

Educating surgery residents in patient safety

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Background

The health care system of the United States has been under immense public and private scrutiny over the past several years. The landmark report of the Institute of Medicine (IOM), *To Err is Human: Building a Safer Health System*, resulted in patient safety emerging as the predominant concern in recent times [1]. The report drew attention to the high incidence of medical errors and made a number of sweeping recommendations to improve patient safety. These included development of curricula in patient safety and adoption of those curricula in training and certification requirements. Patient safety was also underscored in the subsequent report of IOM, *Crossing the Quality Chasm: A New Health System for the 21st Century*, which recommended restructuring clinical education across the continuum of professional development to promote the delivery of safe, effective, patient-centered, timely, efficient, and equitable health care [2]. The report articulated the need to incorporate new knowledge and skills into practice, develop effective teams, and use information technologies to improve access to clinical information and support clinical decision making. The next report from IOM, *Health Professions Education: A Bridge to Quality*, emphasized that all health professionals should be educated to deliver patient-centered care as members of interdisciplinary teams. Emphasis was placed on evidence-based practice, quality improvement approaches, and informatics [3]. The report defined core competencies for

Supported in part by a grant from the Agency for Healthcare Research and Quality, U18 HS12021.

The opinions expressed in this article are those of the authors and do not necessarily reflect the official position of the American College of Surgeons.

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health professionals, which include skills in identifying errors and hazards in care, understanding and implementing basic safety design principles, measuring quality of care, and developing interventions to change processes and systems of care to improve quality. The need to focus on learning outcomes within the framework of competency-based education was also expressed in the report.

The national agenda regarding physicians' competence and patient safety has been driven by accreditation and certification bodies as well. The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) have both defined six core competencies that all physicians must acquire and demonstrate. These are: (1) medical knowledge, (2) patient care, (3) interpersonal and communication skills, (4) professionalism, (5) practice-based learning and improvement, and (6) systems-based practice [4,5]. All six competencies are key to providing high-quality and safe patient care. Although technical skills have not been identified within a separate core competency, these skills are encompassed by the competency of patient care. The competency of systems-based practice includes specific focus on the systems in which health care is delivered, and on safe practices within these systems. The definition of the same six core competencies by both ACGME and ABMS is significant, and underscores the importance and relevance of these competencies across the continuum of professional development, from residency education to independent practice. Also, the importance of assessing the competence of residents and adequately supervising residents has been articulated by the Association of American Medical Colleges (AAMC) [6].

Another topic that has generated considerable concern and national debate over the past few years is the impact of fatigue on physician performance [7]. The restriction on resident duty hours imposed by the ACGME in 2003 is aimed at addressing concerns about resident fatigue and its impact on patient safety. Creative surgical education models and novel approaches are being developed to comply with this requirement, and to ensure that surgery residents receive appropriate educational experiences in this new paradigm [8,9]. There also has been considerable discussion regarding the perceived negative impact of shorter resident work hours on the continuity and quality of patient care [10,11]. The full impact of the resident duty-hour restriction on surgical care and residency education needs to be carefully evaluated through well-designed longitudinal studies.

Education has been the subject of considerable discussion within the context of patient safety, because of its enormous potential to change physicians' behaviors and impact the systems of health care. The need for special interventions to educate the surgical workforce in patient safety has become abundantly clear. Surgery residents are at the heart of health care delivery in teaching institutions. Thus, education of surgery residents in patient safety should constitute a key strategy to ensure optimum outcomes.

Such educational efforts are also critical to appropriately train surgeons of the future. Educational efforts must take into consideration recommendations from national bodies, such as the IOM, ACGME, ABMS, and AAMC, as well as opinions of experts in this field. The special needs within each residency program should be considered, and the educational interventions implemented within the context of the restricted resident duty hours.

Principles underlying educational interventions

Education of surgery residents in patient safety should be based on principles and practices of contemporary adult education, experiential learning, and patient safety. Both traditional and innovative educational approaches may be used to address the learning needs of residents. State-of-the-art technology can be very useful in implementing educational programs and evaluating their impact. Assessment of residents requires the use of valid and reliable methods. Results of these assessments should be used to modify goals and learning objectives of the educational programs, through an ongoing cycle of continuous quality improvement.

Educational approaches designed to address patient safety and the core competencies of individuals should be based on principles of contemporary adult education and experiential learning [12]. Learners need to recognize the relevance of the content to their professional work in order to be motivated to participate fully in the educational programs. Their past experiences and skills should be considered in designing and implementing such programs. The interventions should involve active learning, and should include specific and timely feedback. Opportunities for self-directed learning need to be provided to ensure relevance, generate motivation, and encourage active participation by the learner. Reflection and metacognition, which involve critical analyses of one's knowledge and skills, are crucial to achieving expertise and should be encouraged.

Within the context of technical skills acquisition, consideration needs to be given to three stages in skills development: (1) cognition, (2) integration, and (3) autonomous learning. The first stage of cognition includes decisions regarding the indications for the procedure, selection of the appropriate procedure, and preoperative preparation of the patient. This stage also involves perceptual awareness of the procedure, during which the learner should visualize and mentally rehearse each step of the procedure. The next stage of integration involves guided learning, during which close preceptorship is provided by an experienced teacher in order to help the learner acquire the skills required to perform the procedure. Graded responsibility is progressively assumed by the learner under the watchful eye of the preceptor. The focus of this stage of learning is not just on the psychomotor domain, but also on cognition and judgment. The final stage of autonomous learning is a lifelong process, which involves ongoing perfection of precision

and efficiency. Reflection is important throughout each stage of learning, but is especially critical during the autonomous stage. Motivation of the learner, deliberate practice, and specific and timely feedback are all crucial during the acquisition of new skills.

The learning curves of individuals should also be considered during the process. A learning curve illustrates the relationship between experience with a procedure and an outcome variable [13]. Although learning curves vary with each individual's ability and skill, the curves are generally steep during the initial stages and become flatter with experience. This progression is associated with a decrease in errors and an increase in speed of the learner. Assurance of patient safety during residency training requires close supervision of resident performance, and attention to individual learning curves. Certain technical skills should be taught and learned in controlled and protected settings, such as skills laboratories, before work in real environments. Learning in skills laboratories can help to ensure achievement of pre-established levels of skills in these protected environments without compromise to patient safety or comfort [14].

Effective educational interventions should help promote changes in the performance of physicians. In the field of continuing education, a variety of strategies have been found to encourage the integration of new knowledge and skills into practice and reinforce learning. Research has shown that pure didactic sessions are not as effective in changing physicians' behaviors as experiential sessions, especially if the experiential sessions are sequenced [15]. Enabling strategies can facilitate the transfer of the newly acquired knowledge and skills to practice, and reminders help in supporting changes in physicians' behaviors [16,17]. Audit of practices, accompanied by specific feedback, has been found to encourage changes in behaviors. Also, involvement of opinion leaders in promoting best practices is effective [18,19]. These principles from the field of continuing education may be readily applied to residency education in order to facilitate changes in the residents' behaviors and practices.

Principles of patient safety have underscored the role of systems in preventing the occurrence of human error and minimizing the impact of errors [20,21]. The special focus on systems recognizes the fallibility of humans and emphasizes the role of systems in reducing the risk of adverse outcomes. High-reliability organizations have established a series of defenses within the systems to serve as safeguards against errors and adverse outcomes. Training of the work force, simplification of tasks, standardization of procedures, and lesser reliance on memory are all important defenses. Redundancies within systems are also essential to compensate for malfunctions in the primary defense mechanisms. However, latent conditions may exist within systems that increase the risk of errors in the presence of the appropriate combination of factors [20]. These latent conditions can remain dormant for extended periods of time, until certain combinations of human failures and systems malfunctions break through

the defenses and result in an error or an adverse outcome. Systems problems that may need to be addressed in the health care environment include failures in the proper design of processes, poor work conditions, complexity of tasks, lack of standardization, and inadequate training of the work force [21]. Although the systems play a critical role in patient safety, the individual skills and responsibilities of health care providers remain paramount. The focus on systems needs to be appropriately balanced with the focus on individuals. Educational interventions should help develop the knowledge and skills of residents in these key elements of patient safety.

