

A Simulation Curriculum for Management of Trauma and Surgical Critical Care Patients

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BACKGROUND: Expectations continue to rise for residency programs to provide integrated simulation training to address clinical competence. How to implement such training sustainably remains a challenge. We developed a compact module for first-year surgery residents integrating theory with practice in high-fidelity simulations, to reinforce the preparedness and confidence of junior residents in their ability to manage common emergent patient care scenarios in trauma and critical care surgery.

METHODS: The 3-day module features a combination of simulated patient encounters using standardized patients and electronic manikins, didactic sessions, and hands-on training. Manikin-based scenarios developed in-house were used to teach trauma and critical care management concepts and skills. Separate scenarios in collaboration with the regional organ donation program addressed communication in difficult situations such as brain death. Didactic material based on contemporary evidence, as well as skills stations, was developed to complement the scenarios. Residents were surveyed before and after training on their confidence in meeting the 14 learning objectives of the curriculum on a 5-point Likert scale.

RESULTS: Data from 15 residents who underwent this training show an overall improvement in confidence across all learning objectives defined for the module, with confidence scores before to after training improving significantly from 2.8 ($\sigma = 0.85$, median = 3) to 3.9 ($\sigma = 0.87$,

median = 4) of 5, $p < 0.001$. Although female residents reported higher posttraining confidence scores compared with male residents (average 4.2 female vs 3.8 male, $p = 0.002$), there were no other significant differences in confidence scores or changes to scores owing to resident sex or program status (categorical or preliminary).

CONCLUSION: We successfully implemented a multimodal simulation-based curriculum that provides skills training integrated with the clinical context of managing trauma and critical care patients, simultaneously addressing a range of clinical competencies. Results to date show consistent improvement in residents' confidence in meeting learning objectives. Development of the curriculum continues for sustainability, as well as measures to embed objective evaluations of resident competence. (J Surg Ed 72:803-810. © 2015 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: simulation, surgery, education, residency, standardized patient

COMPETENCIES: Patient Care, Medical Knowledge, Professionalism, Interpersonal and Communication Skills, Practice-Based Learning and Improvement, Systems-Based Practice

BACKGROUND

Graduate medical education and training has traditionally relied heavily on experiential learning from patient encounters as part of clinical practice and service. Contemporary patient safety and ethical imperatives firmly focus on protecting the patient, in effect forbidding learning through trial and error on real patients. Simulated encounters can provide integrated training without risk to patients, and simulation-based education for trauma and surgical critical care has evolved rapidly with many available modalities, as

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well as emerging methods for assessment.¹ Use of patient simulation has become a mainstay in trauma education through the Advanced Trauma Life Support (ATLS) course, which the American Board of Surgery has required for applications for General Surgery Certification in the 2009-2010 academic year or thereafter.² Our institution has also integrated patient simulation into the Fundamental Critical Care Support (FCCS) course promoted by the Society for Critical Care Medicine.³

Education is a particularly pressing issue in fields like trauma and surgical critical care, where the volume of clinical experience is limited to a small number of patient encounters in select institutions. Exposure to immediately life-threatening time-critical trauma is uncommon, yet even entry-level providers are expected to be competent every time they are called on to manage such patients.⁴ Despite this, the specifics of organizing such curricula, best practices, and strategies for integrating simulation, as well as suggestions for sustainability, have yet to be established and are left to individual institutions. Training programs today face complex issues such as duty-hour standards, combined with ever-increasing demand to staff clinical services.⁴ This creates significant tension between the need to provide accountable education and the need to safely render health care services and maintain the institution's bottom line.

As part of an effort to accelerate competence of general surgery residents, we describe the design, implementation, and results from the first year of a modular simulation curriculum for trauma and surgical critical care. Our approach balances the need to provide targeted education for residents while being cognizant of the perceived opportunity cost to the health system of sequestering frontline providers—both residents and faculty—for dedicated educational programs.

METHODS

Protection of Human Subjects

This research was conducted within the residency program in general surgery at the Hospital of the University of Pennsylvania. We submitted our protocol to the Institutional Review Board and received confirmation of exemption under 45 CFR 46.101, category 1 for human subjects research regarding the effectiveness of instructional curricula in established educational settings. Furthermore, written consent was sought from all participating first-year residents regarding the video recording and collection of data regarding their educational experience and simulated clinical performance for the purpose of research and publication, with the understanding that their consent or refusal would not have any effect on the provided educational content or their standing as a resident in the program.

Scheduling of Residents

Finding a balance between service and training is a recurring issue in contemporary graduate medical education. The

reality of any clinical training program is that trainees are also essential to the staffing of clinical services, meaning only a limited number at a time may be assigned to nonclinical duties. Furthermore, participation in this simulation-based curriculum is not considered “time free off duty”—it is an educational assignment integral to the residency program and is subject to duty-hour regulations.⁵

Our simulation curriculum was implemented in a modular manner, where residents are scheduled for blocks of 3 weekdays, distributed throughout the year. This modular implementation accommodates residents in small groups to minimize staffing disruptions. Other residents, physician assistants, and nonphysician practitioners on the team cover resident duties while they take part in simulation education. These compact 3-day modules can be repeated over the course of the year to ensure the entire resident class, categorical and preliminary residents alike, is given equal access to this educational opportunity.

The 3 iterations of the module occurred in September ($n = 6$), February ($n = 5$), and April ($n = 4$), with resident assignments based purely on the logistics of drafting them from clinical service rotations. The possibility of “just-in-time” training synchronized with clinical rotations was considered, but was incompatible with clinical service demands. This resulted in a pseudorandom crossover of residents' level of clinical exposure to trauma and critical care experiences. For example, some participating residents had yet to rotate through trauma, whereas others had already done so earlier in the year, and some were currently on their trauma rotation.

The Module

Trauma and critical care surgery was selected as 1 of 6 surgical specialty areas in which first-year residents would benefit most from simulation-based training (the others being acute care, biliary, cardiovascular, colorectal, and foregut). The surgery simulation program director (R.A.) consulted with faculty in the Division of Traumatology, Surgical Critical Care, and Emergency Surgery (N.D.M. and J.L.P.) to outline learning objectives for the module.

Established national programs served as a starting point for the selection of level-appropriate curricular content. For the trauma aspect of the module, the ATLS program⁶ and course objectives, as well as the postgraduate year-1 level Trauma content from the Surgical Council on Resident Education (SCORE) Portal,⁷ were referenced. For surgical critical care, the Society of Critical Care Medicine's FCCS course objectives and topics,³ as well as the relevant Surgical Council on Resident Education (SCORE) Portal content at the postgraduate year-1 level, were referenced. Topics were selected based on perceived importance and relevance to trainees' practice at our institution. [Table 1](#) shows the primary source of course objectives and topics selected for inclusion in the curriculum. Priority was given to reinforce topics and skills that are expected to be a routine part of the

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