

Diane B. Wayne, MD<sup>1</sup>  
Jeffrey H. Barsuk, MD<sup>1</sup>  
William C. McGaghie, PhD<sup>2</sup>

<sup>1</sup> Department of Medicine, Northwestern University Feinberg School of Medicine, Chicago, Illinois

<sup>2</sup> Department of Medical Education and Faculty Development, Northwestern University Feinberg School of Medicine, Chicago, Illinois

## Procedural Training at a Crossroads: Striking a Balance between Education, Patient Safety, and Quality

“**S**ee one, do one, teach one” is a refrain familiar to all physicians. Historically, most procedural training has occurred at the bedside. In this model, senior residents, subspecialty fellows, or faculty members would demonstrate procedural skills to junior trainees, who would subsequently practice the procedures on patients, often with uneven, risky results. Acquisition of procedural skills by residents and fellows on inpatient wards is suboptimal for at least 2 reasons beyond the risks to patient safety: (1) clinical priorities are more important than educational priorities in this setting, and (2) the patient, not the medical learner, is the “most important person in the room.”

Recently, several new factors have challenged the traditional medical education model. For a variety of reasons, general internists currently perform far fewer invasive procedures than they used to.<sup>1</sup> A heightened focus on patient safety and quality raises questions about the qualifications needed to perform invasive procedures. Assessment requirements have also become more stringent. The Accreditation Council for Graduate Medical Education (ACGME) now requires the use of measures that yield reliable and valid data to document the competence of trainees performing invasive procedures.<sup>2</sup> In 2006 these factors, and the challenge to educate, assess, and certify residents, prompted the American Board of Internal Medicine to revise its certification requirements and remove the need for technical proficiency in several procedures including paracentesis, central venous catheter placement, and thoracentesis.<sup>3,4</sup>

Two studies reported in this issue of the *Journal of Hospital Medicine* highlight important issues about preparing residents to perform invasive procedures. These include the educational limits of routine clinical care and the challenge to design rigorous educational interventions that improve residents' skills. Miranda and colleagues<sup>5</sup> designed a clinical trial to evaluate an educational intervention in which residents practiced insertion of subclavian and internal jugular venous catheters under the supervision of a hospitalist faculty member. The goal was to reduce the frequency of femoral venous catheters placed at their institution. Although residents demonstrated increased knowledge and confidence after the educational intervention, the actual number of subclavian and internal jugular venous catheter insertions was lower in the intervention group, and was rare overall. The intervention did not

achieve the stated goal of reducing the number of femoral venous catheters placed by residents. This research highlights that residents cannot be trained to perform invasive procedures through clinical experience alone. In addition, it demonstrates that brief educational interventions are also insufficient. Whether a longer and more robust educational intervention might have shown different results is uncertain, but many experts believe that opportunities for deliberate practice<sup>6</sup> using standardized and sustained treatments<sup>7</sup> can be a powerful tool to boost the procedural skills of physicians.

At the same institution, Lucas and colleagues studied the impact of a procedural service on the number of invasive procedures performed on a general medicine inpatient service.<sup>8</sup> They found a 48% increase in procedure attempts when the procedure service staffed by an experienced faculty member was available. However, no improvement in success rate or reduction in complications was demonstrated. Thus, opportunities for trainees to perform procedures increased, but the presence of a faculty member to provide direct supervision did not improve the quality of the procedures accomplished.

Together these reports highlight challenges and opportunities in training residents to perform invasive procedures. Both studies involved the procedural skills of residents. One used an educational intervention, the other featured faculty supervision. Both studies produced outcomes that suggest improved procedural training, but neither improved the actual quality of delivered care. A brief educational intervention increased resident confidence and knowledge but did not increase the quality or number of procedures performed by residents. Opportunities to perform invasive procedures increased dramatically when an experienced attending physician was available to supervise residents. However, more education was not provided, and the quality of procedures performed did not improve.

Given these limitations, how should physicians learn to perform invasive procedures? We endorse a systematic approach to achieve high levels of procedural skills in resident physicians. First, procedures should be carefully selected. Only those essential to future practice should be required. If possible, opportunities should be available for selected trainees to develop skills in performing additional procedures relevant to their future careers. An example would be the opportunity for residents

in a hospitalist track to develop proficiency in central venous catheter insertion through clinical experience, didactic education, and rigorous skill assessment. Second, dedicated programs are needed to train and assess residents in procedural skills. Reliance on clinical experience alone is inadequate because of the low frequency at which most procedures are performed and the inability to standardize assessments in routine clinical practice.

Simulation technology is a powerful adjunct to traditional clinical training and has been demonstrated to be highly effective in developing procedural skills in disciplines such as endoscopy<sup>9</sup> and laparoscopic surgery.<sup>10</sup> At our institution, a simulation-based training program has been used to help residents achieve<sup>11</sup> and maintain<sup>12</sup> a high level of skill in performing advanced cardiac life support procedures. We use simulation to provide opportunities for deliberate practice in a controlled environment in which immediate feedback is emphasized and mastery levels are reached. The rigorous curriculum is standardized, but learner progress is individualized depending on the practice time needed to achieve competency standards.

Most important, when training physicians to perform invasive procedures, it is critical to use interventions and training programs that can be linked to improvements in actual clinical care. The studies by Miranda et al. and Lucas et al. highlight the utility of focused educational programs to complement clinical training as well as the positive impact of direct faculty supervision. These results are important starting points for programs to consider as they train and certify residents in required procedural skills. However, much work remains to be done. These studies have revealed that improvements in patient care outcomes are not likely to occur unless robust, learner-centered educational programs are combined with adequate opportunities for residents to perform procedures under appropriate supervision.

Address for correspondence and reprint requests: Diane B. Wayne, MD, Department of Medicine, 251 E. Huron St., Galter 3-150, Chicago, IL 60611; Fax: (312) 926-6905; E-mail: dwayne@northwestern.edu

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