The organizational culture

On one hand, educational interventions focusing on patient safety are most effective if they are implemented in an organizational culture that promotes patient safety. On the other hand, the educational interventions themselves are necessary to create such a culture. Organizations that successfully perform in a highly reliable manner attribute this success to the development of a culture that integrates safety into every aspect of their work. Efforts must be made to create an overarching culture of safety in surgery, similar to that in high-reliability organizations. Effective team leadership and membership, clear communication, and exemplary professionalism are all crucial to creating a safe milieu. A culture of patient safety should recognize the role of systems and consider safety as everyone's responsibility, avoid blame, and view errors and near misses as learning opportunities [22,23]. Such a culture should encourage voluntary disclosure of errors and near misses, promote reflection when such events occur, provide emotional and personal support for individuals to deal with the consequences of such events, and facilitate changes in practice for the future. Effective leadership from the chair of the surgery department, division chief, and residency program director is critical in creating and promoting such a milieu. The leaders within the department need to serve as sterling role models, preceptors, and mentors who promote patient safety by example. Safe practices and efforts to enhance safety should be visibly recognized and rewarded.

Near misses present special learning opportunities that should be used to promote a culture of patient safety [24]. They are valuable in highlighting the role of defense mechanisms within systems that may have prevented the occurrence of an adverse outcome or an error. In comparison with errors and adverse outcomes, there are larger numbers of near misses. Thus, near misses generally present a broad spectrum of situations and issues for discussion. Further, near misses are not accompanied by the emotional responses and defensive reactions that usually accompany errors or adverse outcomes; thus, the learning environment is more conducive and the learners more receptive.

Patient safety must be monitored through a comprehensive and ongoing process [25]. Specific criteria should be used to define errors and near misses;

systematic chart reviews need to be conducted by faculty members and staff to identify errors and near misses; and regular input regarding such events needs to be solicited from members of the surgical team. Information-based systems permit automatic computer screening for adverse outcomes, errors, and near misses, and facilitate convenient entry of information. This information can come from various sources, including health care personnel, the laboratory and radiology departments, and routine surveillance conducted by institutional committees. Data from these sources should be coordinated through systems that are convenient to access and user-friendly. These data should be collated and synthesized, shared with the health care providers, and used as the bases for discussions in educational programs. Reminders about identification and reporting of such events help improve compliance with reporting requirements. Self-reporting of errors and near misses should be encouraged, recognized, and rewarded.

Educational interventions are most readily accepted when they are not implemented in isolation, but are an integral part of the daily routines of the department and the service on which the residents are rotating. Individuals from across the health care disciplines should be encouraged to identify and bring to the attention of the team leaders and team members problems and practices that may compromise patient safety. Leaders of surgical teams should accept the observations graciously and recognize these contributions. Also, residents should be encouraged to discuss their mistakes with other members of the team and their superiors, and should be able to do so without fear of reprisal or reprimand. Faculty members should discuss their own mistakes openly, and demonstrate exemplary role modeling for the residents to emulate. Guidelines need to be provided about steps that should be taken when a resident is uncertain about a situation. A culture of patient safety should also emphasize evidence-based practice in clinical activities.

Individuals learn values and behaviors from their peers and superiors through a process of socialization. This is often described as the “hidden curriculum” [26]. A change in the culture within surgical teams and surgery residency training programs is necessary to transform a hidden curriculum that involves blaming individuals for adverse outcomes to one that considers errors and near misses as learning opportunities. Good role modeling is key to creating this change. Education can play a pivotal role in establishing a culture of patient safety [27].

Surgical traditions and norms may influence efforts directed at promoting a culture of patient safety. A study of physicians, residents, nurses, and airline pilots found different attitudes regarding hierarchy, teamwork, and errors [28]. Most pilots and intensive care staff (97% and 94%, respectively) advocated flat hierarchies, in which the senior team members are open to questions about their decisions from the junior team members. In contrast, only 55% of surgeons advocated flat hierarchies. High levels of teamwork with surgeons were reported by 73% of surgery residents and 64% of surgeons, in comparison with 28% of surgery nurses, 39% of anesthesiologists, and 25% of

anesthesia nurses. One-third of the intensive care staff did not acknowledge making errors, and several barriers to discussing errors were identified by the staff. Also, surgeons were more likely to deny the impact of stress and fatigue on performance, as compared with pilots.

The cultural differences resulting from traditions and norms need to be considered in creating a milieu of patient safety within surgery. Certain characteristics of surgical teams may make acceptance of new approaches difficult. On one hand, the traditional steep hierarchical structure of surgical teams, as well as the extraordinary emphasis on personal responsibility and excellence, may thwart efforts to create a supportive environment that allows residents to learn from free admission and discussion of their errors and near misses [27]. On the other hand, the normative behaviors expected within surgical teams and the strong emphasis placed on achieving goals may facilitate implementation of new approaches directed at patient safety. Once the team leader adopts a new approach, it is likely to be readily accepted by other team members. Leadership at all levels is essential to create the needed cultural shift. Even with such leadership, this change will be an evolutionary process, which may take time to implement and be widely accepted.

Focus on individual surgery residents as learners

Focus on individual surgery residents as learners is key to promoting patient safety in residency programs. The selection of residents, input from residents about safety practices, and support for residents following admission of errors are worthy of special consideration. In addition to the usual criteria used to choose residents, certain qualities and abilities of the candidates may be important to evaluate during the selection processes. These include introspection, inclination to critically assess one's strengths and weaknesses, receptivity to constructive feedback, ability to function well in teams, awareness of the impact of systems on individual performance, and willingness to accept change. Individuals with these qualities and abilities may be more likely to function effectively within health care teams and in environments that consider patient safety as their highest priority.

Suggestions from residents for reducing errors can be of immense value in creating an environment of patient safety and designing educational programs to support this goal. As individuals involved on the front lines of patient care, residents offer a unique perspective. Residents have emphasized the need for change in the culture of surgery to encourage reporting of errors by residents and to support frank and open discussions about such occurrences, especially during morbidity and mortality conferences [29]. They also have highlighted the need to standardize training to perform procedures, and have underscored the roles of leadership, communication, and coordination in health care teams. The value of formal leadership training for residents has been stressed as well. Residents have identified problems with sign out procedures and have enunciated the merits

of computerized sign out systems in promoting patient safety. Safe and effective sign out procedures have assumed great importance in the current environment of restricted resident duty hours and cross-coverage by resident teams not familiar with the patients.

The impact of errors on residents must also be considered. A study of internal medicine residents revealed that only 54% of the residents discussed their mistakes with their staff physicians, and only 24% shared this information with patients or the patients' families [30]. Of note, 90% of residents reported that patients experienced significant adverse outcomes following the mistakes, and mistakes often resulted in multiple adverse outcomes. Cognitive, emotional, and cultural barriers may prevent acceptance of medical error [31]. The errors may be associated with concern regarding the patient's welfare, feelings of shame, fear of perceived incompetence, and the worry about the potential for litigation [32]. Competitive environments within residency programs may also deter residents from reporting errors. Further, expressions of doubt may be interpreted as a sign of weakness, which could result in the residents' downplaying their uncertainties.

Another study of internal medicine residents found that the major mechanisms used by residents to deal with errors were denial, discounting, and distancing [33]. Denial involved the resident's rationalizing that the practice of medicine includes gray areas and repressing the error. Discounting involved externalizing the blame and attributing the error to circumstances beyond the resident's control. Distancing, which occurred when the resident could neither deny nor discount an error, involved the justification that everyone makes mistakes, and that the resident's error was unavoidable. Such reactions to errors must be considered by faculty members and program directors as they strive to provide residents with meaningful feedback and support. Residents should also be taught to recognize these typical reactions to error, and provided guidance regarding mechanisms to help offset them.

Disclosure of errors to the patient and the patient's family can present special challenges, because of the differences in perspectives of the physician and patient. Studies have shed considerable light on such differences [34,35]. Physicians tend to define errors narrowly. They are inclined to disclose only the errors that cause harm, and are not keen to disclose near misses. Physicians choose their words carefully and are concerned that an apology may create a legal liability. Also, they have concerns regarding the negative impact of the error on their careers. The patients, on the other hand, define errors broadly. They want full disclosure of all errors that cause harm, and some patients want near misses to be disclosed as well. In addition, patients desire an apology, and want to know what will be done differently in the future to prevent a similar occurrence. The process of disclosing an error may become quite difficult in view of the different perspectives, emotional reactions, and concerns of the patient and the physician.

Clearly, a variety of forces combine to deter disclosure of errors by physicians. Residents need to learn appropriate approaches to deal with error, from involving a faculty member to discussing the event with the patient and the patient's family [36]. They also must learn how to handle their personal feelings following such an event. Faculty members should provide residents with the necessary support and guidance, and should serve as exemplary role models who demonstrate effective approaches for dealing with errors, both professionally and personally.

