.

Each role emphasized collaborative care, critical thinking, and effective communication in high-pressure environments, preparing students for interprofessional healthcare delivery in real crisis events.

## **Evaluation of Disaster Day IPE Simulation Program**

To evaluate the educational impact of FGCU's 2024 Disaster Day Interprofessional Simulation, a mixed-methods approach was employed, incorporating both quantitative and qualitative data collection protocols. The sample included over 200 student participants representing nursing, volunteers, social work, public health, physician assistant, physical therapy, occupational therapy, and performing arts programs. Faculty observers, standardized patient actors, and emergency response professionals also contributed to the data pool through structured feedback and performance assessments.

Briefly, Kirkpatrick's Four-Level Evaluation Model was applied (Kirkpatrick, 1994). At level 1 (reaction), student feedback was collected from graduate-level participants in the form of structured debriefing sessions and reflective journals. At level 2 (learning), knowledge acquisition and skill development were assessed using pre- and post-assessments. At level 3 (behavior), changes in clinical performance and interprofessional collaboration during the simulation were assessed through observational data gathered by trained faculty to assess teamwork, communication, and triage accuracy during simulation scenarios. At level 4 (results), broader outcomes, such as improved stabilization times and enhanced community readiness, were assessed.

Quantitative data were gathered using pre- and post-simulation surveys administered electronically via Qualtrics. These surveys included Likert-scale items aligned with the Interprofessional Education Collaborative (IPEC) core competencies—values/ethics, roles/responsibilities, communication, and teamwork—as well as disaster response confidence and triage decision-making accuracy. The survey instruments were pilot tested for clarity and reliability prior to deployment. A subset of 150 students completed both pre- and post-surveys, allowing for paired statistical analysis.

Observational data were collected using standardized rubrics developed by the FGCU Simulation Education Center. These rubrics assessed interprofessional communication, leadership behaviors, and clinical task performance during simulation scenarios. Observers were trained in rubric use to ensure inter-rater reliability. Key performance indicators included stabilization time, triage accuracy, and team coordination under timed conditions.

Qualitative data were obtained through structured debriefing sessions facilitated by faculty using the PEARLS framework (Promoting Excellence and Reflective Learning in Simulation). Students also submitted reflective journals, which were thematically coded using NVivo software to identify patterns in emotional response, ethical reasoning, and collaborative learning. Feedback from standardized patient actors and emergency responders was integrated to triangulate findings and enrich contextual understanding.

Analytic methods included paired t-tests to assess changes in survey scores, descriptive statistics for observational metrics, and thematic analysis for qualitative data.

## **RESULTS**

This study employed a mixed-methods program evaluation design to assess the educational impact of FGCU's 2024 Disaster Day Interprofessional Simulation. The simulation was designed to evaluate interprofessional collaboration, clinical decision-making, and disaster response competencies across multiple health disciplines.

### **Participants**

Participants included over 300 students from nursing, social work, public health, physician assistant, occupational therapy, physical therapy, and performing arts programs, along with more than 100 standardized patient actors and volunteers.

## **Program Evaluation**

Results revealed a 35% increase in self-reported confidence in disaster response skills, a 40% improvement in interprofessional communication scores, and a 30% rise in accurate triage decision-making under timed conditions. Observational assessments documented a 25% reduction in average patient stabilization times between early and late scenarios, indicating improved team efficiency. NPS analysis yielded a score of 9.5 out of 10, reflecting strong satisfaction and perceived value by the students.

## **Community Collaboration**

The 2024 Disaster Day Interprofessional Simulation, hosted by Florida Gulf Coast University's Marieb College of Health & Human Services, stands as one of the largest and most comprehensive training events of its kind in Southwest Florida.

Critical support and active engagement came from multiple local and regional emergency response agencies, including fire departments, law enforcement, EMS teams, and helicopter medevac units, who participated in drills to replicate real-world disaster conditions. Key programs and organizations such as the FGCU Simulation Education Center, the School of Nursing, the School of Social Work, the Department of Health Sciences, and local hospital partners played vital roles in planning and execution. Simulation stations ranged from triage tents and emergency department set-ups to mental health assessment zones, offering students a rare, immersive opportunity to practice interprofessional collaboration, decision-making, and crisis management in a controlled yet realistic environment.

