Simulation-Based Curriculum: The Breadth of Applications in Graduate Medical Education

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Three studies in the September and December 2012 issues of the *Journal of Graduate Medical Education* highlight how simulation in various forms can be used to provide highly relevant learning experiences in different domains of medical practice.[1–3] In contrast to traditional passive didactic learning strategies that stress knowledge, simulation creates an active, participatory, realistic learning environment where participants can hone skills that are directly relevant to patient care. The approach described in the 3 manuscripts not only meets the call for medical education reform,[4] it also addresses patient safety imperatives by providing a method for trainees to develop skill and experience in various dimensions of medical management without endangering the health and life of a human patient.[5]

The 3 studies illustrate both the range of simulation methodologies that can be employed (full-size electromechanical mannequins, standardized patients, and task-training devices), and the different competencies where simulation can enhance learning (cognitive, communication, and procedural skills; TABLE). The curriculum described in these articles reflects the range of learning objectives possible with simulation. The articles are instructive about how to tailor a curriculum to meet specialty-specific as well as local institutional resident needs for education.

As highlighted in the 3 studies, simulation can include a number of devices and technologies that offer the potential to accelerate the acquisition of skills and expand the breadth and depth of clinical experiences. These studies are similar in that the simulated clinical experiences include skills that are infrequently encountered in practice and can pose a risk to patients if they are not effectively performed. Essential elements of each curriculum include the ability to provide multiple experiences in a particular domain of practice, and a controlled setting where various steps can be demonstrated, deconstructed, and debriefed. The multiple station or scenario approach provides the breadth of experience to effectively demonstrate ability as well as the reinforcement needed to master the skill sets required for each task or scenario.[6–9]

In the study by Peterson et al from the September issue,[1] a simulation-based curriculum using standardized patients was used to enhance the skills of health care professionals in communicating difficult news. In this issue, Miloslavsky et al[2] employed full-size electromechanical mannequins to advance the cognitive and decision-making acute care skills of internal medicine residents. Also from this issue, the study by Augustine and Kahana[3] documents the efficacy of a simulation-based program designed to enhance procedural skills of pediatrics residents. All 3 studies provide some evidence to support the validity of the various simulation modalities, mostly from a content perspective. This preliminary evidence is derived through documenting improved trainee self-confidence and perceived expertise, but this is only a starting point for measuring effectiveness. The desired skills and abilities of interest must be assessed to ensure that (1) the curriculum is meeting learning objectives, (2) strengths and weaknesses in skill sets among the participants can be identified, and (3) residents have met a competence goal.

The study by Peterson et al[1] is unique in that both physicians and nurses (and even a chaplain) were exposed to the educational intervention. Their study highlights the fact that many skills required of physicians are also in the domain of other professions. Thus, simulation applications can be used to accomplish an interdisciplinary curriculum. Although Peterson et al documented a significant improvement in participants' precurriculum and postcurriculum self-reported perceptions of skill (breaking bad news), an assessment of communication ability prior to and following various communication paradigms (disclosing medical error, discussing the limits of therapy, and resuscitation) would further establish validity and help determine whether these communication skills generalize across the range of difficult conversations. The ultimate validity measure is how these professionals apply their communication skills in clinical settings.

In the Miloslavsky et al[2] study, the curriculum included a set of 8 scenarios that an internal medicine resident might encounter while on call in the acute care setting. The scenarios were designed to require residents to use

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TABLE **Types of Simulation and Curriculum for the Studies of Miloslavsky et al, Peterson et al, and Augustine and Kahana**

Article	Simulation Modality	Domains of Medical Practice
Miloslavsky et al	Full-size electromechanical mannequin	Acute care management decisions:
		• Situational awareness
		• Differential diagnosis
		• Setting management priorities
		• Implementing therapy
Peterson et al	Standardized patients	Difficult conversations:
		• Disclosure of error
		• Family anger
		• Limitations of care
		• Do not resuscitate decisions
Augustine et al	Task-training devices	Pediatric procedures:
		• Airway management
		• Vascular access
		• Lumbar puncture
		• Chest tube placement

decision-making skills to make appropriate judgments regarding diagnosis and treatment. This study, although primarily supported by self-report measures, illustrates the advantages of simulation in the context of improving clinical judgment, decision making, and situational awareness. The curriculum includes many of the management skills required in acute care clinical settings and frequently noted to be deficient in the novice resident.[10] In managing the scenarios, the resident is required to conduct a logical, sequential examination, make inferences about management, and maintain situational awareness as the mannequin's condition deteriorates despite the initial correct management. Prior to the advent of simulation, these skills were difficult to re-create in an educational environment. This study reinforces the utility of a multiple scenario curriculum that requires the resident to demonstrate the ability to diagnose a broad range of conditions and generate appropriate management plans.[8,9,11] Simulation, especially when combined with tailored feedback, provides a standardized environment where residents can gain experience and improve their skills.

The study by Augustine and Kahana[3] documents the limited opportunities that many pediatrics residents have to practice procedural skills and their related lack of confidence in performing many of these skills. A variety of studies indicate that a curriculum using task-training devices can successfully improve a resident's ability in practice settings. The measures of efficacy are those associated with improved practice performance, a decrease in the number of adverse events, and fewer failure modes in practice settings.[6,7,13,14] To master any procedure, the ability to deconstruct a procedure is helpful in learning the appropriate steps and developing expertise.[7] Various task-training devices allow residents to practice specific procedures and gain insights into their own strengths and weaknesses.

A limitation of the 3 studies is that they use learning outcomes that are limited to self-reported measures of skill and confidence. Although this is an important first step, the evidence that learning objectives are being met requires assessment beyond self-reported outcomes.[9,11] For learning experiences that include more advanced, complex, and often specialty-specific scenarios and tasks, not only is a score helpful to provide feedback to the participant, but score analysis also can be used to address questions about the reproducibility, relevance, and validity of the curriculum. Ultimately, studies are needed that determine whether the skills acquired in simulation can be applied to successfully manage patients.

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