Constructive changes in the residents' practices have been found to be associated with the residents' accepting responsibility for their mistakes and with the extent of discussion of the mistakes [30]; however, residents who accept the responsibility are more likely to experience emotional distress as compared with residents who do not accept such responsibility [30,37]. The error needs to be placed in perspective, balancing individual accountability with the role of systems. Opportunities should be offered to the resident to express his or her emotions, have these responses validated, and receive reassurance. The resident may need to be assured that an error is not a sign of incompetence. The error should be analyzed thoroughly, and specific feedback provided regarding steps that need to be taken to reduce the risk of a similar occurrence in the future. The feedback should be specific, timely, sufficiently detailed, and must be shared in a supportive environment [38]. Faculty members providing support and feedback may want to share their own experiences with the resident while discussing the resident's error to help boost the resident's confidence. A mentor who is well respected by the resident may be a source of valuable support, comfort, and feedback for the resident. The program director and faculty members need to establish systems within the residency program to provide emotional support and advice to residents with the goal of preventing recurrence of errors.

Curriculum in patient safety for surgery residents

A comprehensive curriculum in patient safety needs to be developed for all surgery residents. Such a curriculum should be competency-based and modular in order to facilitate its adoption or adaptation across all surgical specialties. Development of the curriculum should begin with a comprehensive needs assessment to help define the curricular content. The needs assessment may involve obtaining information from high-reliability organizations, the patient safety literature, and the work of other medical specialties that have designed such curricula. Expert opinions of the surgery faculty, especially those experienced with patient safety practices and patient safety education, and feedback from surgery residents should form a vital part of the needs assessment. The goals and learning objectives should be defined for the entire curriculum and the individual teaching and learning modules, based on the results of the comprehensive needs assessment. Teaching plans will then need to be developed, and resources and materials

identified to implement the modules. Representatives from various surgical specialties may be invited to provide input into the development and implementation of such a curriculum. Also, the faculty members will need to be trained to effectively conduct the teaching and learning sessions.

A patient safety curriculum for emergency medicine residents has been developed [39]. It addresses the learners as well as the systems. The curriculum includes the following content areas: awareness of medical error, definitions and models of error, cognitive error and medical decision making, learning from the experiences of others, complications resulting from invasive procedures, medical error from a systems perspective, and living with the reality of medical error. A patient safety curriculum has also been outlined within the context of continuing education, and includes topics relating to adverse drug events, errors of omission and commission, discharge planning, transitions in the level of care, consultation, pre-operative evaluation, and drug interactions [40]. The content areas defined in these curricula may be considered in developing a curriculum in patient safety for surgery residents. Also, errors in communication, postoperative monitoring and care, and diagnosis have been found to occur quite frequently in the surgical environment, and should be considered in defining the curricular content for surgery [41].

The construct of a curriculum in patient safety for surgery residents has been outlined [27]. The curriculum needs to especially focus on the prevention of errors and adverse outcomes. The causes and impact of surgical errors, information on human factors, and the role of systems should be learned by all surgery residents. During the early years of residency training, attempts need to be made to build on patient safety lessons learned in medical school. Basic concepts of patient safety and error prevention should be highlighted, including error theory, classification of errors, human factors engineering, roles of individuals and systems, teamwork, communication, and professionalism. Systems that have been especially designed to reduce the risk of errors in various surgical environments should be highlighted. Residents should be introduced to the process of systematically analyzing errors and near misses. The interplay of multiple causes in the occurrence of errors needs to be emphasized, in order to dispel the myth that there is usually a single root cause of an error. Information on approaches to dealing with personal error and handling an error committed by others needs to be provided. Fundamental concepts for disclosure of adverse outcomes, errors, and near misses should be introduced, including disclosure of such events to the faculty member responsible for the patient's care, as well as to the patient and the patient's family. Information on reporting errors should be provided as well. The residents must be expected to demonstrate the basic knowledge and skills in these areas.

During the later years of residency training, patient safety issues need to be addressed within the context of increasingly complex situations in various surgical settings. Residents should be able to interact effectively with other

members of the surgical team during routine clinical activities in complex environments and during crises. They should be able to provide exemplary leadership and serve as effective members in interdisciplinary teams. Residents should also be expected to appropriately handle personal errors and errors made by others, and to disclose complex information regarding errors to the faculty members, the patients, and the patients' families. They should acquire the skills to lead efforts to systematically analyze errors and near misses, identify potential sources of error, and propose solutions to reduce the risk of such errors in the future. They may be provided opportunities to pursue surgical patient safety activities at the organizational level through their participation in institutional and departmental committees. Residents need to become proficient with the reporting requirements of the institution and various regulatory bodies. The surgery residents at senior levels must be expected to demonstrate advanced knowledge and skills in these areas. A list of content areas for a curriculum on patient safety for surgery residents appears in **Box 1**.

The didactic content of the patient safety curriculum should be addressed using a variety of traditional and innovative educational approaches. A self-assessment exercise may be offered to residents at the beginning of the educational program to help them define their individual learning needs, motivate them to participate in the program, and guide them in their learning efforts. The core of the didactic material may be covered through case studies. The case studies bring relevance to the content and offer an engaging format for learning. Residents may be assigned selected readings before reviewing a case study to identify the safe and unsafe practices. Residents could be asked to describe management of consequences of the errors discovered, and to develop plans to minimize the risk of adverse outcomes. Ideally, the work with case studies should be followed by interactive discussions of the cases, led by an experienced and respected faculty member. Enthusiastic participation by faculty members not only helps residents learn through the faculty members' experiences and expertise but also emphasizes the importance of the field to the residents. Independent study modules may also be made available to the residents. Availability of the case studies and modules on the Internet or on CD-ROMs can provide residents greater flexibility to complete the exercises at their own pace, and to accommodate the educational activities in their busy routines.

The didactic material relating to interpersonal and communication skills and professionalism may be effectively taught and learned through the use of case studies and videotaped vignettes, which should be used as the basis for interactive discussions. Videotaped vignettes are effective in demonstrating both good and bad behaviors, and can be developed to highlight errors and near misses. Critique of short vignettes by residents may be followed by interactive discussions led by faculty members.

Role play exercises are effective in addressing interpersonal and communication skills, professionalism, and psychosocial issues relating to

Box 1. List of content areas for a curriculum in patient safety for surgery residents*Early years*

- Basic concepts of patient safety and error prevention
- Error theory; classification of errors
- Human factors engineering
- Roles of individuals and systems
- Effective teamwork and communication; exemplary professionalism
- Safety systems in surgical environments
- Introduction to analyses of errors and near misses
- Basic concepts regarding handling personal errors and errors committed by others
- Fundamental concepts relating to disclosure of adverse outcomes, errors, and near misses to faculty members, patients, and patients' families
- Information on reporting of errors and near misses

Later years

- Patient safety in complex situations in various surgical settings
- Effective interactions with other team members in complex environments and during crises
- Exemplary leadership and effective membership in interdisciplinary teams
- Skills in handling personal errors and errors committed by others
- Skills in disclosing complex information regarding errors to faculty members, patients, and patients' families
- Skills in leading analyses of errors and near misses
- Opportunities to pursue patient safety activities through participation in institutional and departmental committees
- Proficiency in meeting reporting requirements

adverse outcomes, errors, and near misses. They can help in demonstrating appropriate strategies for disclosure of such events. The reactions of health care providers and patients in various difficult clinical situations can be demonstrated with high fidelity through role play, and residents asked to respond to these situations. Debriefing with the surgery faculty helps the residents acquire the requisite skills to handle such events.

Skills in practice-based learning and improvement play a pivotal role in delivering high-quality surgical care and ensuring patient safety. Residents should be introduced to practice-based learning and improvement through

didactic teaching and learning activities. Practice-based learning and improvement involves systematic monitoring of one's outcomes, benchmarking these with national or regional data, identifying gaps between one's performance and the benchmarking information, developing personal learning projects and acquiring new knowledge or skills to bridge these gaps, applying the new knowledge and skills to one's practice, and again monitoring one's outcomes in a cycle of continuous quality improvement. This cycle is illustrated in Fig. 1. Such practice-based learning and improvement opportunities should be made available to both junior and senior residents [42]. Junior residents may be introduced to the principles of practice-based learning and improvement, and asked to begin the process of systematically monitoring their patient outcomes. The senior residents should be able to demonstrate the requisite skills in practice-based learning and improvement and serve as resources for the junior residents. Practice-based learning and improvement activities may be documented using a portfolio, which is described in greater detail later in this article. Acquisition of these skills during training should bear surgery residents in good stead as they begin independent training practice. The competency of practice-based learning and improvement assumes a central role in professional work following residency training, and helps to define the learning needs in the other competency domains. The central role of practice-based learning and improvement vis-à-vis the other core competencies for surgeons in practice is illustrated in Fig. 2.