This event not only showcases FGCU's leadership in interprofessional education and simulation-based learning but also highlights the power of community and agency partnerships in preparing the future healthcare workforce. NCH Healthcare System, San Carlos Fire Department, Florida State Guard, FEMA, Salvation Army, Red Cross, and Florida Southwestern State College (FSW) played pivotal roles in supporting the IPE Disaster Day event at FGCU. NCH provided invaluable clinical expertise and resources, contributing to the realistic simulation scenarios and ensuring that students had hands-on experience with actual healthcare practices. FSW's collaboration further enhanced the event by offering faculty support, coordinating logistics, and assisting in the integration of various healthcare programs. Their collective involvement helped create a comprehensive and immersive training experience for all participants, reinforcing the importance of interprofessional collaboration in disaster response scenarios.

### *Planning the 2024 Disaster Day Interprofessional Simulation: A Timeline of Collaboration and Coordination*

Planning for the 2024 Disaster Day Interprofessional Simulation officially launched in February 2024, with a strategic planning team formed under the direction of FGCU's Marieb College of Health & Human Services. The initial meetings focused on reviewing previous years' feedback, identifying learning objectives, and setting goals for enhanced realism and interprofessional engagement.

Planning and implementation of the 2024 Disaster Day Interprofessional Simulation at Florida Gulf Coast University followed a structured, multi-phase timeline grounded in experiential learning and simulation theory. Between February and March 2024, an interdepartmental steering committee was convened, comprising faculty from Nursing, Social Work, Public Health, and Health Sciences. This team collaboratively identified key themes for the simulation, including mass casualty response, disaster triage, behavioral health crises, and emergency preparedness. Student learning outcomes were defined with a focus on core competencies outlined by IPEC, such as interprofessional collaboration, communication, and critical thinking. Early outreach to community partners such as Lee Health, Collier EMS, local law enforcement, and aerial medical evacuation services laid the foundation for a robust, multi-agency training experience.

From April to May 2024, logistical planning intensified. Simulation spaces were secured, including the SoVi Green, on-campus emergency shelters, and the Simulation Education Center. Volunteers and standardized patient actors were recruited and trained through the Bower School of Music & the Arts.

Emergency services coordinated live vehicle demonstrations, helicopter landings, and triage simulations, while a multi-agency operations plan was developed to ensure safety, security, and real-time communication throughout the event.

From June to August, scenario development and training were the primary focus. Faculty workgroups designed scripted cases addressing physical trauma, emotional distress, hazardous exposure, and pediatric emergencies. These scenarios were aligned across disciplines to promote interprofessional learning. Once the cases were developed, training sessions for student leaders and volunteers were initiated for moulage techniques, actor behavior scripting, and emergency protocol rehearsals.

In the final phase from September to October, tabletop drills and walkthroughs were conducted with faculty, emergency responders, and student leaders to validate logistics and readiness. Promotional efforts included campus-wide communications, flyers, and interdepartmental announcements to ensure broad participation. Final coordination meetings with external agencies confirmed roles, contingency plans, and operational flow.

The simulation was executed in November 2024, hosting over 600 participants across multiple zones. Post-event debriefing sessions were held to assess student performance, gather feedback, and evaluate interagency collaboration. Data and reflections were compiled to inform future simulations and contribute to scholarly dissemination.

## **Integration of Simulation Technology**

Technological advancements are redefining the landscape of healthcare simulation. FGCU's Disaster Day utilizes a variety of tools that reflect this evolution. For example, high-fidelity mannequins simulate physiological responses such as bleeding, breathing, and cardiac function. Audio-visual systems capture live footage for later debriefs, reinforcing the value of feedback-based learning (Motola et al., 2013). Research supports these models as highly effective. For example, a study by Foronda et al. (2020) found that hybrid simulation improved clinical reasoning and communication skills as much as, if not more than, traditional in-person formats. This allows institutions to extend disaster training even to students who may not be physically present at the simulation site.

