

Initial Experiences in Embedding Core Competency Education in Entry-Level Surgery Residents Through a Nonclinical Rotation

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ABSTRACT

Background Health care continues to expand in scope and in complexity. In this changing environment, residents are challenged with understanding its intricacies and the impact it will have on their professional activities and careers.

Aim Embedding each of the competency elements in residents in a meaningful way remains a challenge for many surgery residency program directors.

Methods We established a nonclinical rotation to provide surgery postgraduate year-1 (PGY-1) residents with a structured, multifaceted, largely self-directed curriculum into which each of the 6 core competencies are woven. Posttesting strategies were established for most curricular experiences to ensure to the greatest possible extent that each resident will have achieved an acceptable level of understanding of each of the

competency areas before being given credit for the rotation.

Results By uniformly exceeding satisfactory scores on respective objective analyses, residents demonstrated an increased (at least short-term) understanding of each of the assessed competency areas.

Conclusion Our project sought to address a prior lack of opportunity for our residents to develop a sound foundation for our residents in systems-based practice. Our new rotation addresses systems-based practice in several different learning environments, including emergency medical service ride-along, sentinel event participation, and hospice visits. Several research projects have enhanced the overall learning program. Our experience shows that a rotation dedicated to competency training can provide an innovative and engaging means of teaching residents the value of each element.

Background

Health care continues to expand in scope and in complexity.¹ In this changing environment, residents are challenged with understanding its intricacies and the effect

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it will have on their professional activities and careers. Resource allocation, cost, quality measurement, systems improvement, communication, and organization management all affect health care delivery. To ensure residents are able to attain a comprehensive understanding of the health care system, the Accreditation Council for Graduate Medical Education (ACGME) requirements² call for all accredited programs to implement competency-based training.

For most surgery resident training programs, strategies that stress fund of knowledge and patient care competencies proved no impediment. Morbidity and mortality conferences provided a foundation for embedding evidence-based medicine in the life-long learning process. However, our ability to instruct residents on interpersonal and communication skills and professionalism proved more of a challenge within curricula stretched to the limits by commitments to clinical and technical responsibilities. These shortcomings rang especially true when seeking means to establish curriculum in systems-based practice, having had no prior learning program dedicated to this competency. Our initial response was to implement programmatic modifications that would demonstrate a

modicum of commitment to competency-based training in these areas. Ultimately, we concluded that, if we were to treat the competencies as valuable assets to be woven into the fabric of the educational program, we would best serve residents by committing time away from the bedside to provide them with a fundamental understanding of the role of each competency in their professional lives and careers.

Concomitant with the establishment of the competencies, the Residency Review Committee for Surgery established simulation and skill training as a resource to be encouraged within training programs. This strategy is bolstered by the American Board of Surgery in its mandate that residents complete the Fundamentals of Laparoscopic Surgery³ simulation course to become board eligible. However, infrastructure and educator costs have somewhat limited many surgery residency programs, including ours, from offering simulation training on anything more than an as-needed basis.

The need for surgery residents to participate in research cannot be overstated if the profession is to maintain the cardinal principal that surgical training is an art and a science. A growing research arena encompasses investigating the health care system for its complexity, errors, and interventions to address errors—a significant component of the competency of systems-based practice. Related to analyzing and reducing health care error, simulation has been shown to be useful for focused research, such as the effect of fatigue on surgical skills,⁴ and for surgical rehearsal and planning.^{5,6}

Despite these appealing applications of systems-based practice, we were faced with a dearth of opportunities to embed the competencies, particularly systems-based practice, within our clinical curriculum. To address this gap, we established a nonclinical rotation for postgraduate year-1 (PGY-1) surgery residents that leveraged assets in simulation training and research with the intent of providing competency education, with a focus on systems-based practice.