In addition, evidence-based information should be used, when available, during the teaching and learning activities to address patient safety. There are a number of safe practices, however, that may not be supported by rigorous evidence. These too should be emphasized in the educational

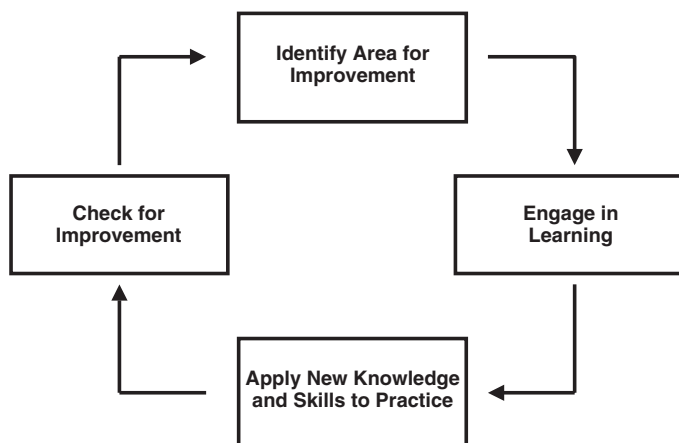


Fig. 1. Practice-based learning and improvement and patient safety in surgery.

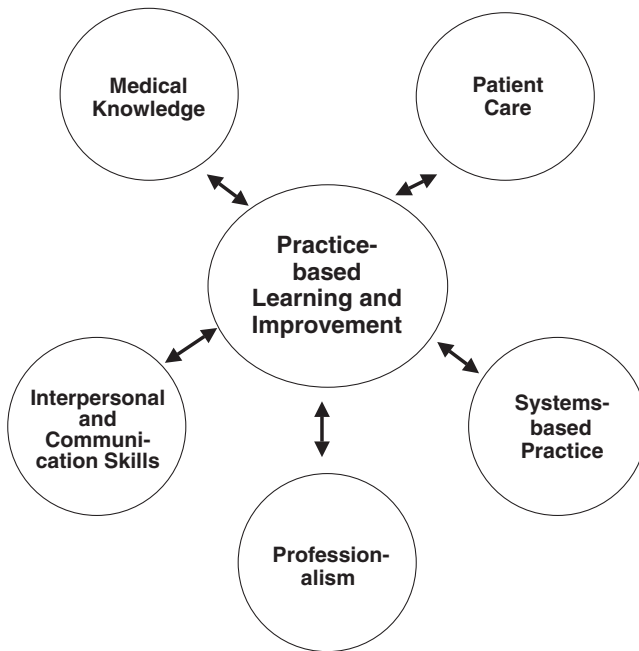


Fig. 2. The central role of practice-based learning and improvement vis-à-vis the other core competencies for surgeons in practice.

programs if they are based on sound expert judgment and established safety practices [43].

Residents may also be assigned special projects focusing on specific aspects of patient safety. The use of simulations, simulators, and conferences in addressing patient safety topics is described later in this article. A list of teaching and learning methods useful in the didactic education of surgery residents in patient safety appears in [Box 2](#).

The didactic educational programs should be complemented by contextual learning in clinical environments. Lessons learned during didactic sessions need to be applied to the real settings of patient care, and their impact assessed. Also, patient safety topics covered in the didactic sessions should be reinforced during daily clinical work in various surgical environments. The ongoing application of the patient safety principles to daily patient care emphasizes to residents that patient safety is not an external concept imposed by others; it is integral to the delivery of high-quality patient care, and a fundamental, core responsibility of all health care providers. Such an approach will also help create and sustain a culture of patient safety. The value of exemplary role modeling and of effective precepting and mentoring cannot be overstated. The program director and the faculty members should personally demonstrate adherence to the

Box 2. Teaching and learning methods useful in the didactic education of surgery residents in patient safety

- Selected readings
- Case studies coupled with interactive discussions
- Independent study modules
- Videotaped vignettes coupled with interactive discussions
- Role play exercises
- Practice-based learning and improvement exercises
- Portfolios
- Special projects in patient safety
- Simulations and simulators
- Conferences

principles of patient safety in their daily clinical practices, and should regularly share their experiences with the residents.

At the beginning of each resident rotation, the orientation for residents should include a specific focus on patient safety. The procedures in place to enhance patient safety need to be outlined. The role of systems should be emphasized and the critical importance of effective teamwork, timely and accurate communication, and exemplary professionalism underscored. Guidelines should be provided regarding the appropriate steps that residents should take if they make a mistake, or witness someone else make a mistake. Residents should also be provided guidance about what they should do if they are unsure about a clinical situation.

Systems and routines to enhance patient safety in various surgical environments should be highlighted during the course of daily activities. Health care organizations have implemented a number of strategies to reduce the risk of medication errors and adverse drug events, as well as to avoid wrong-site surgery. State-of-the-art technology has been helpful in supporting patient safety initiatives. The use of bar codes and computerized order entry systems designed to reduce the risk of medication errors are examples of patient safety efforts that have been undertaken by health care organizations to improve patient safety. The operating room, intensive care unit, and emergency department offer numerous opportunities to identify and discuss safety systems specially designed based on human-factors engineering to prevent errors and compensate for errors in these busy and complex surgical environments.

Many institutions have implemented read-back systems in the operating room and other locations. Residents must learn about these systems and practices, and be asked to actively participate in such activities. Before the commencement of an operation, the critical information regarding the patient's condition, the planned procedure, and the anticipated challenges

should be discussed among members of the operating room team. Residents should be actively involved in these discussions. A supportive environment must be created in the operating room, to allow any member of the operating room team to bring to the attention of others, without fear or hesitation, any situation that may compromise patient safety. Debriefing among members of the operating room team at the completion of the operation provides everyone the opportunity to reinforce the key steps taken to ensure patient safety and deliver the highest quality of surgical care, and to discuss near misses and error-prone points that may have been encountered. Residents should be actively engaged in these discussions as well.

Residents need to learn effective leadership and membership in teams during routine clinical situations and crises. Interdisciplinary teaching and learning with other members of the health care team may help promote teamwork. Residents should learn approaches to disclose errors to faculty members, patients, and patients' families within the context of their clinical work. They also need to participate in the process of reporting errors and near misses. Also, best practices of residents in patient safety should be shared with other residents in the program.

The sign outs between resident teams are points of care when there is considerable potential for inadequate communication, miscommunication, and error. Standardization of the processes and procedures should help in ensuring continuity of care and enhancing patient safety. Standardization of sign outs may be achieved through the use of special cards to enhance communication between resident teams [44]. Computerized sign-out systems may also be of value in this regard [45]. Such systems need to be developed and implemented, with input from residents into the design of the systems.

The discharge of surgical patients from the hospital, ambulatory surgery unit, or office is another event when patient safety may be compromised. Patients often leave these areas without adequate knowledge or skills to take care of themselves. The instructions may be confusing, and the information shared by various health care providers might be inconsistent. Also, the patients are often apprehensive and may not fully comprehend the information provided. Patients are sent home earlier in the current health care environment than in the past, and need to take care of their wounds, drains, ostomies, and other devices. Their skills to appropriately care for such devices are not always confirmed before discharge. The patients' family members may also be confused about the instructions, or possess inadequate skills to take care of the patients. Standardization of patient instructions, objective assessment of the knowledge and skills of patients and patients' families, and reminders following discharge are all important interventions to enhance the quality of patient care and improve patient safety. Principles of contemporary surgical education may be applied to patient education, especially in the context of skills acquisition. Special attention must also be directed to the patients' medications to avoid bioincompatibilities and drug interactions. Computerized medical records and order entry systems may

help prevent such incompatibilities and interactions; however, health care providers need to play a pivotal role in ensuring that the risk of such untoward events is minimized. Surgery residents should be asked to participate actively in discharge planning and patient education, in order to improve the quality of care and patient safety. Good role modeling and visible involvement of faculty members in these activities will set high standards for the residents.

Assessment of competency of residents should remain a central focus of residency training programs, to ensure optimum patient care and enhance patient safety. A competency-based curriculum that includes verification of the skills of residents based on objective criteria should be implemented. The focus on residents' competencies promotes patient safety, and creates a milieu in which professional competence is emphasized and opportunities to support patient safety are valued.