These technologies are rooted in the INACSL Standards of Best Practice for simulation, which emphasize realism, scenario design, and debriefing as core pillars for effectiveness (INACSL Standards Committee, 2021). At FGCU, post-simulation debriefs are structured using the PEARLS framework (Promoting Excellence and Reflective Learning in Simulation), allowing learners to internalize lessons from real-time events.

Hybrid simulation – a combination of virtual reality, standardized patients, and physical equipment – was crucial to the success of the Disaster Day event. This growing focus in healthcare education offers scalability and accessibility, particularly valuable in post-pandemic educational environments. The hybrid model allowed for a seamless integration of both in-person and virtual learning experiences, ensuring accessibility, flexibility, and realism in the mass casualty training scenario. FGCU's simulation curriculum includes remote prep modules, asynchronous training, and real-time telehealth integration, blending virtual and hands-on learning.

During Disaster Day, students engaged in hands-on, high-fidelity simulation while also incorporating virtual tools such as remote patient assessments, telemedicine platforms, and crisis management systems. Students from different health disciplines—nursing, physical therapy, social work, and physician assistant programs—participated in both physical simulation activities (like triaging patients, performing emergency medical procedures, and providing crisis counseling) and virtual components. Some students used telemedicine to assess patients remotely or practice virtual

collaboration with team members in different locations. Virtual patient monitoring allowed students to interact with simulated patient data, such as heart rates, oxygen levels, or lab results, enhancing their ability to make clinical decisions based on real-time information (Figure 4).

**Figure 4**

*Florida State Guard*



*Note.* The integration of State, Federal, and Local agencies in the IPE Disaster Day allowed participants to learn based on best practices.

This approach was particularly valuable in preparing students for real-world disasters, where technology often plays a critical role in emergency response coordination. Additionally, it enabled broader participation, allowing students who might have been unable to attend in person—such as those in remote locations or with scheduling conflicts—to still be involved. By combining in-person, interactive scenarios with digital elements, the hybrid simulation provided a comprehensive and realistic training environment that closely mirrored the dynamic, multi-faceted nature of actual disaster response.

### **Accessibility and Cost Efficiency**

Hybrid simulations also increase educational access by providing virtual modules to rural or underserved programs to replicate disaster training. FGCU's use of hybrid tools allows for broader inter-university collaboration and a more inclusive approach to health equity education, ensuring all students experience high-impact scenarios regardless of location.

Vendors played a crucial role in the accessibility and cost-efficiency of the Disaster Day event by providing essential resources, tools, and support that helped maximize the event's impact without placing financial strain on the organizers. Vendors supplied high-quality equipment such as medical supplies, simulation mannequins, moulage materials, and even virtual simulation platforms. This support allowed for a more immersive and professional simulation experience, enhancing the realism of the scenarios. Partnerships with vendors often come with discounts or donations, reducing the overall cost of running such a large-scale event. By securing these external resources, FGCU could

offer students and volunteers an authentic disaster response training experience without the burden of purchasing or renting expensive equipment. Additionally, vendors' participation helped ensure that the event could be held on a larger scale, allowing for more students, diverse simulations, and numerous disaster response roles. The authors would like to recognize Laerdal, Elevate, Tac Medical, Gaumard, and Medtronic for their contributions to the event's accessibility and long-term sustainability.

Additionally, simulation programs reduce long-term costs by lowering liability in clinical placements, improving readiness, and decreasing turnover due to burnout among new graduates (Rutherford-Hemming et al., 2014). Thus, the return on investment is both educational and economic.

## **DISCUSSION**

The 2024 Disaster Day Interprofessional Simulation, hosted by Florida Gulf Coast University's Marieb College of Health & Human Services, stands as one of the largest and most comprehensive training events of its kind in Southwest Florida. We showed an improvement in self-reported confidence in disaster response skills, interprofessional communication scores, accurate triage decision-making under timed conditions, and time to patient stabilization.

These results were interpreted through the lens of Bloom's Taxonomy, which scaffolded learning across cognitive (triage protocols and decision-making), affective (empathy and ethical care), and psychomotor (hands-on clinical skills) domains. Miller's Pyramid Clinical Competence was used to evaluate progression from foundational knowledge ("knows") to real-time performance ("does"), particularly among graduate students who assumed leadership roles. Kirkpatrick's Four-Level Evaluation Model provided a comprehensive framework for assessing reaction (student satisfaction), learning (knowledge and skill acquisition), behavior (application in simulation), and results (impact on team performance and readiness).