Fundamentals in Establishment of the Rotation

The Phoenix Integrated Surgical Residency is based at Banner Good Samaritan Medical Center in Phoenix, Arizona, with the Phoenix Veterans Administration Integrated Health Care System, and several medical centers in Phoenix, Arizona, and Anchorage, Alaska, serving as added clinical sites. Thirty categorical (6 PGY-1) and 6 preliminary (all PGY-1) residents interact with 32 faculty physicians. In 2006, we conceptualized a rotation for PGY-1 residents that would (1) deliver a robust competency-based curriculum, (2) include an environment for cutting-edge simulation skills, (3) provide for engagement in clinical research, and (4) be implemented on a cost-neutral basis. In 2007, a 1-month rotation (equal in length to our standard PGY-1 rotation) was established for each categorical resident in collaboration with 2 primary entities. The first is

our American College of Surgeons Level I–Accredited Educational Institute, the Simulation Education and Training Center at Banner Good Samaritan Medical Center, with 2 staff members from the center providing consultative services to the residents. Added staffing came from the Human Machine Symbiosis Laboratory at Arizona State University. Banner Good Samaritan Medical Center provided half-time salary support for a bioengineering doctor, who, among other duties, would mentor the PGY-1 residents, with a particular focus on the development of research proposals. A half-time research coordinator serves as the liaison between the doctor and the residents to allow them to produce research worthy of presentation and publication in the peer-reviewed literature.

One roadblock to rotation implementation was that there was no federal salary offset for residents participating in nonclinical rotations. We considered placing residents on evening/night time clinical duties to allow some reimbursement but felt this might undermine the value of competency-based training. Our Veterans Administration partners offered to subsidize the position as a “New Innovation” rotation, with value achieved by formally introducing residents to error reduction, simulation-based skills training, and sentinel event management.

Curriculum

The curriculum provides elements of competency training, research, and simulation training through a series of scripted interactions the resident must complete and which are posted on an intranet rotation calendar administered by the program coordinator. Content delivery occurs through self-study, observational visits, educator facilitation, and didactic training. The overarching structure includes regular progress monitoring by the program coordinator and formal documentation exercises that must be completed by the residents and presented to the program director at the conclusion of the rotation to receive credit for the rotation (these vary from signatory to certification to posttesting).

Medical Knowledge

Medical knowledge is emphasized through didactic conference (eg, basic sciences, selected readings, morbidity and mortality conferences, grand rounds, specialty conferences) participation. Other pieces of this curriculum are detailed below.

Patient Care Skills Training in the Simulation Laboratory

A little over five years ago, the Surgery Residency Review Committee added the documentation of 35 upper gastrointestinal endoscopic and 50 colonoscopy procedures in order for graduating trainees to participate in the American Board of Surgery Certification process. To mitigate patient risk, we began a policy that required our PGY-1 residents to pre-train in upper endoscopy, colonoscopy, and bronchoscopy using the modular components offered through its simulator manufacturer

(Immersion Corporation, San Jose, CA). Residents also complete the Fundamentals of Laparoscopy Simulator training course. Supervision and assessment are provided by a volunteer faculty member (1 h/wk). The core of our simulation training is accomplished using advanced skills-training simulators developed in our laboratory. The modules recognize that simulation is a reliable and safe method of offering skills training. Several studies⁷⁻⁹ have validated that simulation is a reliable and safe method of offering skills training, and that simulation-based assessments can reliably distinguish between experts and novices. That said, Gallagher et al⁹ hypothesized that skills learning on a simulator risks producing nothing more than a pretrained novice. To limit the threat of such an outcome, we sought to create modules that would result in learning surgical proficiency skills that were transferrable to realistic surgical environments.

One challenge in robust skills training is to address the growing cognitive load placed on surgery residents. Evaluation and monitoring of skills becomes an even more critical component of safe and effective training. Therefore we developed a novel methodology to offer psychomotor and cognitive training through custom virtual-reality simulators, with a key advantage being their ability to offer immediate feedback and remediation. We introduced the notion of embodiment training, in which simulators replicate surgical working conditions (eg, ambient noise). To compensate for reduced training time, we have established take-home training by modifying affordable platforms, such as Nintendo Wii (Nintendo of America, Inc, Redmond, WA).¹⁰ This helped us develop focused simulation training that allows time in the simulation center to be used to learn hands-on psychomotor skills with technical proficiency that was significantly better than that achieved by residents not exposed to this training.

For each module created, we developed expert scores. The resident is given a checklist denoting the minimum number of iterations (ranging from 30 to 120 repetitions, averaging 3 to 6 minutes per attempt) generally required to achieve expert proficiency. While the resident completes each simulation, our customized measurement architecture produces a quantitative evaluation of skills, which is compared with that of the expert. Any resident who does not meet criteria participates in further sessions until success is achieved. Throughout this phase, the resident is given additional feedback by trained simulation center staff members. A detailed, confidential skills summary report is given to each resident.