A list of clinical teaching and learning approaches relating to patient safety for surgery residents appears in [Box 3](#).

Use of simulations and simulators

Simulations and simulators can be very helpful in supporting teaching and learning, ensuring achievement of the desired educational outcomes, and improving patient safety. They may be used to address cognitive and technical skills as well as judgment. In addition, simulations and simulators are extremely useful in team training. Simulated settings offer residents opportunities to repeatedly practice various skills without compromising patient safety or comfort. Simulations and simulators provide controlled settings with the option of adjusting the variables, which can offer residents a spectrum of learning opportunities. They also allow for standardization of educational experiences across all residents. This is especially important in the current era of restricted resident duty hours and changes in surgical practice, which have increased the likelihood of the residents' receiving varying learning experiences. Also, errors may be allowed to progress during the simulation, in order to help residents learn the impact of errors and to enable them to develop strategies to address the errors [46]. In addition, sophisticated simulators can provide residents accurate and timely feedback, which may allow parsimonious use of faculty time.

Despite the promise of simulations and simulators, they still are not widely used. Technology has frequently driven the educational opportunities, and most curricula associated with simulations and simulators continue to be weak. High-fidelity simulators are not available for many operations. Metrics for evaluation of performance have not been standardized for most simulators and simulations. Large-scale national efforts have not been undertaken to objectively evaluate the educational effectiveness and added value of simulation-based education. The high costs, limited access, and infrequent train-the-trainer activities negatively impact the use of simulations and

Box 3. Clinical teaching and learning approaches relating to patient safety for surgery residents

- Application of patient safety principles in clinical practice
- Exemplary role modeling; effective precepting and mentoring
- Focus on effective communication and exemplary professionalism
- Emphasis on effective leadership and membership within teams
- Interdisciplinary teaching and learning
- Emphasis on safety systems in various surgical environments; exploration of opportunities to enhance patient safety
- Briefing before operations and debriefing after the operations
- Supportive environment in the operating room
- Effective sign outs
- Effective discharge planning, and patient education
- Focus on handling personal errors and errors of others; reporting of errors and near misses
- Approaches to disclose errors to faculty members, patients, and patients' families
- Identification of best practices of residents in patient safety
- Emphasis on verification of residents' knowledge and skills

simulators. In addition, the forces favoring the status quo continue to impact the adoption of these new methods of education.

Innovative curricula need to be developed, and the role of simulations and simulators needs to be clearly defined based on the educational needs identified. A number of simulations and simulators have been validated through well-designed studies. These should be incorporated into curricula without further delay. Simple bench-model simulations and standardized patients are relatively easy to include in most educational programs; however, the resource-intensive sophisticated simulations, simulators, and virtual reality models may need to be based only at certain sites, such as comprehensive skills centers. Each such center could serve as a resource for the learners in the local geographical area. Faculty development and training are also essential to realize the full potential of simulations and simulators in surgical education.

Standardized patients can be of immense value in educational efforts directed at residents to enhance patient safety [47]. They can provide uniform clinical learning experiences and serve as valid and reliable assessment methods. Traditional one-to-one physician encounters with standardized patients can be used to address a spectrum of clinical skills, such as taking a history, performing a physical examination, ordering and interpreting tests, communicating effectively with patients, and demonstrating professionalism.

In addition, standardized patients may be used to simulate a standardized family for teaching, learning, and assessment of residents' skills in sharing bad news, or discussing an adverse surgical event or error. Also, standardized health care workers may play the roles of members of the operating room team to support teaching, learning, and assessment of teamwork, interprofessional and communication skills, and professionalism.

Team training has received great emphasis within the context of patient safety [48–53]. The specialties of anesthesiology and emergency medicine have led the way in developing innovative educational approaches to enhance team training through simulation. The Anesthesia Crisis Resource Management (ACRM) program is based on the Crew Resource Management program, which has been very successfully used by the airline industry to improve safety [48]. The training focuses on task management, teamwork, situational awareness, and decision making. Realistic scenarios are used to address complex decision making and interactions between multiple personnel. The ACRM program focuses on a spectrum of skills, including specific technical skills relating to a variety of clinical situations; generic skills of dynamic decision making, including resource management, leadership, and teamwork applicable to challenging clinical situations; effective work with different personalities and behaviors exhibited by other team members; and organizational learning through individual and group debriefing. The debriefing occurs in a supportive and nonjudgmental environment, and involves interactive discussions based on critical review of the videotaped sessions. Participants have been very positive about their experiences with such exercises. An Emergency Team Coordination Course has also been developed. This includes topics relating to maintenance of team structure and climate, application of problem-solving strategies, effective communication, implementation of plans and management of workload, and improvement of team skills [49]. This program has demonstrated improvement of the quality of team behaviors and reduction in the number of clinical errors.

Such simulation-based exercises offer special learning opportunities, and are engaging because of the experiential format, realistic setting, direct observation of performance, and specific feedback. The exercises also provide the opportunity for individualized teaching and learning, and allow participants to reflect on their knowledge and skills. This focus on metacognition should facilitate the development of expertise. Such simulations need to become an integral part of residency education in surgery. Faculty members may require special training to serve effectively as instructors for these exercises.

Conferences

Surgical conferences are important in supporting educational efforts directed at patient safety. The fervent desire to improve the quality of

surgical care and diligently address adverse events is the hallmark of the surgical profession. Discussions of errors resulting in adverse outcomes have been found to occur more frequently in surgery conferences than in internal medicine conferences, and errors are more often attributed to an individual, team, or system in surgery [54]; however, not all the errors are discussed explicitly, and opportunities to promote safety are frequently missed during conferences because of the traditional formats of the conferences.

The morbidity and mortality conference remains the premier educational conference in most surgery departments and surgery residency programs. Many distinctive features of this conference can make it vital in enhancing the knowledge and skills of residents relating to the quality of surgical care and patient safety. The conference offers a forum for contextual learning, in which the cases with which the residents have been involved are critically reviewed and discussed. Because of the resident participation in the care of the patients, the intrinsic motivation of residents to learn is high. Also, the residents are generally required to actively participate in the discussions of these cases, which provides opportunities for interactive learning. The presence of experienced teachers and mentors at the conference is another positive feature, because residents are able to learn from individuals with significant experience and expertise, whom the residents respect and trust.

The effectiveness of morbidity and mortality conferences, however, is often compromised because of a harsh and punitive environment, in which the intense focus on individual responsibility overshadows critical analyses of the events and the systems. A negative milieu, in which the principal corrective action appears to be assignment of blame, may severely compromise the learning process. Discussions of adverse outcomes tend to be associated with significant concerns and negative reactions, especially when errors are involved. The environment of morbidity and mortality conferences can create strong feelings of defensiveness on the part of residents [55]. Also, preparation for these conferences is frequently inadequate because of the hectic schedules of residents; relevant studies may not be available for review at the conferences; and learning opportunities during the conferences might be missed because of time constraints. Further, a record of the cases discussed is infrequently maintained following the conference; thus, the lessons learned during the conference are not archived for future use.

The goal of the morbidity and mortality conferences should not be to criticize, but to provide a positive learning environment that facilitates sharing of experiences in order to enhance the care of surgical patients. A clear message needs to be conveyed that errors may occur in spite of the surgeon's competence and skill. The forum should encourage individuals to acknowledge and address reasons for the mistakes, support constructive discussions of the events, reinforce accountability for providing high-quality care, and disseminate information and insights about patient care drawn from these experiences. Reflection both during and after morbidity and mortality conference is key to learning.

A number of strategies may be used to further enhance the learning experience during morbidity and mortality conferences [56,57]. The importance of discussing near misses has been clearly articulated by many authors [23,24,27,58–60]. Near misses present unique opportunities for learning and analyzing systems of care, and should be routinely included in discussions during morbidity and mortality conferences. Systems need to be designed to identify and record near misses, in order to allow discussion of these events during the conference. Tracking of errors and near misses may be facilitated through data entry by residents and other members of the health care team, and through the use of state-of-the-art technology. A Morbidity and Mortality Matrix has been described to address some of the traditional problems outlined above [61]. Lengthening of the conference, using a uniform format for presentations, sharing all relevant data, presenting brief literature reviews, and encouraging multi-disciplinary attendance, have been found to increase the likelihood of reaching consensus and considering more complications as avoidable, as compared with traditional practices [62]. Residents' perceptions of the conference may also become more positive as a result of changing the presentation format, including focused literature reviews, encouraging active faculty participation, addressing as many complications as possible without preselecting a few cases, changing the time of the conference, and adequately preparing for the conference [63]. Individuals from other related specialties and disciplines should be invited to the conferences to discuss cases in which they have been involved, and to especially focus on teamwork. Residents should be actively engaged in exploring solutions to the problems and in following up on the corrective actions. Also, consideration should be given to renaming the morbidity and mortality conference as the “surgical patient safety conference,” in order to underscore the broader scope of this conference beyond just morbidity and mortality in surgery.