Together, these metrics support FGCU's Disaster Day as a best-practice model for immersive, interprofessional disaster preparedness training. The integration of data collection protocols, theoretical frameworks, and multi-source feedback ensures that the simulation meets both educational and empirical standards, contributing to the field of simulation-based learning.

## **Advanced Interprofessional Competencies**

Graduate students, particularly those in nurse practitioner, physician assistant, and social work programs, played a unique leadership role in Disaster Day. Their responsibilities include supervising undergraduate peers, coordinating command structures, and analyzing systemic risk factors. These roles are essential in replicating the hierarchy and team dynamics found in real disaster scenarios.

Through advanced participation, graduate students demonstrate IPEC's Level 3 competencies, focusing on systems thinking and collaborative leadership (IPEC, 2016). FGCU assesses graduate student outcomes through leadership rubrics, reflective journals, and interprofessional peer evaluations, which demonstrate improvements in delegation, ethical decision-making, and team-based care planning.

## **Curriculum Development at the Graduate Level**

FGCU's simulation event is fully embedded into capstone courses and practicum experiences. Many programs were involved in this simulation, including graduate students from occupational therapy, physical therapy, and the physician assistant program. Students are assessed not only on clinical judgment but also on community collaboration, psychosocial response, and trauma-informed care. Some of the key components look at the complexity of understanding BLS and ACLS standards. This scaffolding aligns with AACN Essentials: Core Competencies for Professional Nursing Education (American Association of Colleges of Nursing, 2021), which emphasize population health, systems-based practice, and interprofessional partnerships as key graduate-level objectives.

The Disaster Day event at FGCU supports Occupational Therapy (OT), Physical Therapy (PT), and Physician Assistant (PA) programs by aligning with accreditation standards, such as ACOTE, CAPTE, and ARC-PA, respectively. These standards emphasize interprofessional collaboration, experiential learning, and emergency preparedness — competencies the simulation directly develops through hands-on experience in communication, ethical decision-making, teamwork, patient triage, mobility, and acute care.

Moreover, the Disaster Day simulation supports Clinical Nurse Educator (CNE) and Doctor of Nursing Practice (DNP) competencies in areas such as quality improvement and clinical decision-making. Faculty use structured evaluation tools to assess whether students meet programmatic outcomes, ensuring alignment with accreditation standards from CCNE and ACEN (Figure 5).

## **Figure 5**

### *Patient Assessment*



*Note.* Nurses and Physician Assistants were critical in the assessment of patients in this event. Graduate programs provided capabilities in student learning and progression.

## **Nationwide Growth of Disaster Simulations**

The relationship between Texas A&M University and Florida Gulf Coast University in the context of disaster day events highlights both similarities and differences in their approaches to interprofessional education and simulation-based training for disaster response. Both universities emphasize interprofessional collaboration, with students from diverse healthcare disciplines, such as nursing, physician assistants, physical therapy, and social work, working together in disaster simulations. This mirrors the IPEC core competencies of teamwork, communication, and understanding each profession's role in healthcare. Both Texas A&M and FGCU also replicate real-world disaster scenarios, offering students valuable hands-on experience in managing mass casualty situations. Community partnerships play a key role in both events, with Texas A&M collaborating with local emergency responders and FGCU working with NCH Healthcare System and Florida Southwestern State College (FSW) to support the training.

Disaster Day simulations are gaining momentum nationwide as essential components of healthcare education. Institutions like Texas A&M Health Science Center, University of New England, and University of Texas Medical Branch have implemented similar programs. These events often simulate natural disasters, pandemics, or chemical exposures to test emergency response systems and interprofessional readiness.

At Texas A&M, for example, more than 600 students participate annually in a simulation that includes realistic scenarios, mass casualty response, and integration with local emergency services. Like FGCU, they employ volunteer actors, moulage, and command center coordination (Figure 6). A 2021 report found that students who participated showed significantly improved communication skills and emergency response efficacy.