Evidence-Based Medicine Learning Through

Clinical Research During the research segment of the rotation, residents are taught the basics of research and study design, during which they are asked to design a study around simulation. By the end of the rotation, a proposal fashioned by residents allows them to pursue the research through Institutional Review Board approval and to recruit

their colleagues to participate in the study. This has proven an effective means of creating a sustainable platform to offer both skills and research training within the flow of investigational research.

Professionalism Experiences The medical relations director for the Arizona State Medical Board meets with the resident in a session that covers issues relating to professional behavior, patient complaints, substance abuse, and sanctions or advisory letters. Any physician who is the subject of a complaint is asked to testify in his or her defense. The resident debriefs with the medical relations director at the end of the session.

Modules With Roots in Systems-Based Practice

Business of Health Care Modules Thirty interactive, computer-based, 20- to 45-minute modules are designed to help residents become “stewards of the resources under their control and passionate advocates for deliberate, systemic improvements in the way health care is delivered.” The modules feature several topics, including economics and cost accounting, operations management, organization and processes of health care, financial analysis, and physician leadership. Progression cannot occur without mastery of each topic through posttesting.

National Institutes of Health Training for Human

Subjects Protection Enhancing resident understanding of human-subject protection mechanisms, Health Insurance Portability and Accountability Act, and related matters uses the National Cancer Institute’s module on participant protection for conducting research with human subjects. Residents must complete the 4-hour course and obtain the training certificate.

Other Observational Experiences Residents are placed on a risk management case or sentinel event review team, with each resident interviewing 1 of the medical center’s chief executive officers for insights into physician and administration relationships, and attending the Graduate Medical Education Committee meeting with the program director.

Interpersonal and Communication Skills Training Sessions

SEGUE (Set the stage, Elicit information, Give information, Understand patient’s perspective, End the encounter) Framework Communication Course This computer-based, interactive modular (4 to 6 hours) course enables residents to learn the importance of communication in the health care system and to develop strategies to be an effective communicator when completing a history.

Hospice Visit Each resident spends half-day sessions at a Phoenix-area hospice center, joining a hospice team composed of physicians, nurse practitioners, and social workers. A typical session includes work-rounds, a patient management debriefing conference, and a 1-on-1 session with the physician director to review specific elements of



FIGURE

FIGURE WORD CHART ELUCIDATING THE RELATIVE FREQUENCY OF COMMENTS OFFERED BY RESIDENTS WHO COMPLETED THE EVALUATION FORM, WITH LARGER FONTS REPRESENTING A GREATER FREQUENCY OF RESPECTIVE COMMENTS

hospice care (eg, use of opiates, recognition of dementia, Arizona state statutes on advanced directives, hospice eligibility). On completion, each resident receives a detailed competency-based posttest report and score card.

Ambulance/Helicopter Ride To better understand the working environment of paramedics and emergency medical technicians and the patient experience, residents are assigned to a *rig* and/or *rotor* for an overnight shift. During this process, residents are encouraged to take notes and then debrief with the paramedics, who must attest to completion of the session(s).

At the end of this rotation, the residents are asked to complete a feedback questionnaire to quantify their perception of the training regime. The questionnaire included a Likert 10 point scale-based overall satisfaction question and open-ended (qualitative) questions.

Outcomes

From a perception perspective, the 25 residents who have thus far completed the rotation were highly satisfied (Likert mean satisfaction 7.8 ± 1.5 SD). A standard word chart¹¹ (FIGURE) was developed to encompass the qualitative aspects of feedback, reflecting words and concepts used more frequently by participants in progressively larger fonts. Suggested improvements included allocating more time for the rotation and developing a more robust measure of cross-simulation performance. We also received participation requests from our own preliminary residents as well as residents in orthopedic surgery and obstetrics and gynecology. Currently, residents from these disciplines are taking part in segments of the curriculum. Although this has resulted in having more than 1 resident assigned to the rotation on occasion, the diversity of experiences offered has diminished the risk of oversubscription.