Journal clubs can also serve as a useful educational tool in the context of patient safety. They should involve discussion of selected articles to help residents learn contemporary principles and practices of patient safety, and should include reviews of evidence from the literature regarding patient safety practices and quality of surgical care. Articles may also be selected to teach and learn the principles of evidence-based surgery. The discussions of articles on patient safety and evidence-based surgery should not be conducted in isolation. Such articles need to be integrated into the discussions of various clinical topics. This will demonstrate the clinical relevance of the articles, and should enhance the effectiveness of journal clubs.

The content learned during the conferences must be linked to the daily clinical activities of residents. The clinical cases with which the residents are involved should be used to emphasize the principles learned during conferences, and to translate these principles into practice. Such an integrated approach is necessary for optimum learning and for retention of knowledge and skills.

Assessment

Evaluation often drives the curriculum, and provides motivation to learn. Inclusion of topics on patient safety in the assessment process emphasizes to the residents that patient safety topics are a critical component of their core curriculum. Knowledge and skills relating to topics in patient safety should be assessed through the use of valid and reliable methods. The faculty members and program directors may require special training and support to include such topics in the assessment process, and to use state-of-the-art methods to assess residents' knowledge and skills. Both formative and summative assessments of resident performance are essential to ensure achievement of various competencies, and to monitor the progressive development of expertise. Formative assessments are ongoing, and may provide detailed information on the strengths and weaknesses of a resident. Such assessments are especially helpful in providing meaningful feedback to improve performance. Summative evaluations involve high-stakes testing for pass-fail decisions. Results of these may also be used to provide feedback to the residents.

The cognitive elements relating to patient safety may be assessed through well-designed, multiple-choice questions that do not merely involve recall of facts but assess the more complex cognitive skills. Performance evaluations conducted by the teaching staff, which are routine in all residency programs, should include specific focus on all six core competencies and should incorporate specific topics pertaining to patient safety. Standardization of forms helps to ensure coverage of the requisite content, and use of behavioral anchors and frame of reference training of faculty members should increase the reliability of these instruments. The problem-solving skills and judgment of residents may be assessed through standardized oral examinations. Standardization of these examinations and training of examiners will help to ensure sufficient reliability of the examination. Objective Structured Clinical Examinations (OSCEs) may be used to assess a range of clinical skills, especially within the competencies of patient care, interpersonal and communication skills, professionalism, and systems-based practice. Assessment of technical skills may be conducted through the use of valid and reliable methods, such as the Objective Structured Assessment of Technical Skills (OSATS), that involves multiple stations at which the technical skills of the resident may be assessed using standardized tools [64]. A spectrum of technical skills may be assessed using OSATS.

New assessment methods for resident evaluation include 360° evaluations and portfolios. The 360° evaluations involve assessment of skills of the resident by multiple individuals within the sphere of the resident's activities. These individuals may be faculty members, peers, nurses, technicians, and patients. Such evaluations are especially helpful in assessing knowledge and skills in systems-based practice and teamwork [65]. Although 360° evaluations have been used successfully in administration, their use in the

medical specialties has been limited. The validity and reliability of 360° evaluations within the context of surgery need to be studied further. Also, the logistics of implementing this method across various surgery residency programs need to be addressed.

Portfolios can be very useful in supporting efforts relating to practice-based learning and improvement [12]. Portfolios are individually driven, criterion-based, learning and assessment tools that can help in the continuous professional development of individuals [66,67]. They involve self-assessment and reflection on the part of the learner. A portfolio may include documentation of learning goals and objectives, data on the individual's performance, information on learning activities and their outcomes, and evidence of the impact of learning on the individual's clinical practice. Benchmarking data may be used to review the individual's outcomes, and to compare these outcomes with national or regional standards of care. Principles for evaluation of portfolios include assessment of the learning plans, learning processes, and educational outcomes. Critical appraisal of the portfolio should be conducted, using pre-established standards and criteria in order to ensure reliability. The development and maintenance of portfolios may be facilitated through the use of state-of-the-art technology, including the Internet and personal digital assistants (PDAs).

Portfolios may prove to be extremely useful in addressing topics relating to patient safety and in developing expertise in this domain. Residents should learn how to prepare individual portfolios that include specific focus on the prevention and management of adverse outcomes, errors, and near misses. Assessment of the portfolios should be based on specific criteria, and should include critical appraisal of the systems and resident performance. Certain portfolio entries may be shared with other residents for broad impact [68]. Use of portfolios should help residents in pursuing continuous professional development, and in developing skills in practice-based learning and improvement.

A list of assessment methods useful in evaluating the knowledge and skills of surgery residents in patient safety appears in [Box 4](#).

Activities of the American College of Surgeons, Division of Education

The American College of Surgeons has appointed a number of special task forces to develop educational programs addressing the core competencies and patient safety. Activities of the American College of Surgeons' Education Task Force on Interpersonal and Communication Skills include development of a new course, *Surgeons as Effective Communicators*, which will be offered to surgeons interested in enhancing their knowledge and skills in this important area and in serving as a resource for others. The theme of the course will be striving for excellence in surgery through effective communication. The goals of the course are to enhance interprofessional

Box 4. Assessment methods useful in evaluating the knowledge and skills of surgery residents in patient safety

- Multiple-choice examinations
- Performance evaluations
- Standardized oral examinations
- Objective Structured Clinical Examinations (OSCEs)
- Objective Structured Assessment of Technical Skills (OSATS)
- 360° evaluations
- Portfolios

and surgeon-patient communication, promote patient safety, and improve patient satisfaction. Principles of effective communication, effective communication in various surgical settings within and across teams, and effective communication during critical and difficult situations will be addressed. The course will be interactive and will involve experiential learning through review of videotaped vignettes and participation in interactive group discussions. Videotapes focusing on appropriate and inappropriate strategies for disclosing errors, breaking bad news, and working in interdisciplinary teams are being created.

The American College of Surgeons Education Task Force on Professionalism has developed a Code of Professional Conduct that was approved by the College's Board of Regents in 2003 [69]. This code addresses a spectrum of issues relating to the quality of surgical care. It defines the responsibility of surgeons in regard to disclosure of adverse outcomes and errors. The code also emphasizes the responsibilities of surgeons to maintain competence throughout their surgical careers, to evaluate their surgical outcomes to improve patient care, and to participate in self-regulation by setting, maintaining, and enforcing practice standards [69,70]. The task force is currently engaged in developing a modular education course to address key principles of professionalism in surgery, using case studies, videotaped vignettes, and critiques of these cases and vignettes. This program will be made available to surgeons on the Internet.

The major project being pursued by the American College of Surgeons' Education Task Force on Practice-based Learning and Improvement is the development of a PDA- and Internet-based system that will allow surgeons to conveniently record their surgical cases in a computerized log and to systematically monitor their outcomes. They will be able to benchmark their outcomes with national and regional standards, identify opportunities for improvement, and develop personal learning projects to enhance their knowledge and skills. Steps are being taken to offer an educational program to surgeons over the Internet to enhance skills in evidence-based surgery.

The American College of Surgeons' Education Task Force on Systems-based Practice is developing an interactive, case-based program focusing on

systems, error-prone points in surgical care, and interventions to reduce the risk of errors and adverse outcomes. This modular program will be available on the Internet. An Ad Hoc Committee on Simulations and Simulators in Surgical Education, created as a result of the task force's deliberations, is pursuing team training through simulation. A special course on team training for surgeons, based on the experiences of the airline industry, will be offered at the next Clinical Congress of the College in October 2004. Also, plans are underway to develop an Internet-based resource to help surgery departments remodel their morbidity and mortality conferences to effectively focus on patient safety issues and make these conferences more conducive to learning.

Major educational efforts of the American College of Surgeons are also being directed at the competencies of knowledge and patient care. Such efforts are being principally implemented at the College's national meetings and through the development of new educational products. The repertoire of skills courses offered at the national meetings has been expanded and new courses have been added. There is also greater emphasis on verification of skills within the context of such courses. CD-ROMs have been developed to address the cognitive elements relating to new procedures. A committee has been appointed to develop a program for accrediting surgery education centers to provide regional support for efforts directed at acquisition and maintenance of surgical knowledge and skills, and to offer surgeons opportunities to learn new procedures and use of emerging technologies.