## **Figure 6**

### *Dynamic Simulation*



*Note.* The participation of standardized patients in the event improved the efficiency of the simulation and allowed practice of verbal communication with patients.

Despite these similarities, there are several differences between the two events. Texas A&M's disaster simulation tends to be on a much larger scale, involving over 600 students annually, and often includes more extensive mass casualty scenarios (Texas A&M University Health Science Center, 2023). In contrast, FGCU's event is generally smaller in scope, focusing on high-fidelity, intimate scenarios. Technology also plays a significant role in the Texas A&M simulation, which incorporates advanced virtual reality (VR) and augmented reality (AR) tools to enhance realism. While FGCU also uses hybrid simulation, blending in-person and virtual components, the level of technological integration at Texas A&M is more comprehensive. Furthermore, Texas A&M's disaster simulation spans multiple phases over several weeks, while FGCU's typically takes place in a single day. Lastly, Texas A&M often includes a focus on global and rural disaster preparedness, training students to respond to international and remote crises, whereas FGCU's training is more localized, addressing Florida-specific disaster risks, such as hurricanes. Despite these differences, both universities share a commitment to preparing healthcare students for effective, collaborative disaster response, equipping them with the necessary skills to respond to real-world emergencies.

Research across various institutions reveals consistent and positive outcomes from large-scale interprofessional education (IPE) simulations. These simulations have been shown to significantly improve communication across disciplines (Cervero & Gaines, 2015), enhance confidence in clinical judgment and leadership skills (Gordon et al., 2020), and deepen participants' understanding of health systems and policy integration (Keller et al., 1998). Notably, students rated these simulations highly, with a Net Promoter Score of 9.5 out of 10, reflecting strong satisfaction and perceived value. Additionally, the trend toward multi-institutional collaboration is becoming a defining feature of advanced simulations. For example, Florida Gulf Coast University (FGCU) has established partnerships with local EMS, law enforcement, and public health agencies, demonstrating how academic institutions can play a central role in promoting community preparedness and resilience.

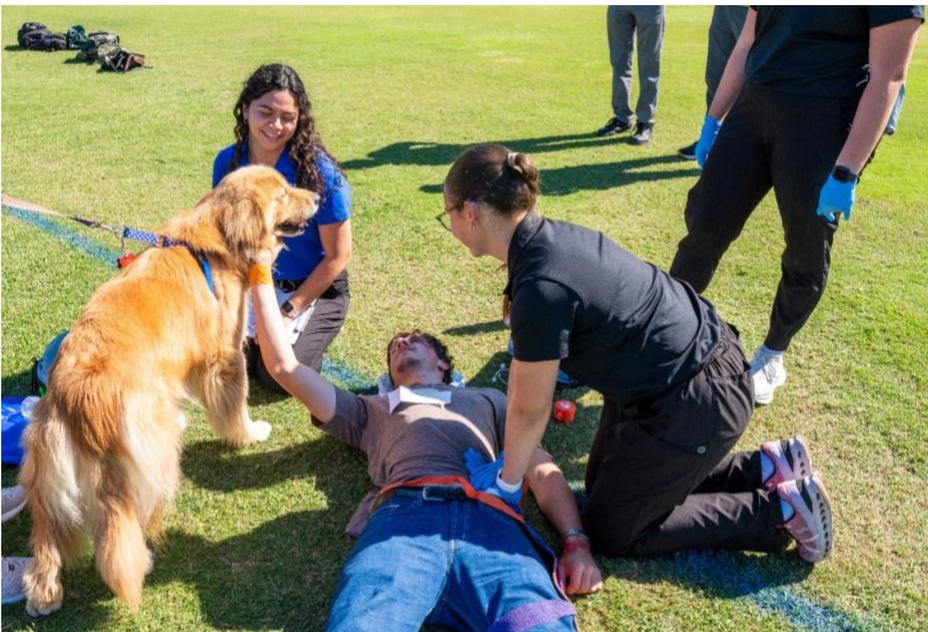
## Challenges and Opportunities

While simulation is effective, it is also resource-intensive. Challenges include securing funding, recruiting volunteers, and ensuring alignment across curricula. Hybrid models and virtual reality can mitigate some of these barriers. Institutions are now exploring regional simulation consortia and open-access toolkits to support widespread adoption and resource sharing (Haerling et al., 2023).