From a research perspective, the course has enjoyed considerable success. Residents have presented their work at regional and national meetings. In the 3 years before instituting the rotation, no peer-reviewed publications were initiated by our residents. Since the implementation of the course, 11 peer-reviewed articles have been published, 3 have been accepted, and several are being prepared for submission. One of our research projects found that the decrement in surgical proficiency at the end of a 12-hour work shift was linked to the time of day the shift was completed (eg, greater decrement after a night float versus day time call), leading to a reassessment of the night float concept.¹² Another approached the concept of structure driving behavior through the development of a patient care pathway to reduce cardiothoracic surgery wound infections.¹³

Discussion

We developed our rotation to address concerns about our residents' lack of opportunity to develop a sound foundation in systems-based practice. Although programs in other disciplines (internal medicine, psychiatry) have reported on rotations designed to address core competency training, to our knowledge, ours is the first purely nonclinical surgical rotation that combines experiences in clinical research, competency training, and procedural skills enhancement. The aim was to provide residents with competency skills to function effectively within the health care system. Advanced psychomotor skills training also gives entry-level residents an opportunity to hone their surgical proficiency before they enter the operating theater. Participation in clinical research enables broader thinking and gives residents the ability to devise strategies to improve patient safety and system efficacy.

A key factor that we believe contributes to the residents' favorable response to the rotation is the combination of the 3 activities. This enables residents to gain understanding in a comprehensive manner rather than receive information and skills through disjointed modules interspersed among their growing clinical responsibilities. We expect that as the course matures, an even more consistent (across resident) experience and robust curriculum will evolve.

The success of the rotation to a considerable extent lies in the hands of the program director, who gathers and maintains educators who donate their time to make the course possible. The program coordinator also is important in ensuring that all elements of the rotation are completed by the residents. Because the rotation is a work in progress, it demands more attention when contrasted with more mature rotations. We are on a continual search for experiences to enhance this rotation. By developing better means to track resident experiences, we hope to modify the curriculum based on consensus feedback. We expect that, in the future, we will be able to document the extent to which this rotation has achieved its goal of long-term integration of the core competencies into the life-long learning process.

References

- 1 Relman A. Education to defend professional values in the new corporate age. *Acad Med*. 1998;73(12):1229–1233.
- 2 Accreditation Council for Graduate Medical Education. ACGME competencies: suggested best methods for evaluation. Available at: <http://www.acgme.org/Outcome/assess/ToolTable.pdf>. Accessed December 12, 2007.
- 3 Fundamentals of Laparoscopic Surgery. Los Angeles, CA: FLS program. Available at: <http://www.flsprogram.org/2005>. Accessed December 12, 2007.
- 4 Kahol K, Leyba M, Deka M, et al. The effect of fatigue on psychomotor and cognitive skills. *Am J Surg*. 2008;195(2):195–204.
- 5 Chou W, Wang T. Human-computer interactive simulation for the training of minimally invasive neurosurgery. In: *Proceedings of IEEE International Conference on Systems, Man and Cybernetics*. Vol 2. Los Alamitos, CA: IEEE Press; 2003:1110–1115.
- 6 Nerlich M, Schaechinger U. *Integration of Health Telematics Into Medical Practice*. Washington, DC: IOS Press; 2003.
- 7 Aggarwal R, Black SA, Hance JR, Darzi A, Cheshire NJW. Virtual reality simulation training can improve inexperienced surgeons' endovascular skills. *Eur J Vasc Endovasc Surg*. 2006;31(6):588–593.
- 8 Brydges R, Kurahashi A, Brümmer V, Satterthwaite L, Classen R, Dubrowski A. Developing criteria for proficiency-based training of surgical technical skills using simulation: changes in performances as a function of training year. *J Am Coll Surg*. 2008;206(2):205–211.
- 9 Gallagher AG, McClure N, McGuigan J, Crothers I, Browning J. Virtual reality training in laparoscopic surgery: a preliminary assessment of minimally invasive surgical trainer virtual reality (MIST VR). *Endoscopy* 1999;31(4):310–313.
- 10 Bokhari R, Bollman-McGregor J, Kahol K, Smith M, Feinstein A, Ferrara J. Design, development, and validation of a take-home simulator for fundamental laparoscopic skills: using the Nintendo Wii for surgery training. *Am Surg*. 2010;76(6):583–586.
- 11 Viegas, F.B., Wattenberg, M., Feinberg, J. Participatory visualization with Wordle. *IEEE Trans Vis Comput Graph*. 2009;15(6):1137–1144.
- 12 Brandenberger J, Kahol K, Feinstein A, Ashby A, Smith M, Ferrara J. Effects of duty hours and time of day on surgery resident proficiency. *Am J Surg*. 2010;200(6):814–818.
- 13 Trussell J, Gerkin R, Coates B, et al. The impact of a patient care pathway on surgical site infection rates in cardiothoracic surgery patients. *Am J Surg*. 2009;196(6):883–889.