Although the aforementioned efforts of the College are primarily directed at the surgeons, the programs are also available to residents. The new CD-ROMs have been of special interest to the residents. Also, as the learning needs of surgeons are addressed through these efforts, they should result in a positive impact on the education of residents, because surgeons will be able to apply their newly acquired skills to resident education.

A manual of ethics cases is being developed by the American College of Surgeons for surgery residents. Topics include conflicts of interest, professional obligations of surgeons, truth telling and the surgeon–patient relationship, and confidentiality. These topics may be of great value to residents within the context of improving the quality of patient care and promoting patient safety.

Through an education and dissemination grant from the Agency for Healthcare Research and Quality, the American College of Surgeons is developing a ten-station Objective Structured Clinical Examination (OSCE), which will help to assess the knowledge and skills of first-year surgery residents to safely manage critical problems that they may encounter from the very start of their training. Clinical scenarios have been developed for oliguria, transfusion reaction, pulmonary embolus, tension pneumothorax, wound hematoma/airway obstruction, lower extremity arterial embolus, postoperative fever, abdominal pain, gastrointestinal bleeding, and hypertension. Most stations include a resident encounter with a standardized patient, and some stations involve telephone calls from the standardized

nurse to the resident and presentation of a case to the resident by a standardized medical student. In each situation, the resident is expected to make an immediate diagnosis and to manage the critical situation effectively. The resident is also expected to call for help from a senior resident, if needed, after the immediate problem is addressed. The blueprint of the OSCE has been developed, and the program has been pilot-tested at four sites nationally. It subsequently has been implemented across seven sites in July and August 2004, and the information on resident performance is being shared with the residents in order to enhance their skills in these important clinical domains and to promote patient safety. The data is being analyzed to assess the validity and reliability of the instrument. The examination will be made available to all surgery residency programs across the country. The OSCE stations may be modified later to serve as standardized teaching and learning exercises.

In addition, the American College of Surgeons, Division of Education continues to offer a number of faculty development programs to enhance the educational skills of the faculty. These should help in enhancing the education of residents. The goal of the comprehensive *Surgeons as Educators* course is to improve the knowledge and skills of surgeons in the principles and practice of contemporary surgical education. A shorter, 1-day course is offered at the Clinical Congress and regional sites, and is aimed at improving the teaching skills of surgeons. A new course, *Surgeons as Leaders*, is being developed to help surgeons successfully fulfill various responsibilities associated with leadership positions, building teams, and serving as exemplary role models for their junior colleagues and residents. A separate course on leadership may be developed later for the residents.

Summary

The recent focus on patient safety has underscored the vital role of education in reducing errors and promoting safety. The period of residency training provides a special opportunity for residents to learn the principles and practices of patient safety. Both traditional and innovative methods of teaching and assessment should be used to promote patient safety. Educational efforts should focus on the individual as well as the systems. Individual competence and professional responsibility must be emphasized, along with the roles of systems that can help prevent errors and enhance patient safety. Educational efforts directed at patient safety must be implemented in a culture that promotes such efforts. Also, these educational efforts are necessary to create such a milieu.

A variety of educational approaches may be used in didactic teaching and learning activities. These include use of special case studies, interactive discussions based on case studies and videotaped vignettes, independent learning models, and conferences. Team training is crucial in educational efforts designed to enhance patient safety, and simulations can be very

useful in supporting such training. Morbidity and mortality conferences should play a key role in supporting education in patient safety. The scope of the conferences should be expanded to focus on near misses in addition to adverse outcomes and errors. The format and environment of conferences may need to change to ensure optimum learning. The didactic teaching and learning should be integrated with contextual learning in clinical environments, in order to facilitate application of the principles learned to practice and to validate these principles. Role modeling, preceptorship, and mentorship by the teaching staff are crucial in supporting the educational efforts directed at patient safety, and in underscoring the importance of patient safety in residency education. Assessment of residents should be conducted using valid and reliable methods. State-of-the-art technology can be of immense help in supporting the educational efforts. Faculty development is key to the implementation of new educational approaches and methods.

The clear focus on patient safety and use of contemporary educational methods should enhance residents' learning. The Division of Education of the American College of Surgeons is engaged in a number of major projects to address the core competencies and patient safety. Optimal educational experiences for residents in patient safety, which include didactic teaching and learning integrated with clinical experiences, should prepare residents to provide safe care of the highest quality to each surgical patient well into the future.

References

- [1] Kohn LT, Corrigan JM, Donaldson MS, editors. *To err is human: building a safer health system*. Washington (DC): National Academy Press; 2000.
- [2] Committee on Quality of Health Care in America. *Institute of Medicine. Crossing the quality chasm: a new health system for the 21st century*. Washington (DC): National Academy Press; 2001.
- [3] Greiner AC, Knebel E, editors. *Health professions education: a bridge to quality*. Washington (DC): The National Academies Press; 2003.
- [4] ACGME Outcome Project. *General competencies*. Chicago (IL): Accreditation Council for Graduate Medical Education; 2001. Available at: <http://www.acgme.org/outcome/comp/compFull.asp>. Accessed April 20, 2004.
- [5] Nahrwold DL. The competence movement: a report on the activities of the American Board of Medical Specialties. *Bull Am Coll Surg* 2000;85(11):14–8.
- [6] AAMC policy guidance on graduate medical education: assuring quality patient care and quality education. *Acad Med* 2003;78(1):112–6.
- [7] Gaba DM, Howard SK. Patient safety: fatigue among clinicians and the safety of patients. *N Engl J Med* 2002;347(16):1249–55.
- [8] DaRosa DA, Bell RH Jr, Dunnington GL. Residency program models, implications and evaluation: results of a think tank consortium on resident work hours. *Surgery* 2003;133(1):13–23.
- [9] Mendoza KA, Mendoza B, Britt LD. A template for change and response to work hour restrictions. *Am J Surg* 2003;186(2):89–96.

- [10] Barden CB, Specht MC, McCarter MD, Daly JM, Fahey TJ 3rd. Effects of limited work hours on surgical training. *J Am Coll Surg* 2002;195(4):531–8.
- [11] Whang EE, Perez A, Ito H, Mello MM, Ashley SW, Zinner MJ. Work hours reform: perceptions and desires of contemporary surgical residents. *J Am Coll Surg* 2003;197(4): 624–30.
- [12] Sachdeva AK. Acquisition and maintenance of surgical competence. *Semin Vasc Surg* 2002; 15(3):182–90.
- [13] Rogers DA, Elstein AS, Bordage G. Improving continuing medical education for surgical techniques: applying the lessons learned in the first decade of minimal access surgery. *Ann Surg* 2001;233(2):159–66.
- [14] Sachdeva AK. Educational interventions to address the core competencies in surgery [invited commentary]. *Surgery* 2004;135(1):43–7.
- [15] Davis D, Thomson O'Brien MA, Freemantle N, Wolf FM, Mazmanian P, Taylor-Vaisey A. Impact of formal continuing medical education: do conferences, workshops, rounds, and other traditional continuing education activities change physician behavior or health care outcomes? *JAMA* 1999;282(9):867–74.
- [16] Davis DA, Thomson MA, Oxman AD, Haynes RB. Changing physician performance: a systematic review of the effect of continuing medical education strategies. *JAMA* 1995; 274(9):700–5.
- [17] Mazmanian PE, Davis DA. Continuing medical education and the physician as a learner: guide to the evidence. *JAMA* 2002;288(9):1057–60.
- [18] Landry MD, Sibbald WJ. Changing physician behavior: a review of patient safety in critical care medicine. *J Crit Care* 2002;17(2):138–45.
- [19] Trowbridge R, Weingarten S. Educational techniques used in changing provider behavior. In: Shojania KG, Duncan BW, McDonald KM, Wachter RM, editors. Making health care safer: a critical analysis of patient safety practices. AHRQ Publication No. 01-E058. Rockville (MD): Agency for Healthcare Research and Quality; 2001. p. 601–6.
- [20] Reason J. Human error: models and management. *BMJ* 2000;320:768–70.
- [21] Leape LL. A systems analysis approach to medical error. *J Eval Clin Pract* 1997;3(3):213–22.
- [22] Casarett D, Helms C. Systems errors versus physicians' errors: finding the balance in medical education. *Acad Med* 1999;74(1):19–22.
- [23] Aron DC, Headrick LA. Educating physicians prepared to improve care and safety is no accident: it requires a systematic approach. *Qual Saf Health Care* 2002;11(2):168–73.
- [24] Spencer FC. Human error in hospitals and industrial accidents: current concepts. *J Am Coll Surg* 2000;191(4):410–8.
- [25] Schenkel S. Promoting patient safety and preventing medical error in emergency departments. *Acad Emerg Med* 2000;7(11):1204–22.
- [26] Lester H, Tritter JQ. Medical error: a discussion of the medical construction of error and suggestions for reforms of medical education to decrease error. *Med Educ* 2001;35: 855–61.
- [27] Sachdeva AK, Blair PG. Enhancing patient safety through educational interventions. In: Manuel BM, Nora PF, editors. *Surgical patient safety: essential information for surgeons in today's environment*. Chicago (IL): American College of Surgeons, in press.
- [28] Sexton JB, Thomas EJ, Helmreich RL. Error, stress, and teamwork in medicine and aviation: cross sectional surveys. *BMJ* 2000;320:745–9.
- [29] Volpp KGM, Grande D. Residents' suggestions for reducing errors in teaching hospitals. *N Engl J Med* 2003;348(9):851–5.
- [30] Wu AW, Folkman S, McPhee SJ, Lo B. Do house officers learn from their mistakes? *JAMA* 1991;265(16):2089–94.
- [31] Pilpel D, Schor R, Benbassat J. Barriers to acceptance of medical error: the case for a teaching programme. *Med Educ* 1998;32:3–7.
- [32] Hevia A, Hobgood C, Lewin MR. Medical error during residency: to tell or not to tell. *Ann Emerg Med* 2003;42(4):565–70.