Volunteers played a crucial role in the success of the Disaster Day event, as they helped bring the simulation to life by acting as patients, providing support, and contributing to the logistical needs of the event. Their participation was vital for creating realistic scenarios and ensuring that students from different healthcare programs could practice their roles in an authentic, interprofessional environment. Volunteers brought diversity to the simulation, including students with disabilities and ESL learners, which enriched the learning experience for participants by enhancing cultural competence and providing exposure to a variety of patient interactions. In addition, therapy animals were used for mental health assistance during crises (Figure 7).

**Figure 7**

*Therapy Animals*



*Note.* Therapy animals represented occupational therapy, social work, and counseling.

However, the lack of commitment from some volunteers, who canceled 48 to 72 hours prior to the event, presented a significant challenge. This unpredictability created logistical issues, as last-minute cancellations meant that organizers had to scramble to find replacements, potentially leading to gaps in the simulation and disruptions in the planned scenarios. The absence of volunteers also meant that certain roles or patient cases could not be fully realized, impacting the quality of the learning experience for students. This lack of commitment also increased stress on event coordinators and may have reduced the overall effectiveness of the event, especially in providing a fully immersive and realistic training environment. Ensuring stronger volunteer engagement and clearer communication about expectations could help mitigate these challenges in future events.

## **Limitations and Opportunities for Future Research**

While this special report provides a comprehensive description of the design, implementation, and outcomes of FGCU's Disaster Day Interprofessional Simulation, the overarching scholarly purpose of the manuscript would benefit from further clarification. Specifically, future iterations of this work should more explicitly delineate whether the primary intent is to evaluate simulation design, execution fidelity, educational outcomes, or comparative institutional effectiveness. Although this event is being presented as a programmatic case study, the inclusion of external institutional comparison offers an important contextual benchmark that could be further developed into a more rigorous comparative analysis framework.

Additionally, outcomes reported in this study rely primarily on single-event pre- and post-assessment data from one annual simulation cycle. Because Disaster Day is an annual event, the inclusion of multi-year longitudinal data would strengthen claims of sustained educational impact and programmatic effectiveness. 2025 is the first event that has held metric values IRB-approved. Future collaborative, multi-institutional studies could help determine whether the observed outcomes are generalizable across different program sizes, geographic regions, and institutional resources.

Another limitation is that outcome measures were aggregated across multiple domains of learner performance. As a result, it is difficult to determine which specific components of the simulation—such as triage training, leadership roles, communication exercises, or hybrid simulation elements—were most strongly associated with observed improvements in learner evaluation. Future research employing stratified outcome analysis or station-specific performance metrics would allow more precise identification of high-impact educational components. Addressing these areas in future investigations will strengthen the empirical foundation of interprofessional disaster simulation scholarship and support broader adoption and scalability of IPE disaster training across institutions.

FGCU is well-positioned to lead in this space, thanks to its community integration, investment in high-fidelity simulation spaces, and support from state and federal preparedness agencies.

## **CONCLUSIONS**

The Disaster Day Interprofessional Simulation at Florida Gulf Coast University represents a gold standard for interdisciplinary healthcare education. By replicating real-world emergencies in a controlled, collaborative environment, students gain not only clinical skills but the ability to lead and innovate in high-stakes settings.

Looking forward, simulation education must expand beyond the classroom. It should incorporate digital technology, support flexible and hybrid access, and be embedded throughout curricula—from pre-licensure through doctoral study. Academic institutions must prioritize faculty development in simulation facilitation, secure sustainable funding, and build stronger alliances with local healthcare systems.

Interprofessional simulation is not just a pedagogical tool—it is a public health imperative. As threats from natural disasters, pandemics, and social crises grow more complex, preparing the future healthcare workforce with responsive, coordinated, and technologically integrated education will be

vital. FGCU's efforts in advancing interprofessional simulation contribute meaningfully to this evolving educational landscape.

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