- [33] Mizrahi T. Managing medical mistakes: ideology, insularity and accountability among internists-in-training. *Soc Sci Med* 1984;19(2):135–46.
- [34] Gallagher TH, Waterman AD, Ebers AG, Fraser VJ, Levinson W. Patients' and physicians' attitudes regarding the disclosure of medical errors. *JAMA* 2003;289(8):1001–7.
- [35] Wears RL, Wu AW. Dealing with failure: the aftermath of errors and adverse events. *Ann Emerg Med* 2002;39(3):344–6.
- [36] Crook ED, Stellini M, Levine D, Wiese W, Douglas S. Medical errors and the trainee: ethical concerns. *Am J Med Sci* 2004;327(1):33–7.
- [37] Wu AW, Folkman S, McPhee SJ, Lo B. How house officers cope with their mistakes. *West J Med* 1993;159(5):565–9.
- [38] Sachdeva AK. Use of effective feedback to facilitate adult learning. *J Cancer Educ* 1996;11: 106–18.
- [39] Cosby KS, Croskerry P. Patient safety: a curriculum for teaching patient safety in emergency medicine. *Acad Emerg Med* 2003;10(1):69–78.
- [40] Elkin PL, Gorman PN. Continuing medical education and patient safety: an agenda for lifelong learning. *J Am Med Inform Assoc* 2002;9(Nov-Dec Suppl):S128–32.
- [41] Proctor ML, Pastore J, Gerstle JT, Langer JC. Incidence of medical error and adverse outcomes on a pediatric general surgery service. *J Pediatr Surg* 2003;38(9):1361–5.
- [42] Ogrinc G, Headrick LA, Mutha S, Coleman MT, O'Donnell J, Miles PV. A framework for teaching medical students and residents about practice-based learning and improvement, synthesized from a literature review. *Acad Med* 2003;78(7):748–56.
- [43] Leape LL, Berwick DM, Bates DW. What practices will most improve safety? Evidence-based medicine meets patient safety. *JAMA* 2002;288(4):501–7.
- [44] Lee LH, Levine JA, Schultz HJ. Utility of a standardized sign-out card for new medical interns. *J Gen Intern Med* 1996;11:753–5.
- [45] Petersen LA, Orav EJ, Teich JM, O'Neil AC, Brennan TA. Using a computerized sign-out program to improve continuity of inpatient care and prevent adverse events. *Joint Comm J Qual Improv* 1998;24(2):77–87.
- [46] Ziv A, Wolpe PR, Small SD, Glick S. Simulation-based medical education: an ethical imperative. *Acad Med* 2003;78(8):783–8.
- [47] Petrusa ER. Taking standardized patient-based examinations to the next level. *Teach Learn Med* 2004;16(1):98–110.
- [48] Gaba DM, Howard SK, Fish KJ, Smith BE, Sowb YA. Simulation-based training in anesthesia crisis resource management (ACRM): a decade of experience. *Simul Gaming* 2001;32(2):175–93.
- [49] Morey JC, Simon R, Jay GD, Wears RL, Salisbury M, Dukes KA, et al. Error reduction and performance improvement in the emergency department through formal teamwork training: evaluation results of the MedTeams project. *Health Serv Res* 2002;37(6):1553–81.
- [50] Glavin RJ, Maran NJ. Integrating human factors into the medical curriculum. *Med Educ* 2003;37(Suppl 1):59–64.
- [51] Blum RH, Raemer DB, Carroll JS, Sunder N, Feinstein DM, Cooper JB. Crisis resource management training for an anaesthesia faculty: a new approach to continuing education. *Med Educ* 2004;38(1):45–55.
- [52] Flanagan B, Nestel D, Joseph M. Making patient safety the focus: crisis resource management in the undergraduate curriculum. *Med Educ* 2004;38(1):56–66.
- [53] Garden A, Robinson B, Weller J, Wilson L, Crone D. Education to address medical error—a role for high fidelity patient simulation. *N Z Med J* 2002;115:133–4.
- [54] Pierluissi E, Fischer MA, Campbell AR, Landefeld CS. Discussion of medical errors in morbidity and mortality conferences. *JAMA* 2003;290(21):2838–42.
- [55] Harbison SP, Regehr G. Faculty and resident opinions regarding the role of morbidity and mortality conference. *Am J Surg* 1999;177:136–9.
- [56] Orlander JD, Barber TW, Fincke BG. The morbidity and mortality conference: the delicate nature of learning from error. *Acad Med* 2002;77(10):1001–6.

- [57] Bohnen JM, Lingard L. Error and surgery: can we do better? *Can J Surg* 2003;46(5):327–9.
- [58] Aspden P, Corrigan JM, Wolcott J, Erickson SM, editors. Patient safety: achieving a new standard for care. Washington (DC): The National Academies Press; 2004.
- [59] Battles JB, Shea CE. A system of analyzing medical errors to improve GME curricula and programs. *Acad Med* 2001;76(2):125–33.
- [60] McCafferty MH, Polk HC Jr. Addition of “near miss” cases enhances a quality improvement conference. *Arch Surg* 2004;139:216–7.
- [61] Gordon LA. Can Cedars-Sinai’s M + M matrix save surgical education? *Bull Am Coll Surg* 2004;89(6):16–20.
- [62] Risucci DA, Sullivan T, DiRusso S, Savino JA. Assessing educational validity of the morbidity and mortality conference: a pilot study. *Curr Surg* 2003;60(2):204–9.
- [63] Murayama KM, Derossis AM, DaRosa DA, Sherman HB, Fryer JP. A critical evaluation of the morbidity and mortality conference. *Am J Surg* 2002;183:246–50.
- [64] Reznick R, Regehr G, MacRae H, Martin J, McCulloch W. Testing technical skill via an innovative “bench station” examination. *Am J Surg* 1997;173:226–30.
- [65] Dyne PL, Strauss RW, Rinnert S. Systems-based practice: the sixth core competency. *Acad Emerg Med* 2002;9(11):1270–7.
- [66] Challis M. AMEE medical education guide no. 11 (revised): portfolio-based learning and assessment in medical education. *Med Teach* 1999;21(4):370–86.
- [67] Mathers NJ, Challis MC, Howe AC, Field NJ. Portfolios in continuing medical education—effective and efficient? *Med Educ* 1999;33:521–30.
- [68] Chisholm CD, Croskerry P. A case study in medical error: the use of the portfolio entry. *Acad Emerg Med* 2004;11(4):388–92.
- [69] American College of Surgeons Task Force on Professionalism. Code of Professional Conduct. *J Am Coll Surg* 2003;197(4):603–4.
- [70] Gruen RL, Arya J, Cosgrove EM, Cruess RL, Cruess SR, Eastman AB, et al. Professionalism in surgery. *J Am Coll Surg* 2003;197(4):605–8.