Published in final edited form as:

Am J Med Qual. 2008 ; 23(4): 271–278. doi:10.1177/1062860608317763.

Planning and Implementing a Systems-Based Patient Safety Curriculum in Medical Education

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Abstract

Using a successful 6-step approach to medical curriculum development, a multidisciplinary systems-based safety curriculum for first-year medical students was developed and implemented. A targeted needs assessment was completed based on students' perceptions of patient safety. Goals and objectives identified were the following: (1) provide a practical framework to identify defects, (2) identify patient hazards, (3) investigate an adverse event, (4) understand incident reporting, (5) understand the impact of teamwork and communication in safety, (6) acquire skills to improve teamwork and communication, and (7) learn to disclose medical mistakes. Students were able to identify many of the teamwork and communication problems entrenched in our current health care culture. Interactive learning was important to the learning process and, on evaluation, deemed a valuable experience. The findings indicate that this is an effective curriculum development strategy and that systems-based patient safety was effective in changing perceptions of patient harm and the provider's role in patient safety.

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The authors have no conflicts of interest to disclose with regard to this article.

Keywords

patient safety; systems-based; curriculum; medical students

INTRODUCTION

Patient safety and medical errors have drawn increasing attention from health care researchers in recent years. The 1999 Institute of Medicine (IOM) report, *To Err Is Human: Building a Safer Health System*, sparked this attention with its shocking estimate of up to 98 000 annual deaths from medical errors in the United States.[1] Cumulatively, these errors and preventable deaths cost about $30 billion annually in lost income and excess health care expenditures.[2] Safety experts have stated that health care must focus on system failures, not providers, to improve safety.[1,3] These systems include technology, practices, procedures, policies, and, more broadly, the culture in organizations. In a safe culture, employees are guided by an organization-wide commitment to safety, in which each member upholds his or her own safety norms and those of coworkers.[4]

A less publicized but equally important report from the IOM, titled *Crossing the Quality Chasm*, identified 6 national aims to deliver quality care— safety, effectiveness, timeliness, patient centeredness, efficiency, and equity.[5] Briefly, s*afety* is prevention of patient injuries. *Effectiveness* means delivering evidence-based medicine to the patients who will benefit, whereas *efficiency* avoids wasting resources and *timeliness* reduces wasted time in provision of care. *Equitable* care does not deviate in quality because of a patient's race, age, or other personal characteristics. Finally, *patient-centered* care makes every effort to meet the specific needs, values, and preferences of the patient.[5]

Since the publication of both IOM reports, efforts have focused on improving patient safety. In fact, many organizations have recognized the need to train the next generation of physicians and health care personnel in this new paradigm of patient safety.[6] In this article, we describe and evaluate the effectiveness of a novel patient safety curriculum for first-year medical students at the Johns Hopkins University School of Medicine.

METHODS

Two health service researchers (DAT, PP) developed and taught a comprehensive systems-based patient safety elective to all first-year medical students as part of a Physician and Society course (PAS). This elective was conducted for 2 consecutive years (2004 and 2005). Details of this curriculum, which was developed using the 6-step curriculum development model established by Kern et al,[7] are described in the following.

Step 1: Problem Identification and General Needs Assessment

Three major findings from the 1999 IOM report are important for patient safety, yet missing in the medical school curriculum. These are (1) patient safety is a nationwide problem, (2) health care workers are not to blame, and (3) safety and harm are products of care systems. In fact, the IOM convened an interdisciplinary summit in 2002 to plan a reformation of the educational curriculum for health professionals to include safety and quality of care. The

report from this meeting focused on integrating a core set of competencies into medical education, including "patient-centered care, interdisciplinary teams, evidence-based practice, quality improvement, and informatics."[8] The cornerstones of such a curriculum would include the concepts of medical errors and near misses, root cause analysis (RCA), systems theory, evidence-based medicine, and the importance of teamwork and communication. Summit attendees identified these concepts as crucial to achieving the goals set forth in the *Crossing the Quality Chasm* report. Several of these competencies represent skills that would be difficult to convey in a didactic lecture setting. Rather, the acquisition of these skills would likely require a problem-based, interactive, "experiential learning" environment, as postulated in adult learning theory.[9-11] Recognizing the importance of these skills, the American College of Graduate Medical Education (ACGME) has introduced a new systems-based learning component to its required competencies. This component requires students to demonstrate an awareness of the larger context and system of health care and the ability to effectively marshal system resources to provide optimal care (www.acgme.org). A large portion of this requirement involves understanding how systems of care affect quality and safety and how defects in communication contribute to patient harm.

Step 2: Needs Assessment of Targeted Learners

Studies suggest that medical school is the optimal time to introduce patient safety and systems-based learning of medical errors—before our future physicians are exposed to the current "name, blame, and shame" of providers for adverse events.[12] Our targeted needs assessment is based on informal discussions with medical students, a method commonly used in the literature.[13-15] Discussions focused on students' responses after reading *To Err is Human*.[1] It was clear that the students knew little about patient safety–related issues and that many, although not yet involved in patient care, equated disclosing mistakes with liability claims.

Step 3: Goal and Specific Measurable Objectives

The goal of this course was to provide students with a foundation for the science of patient safety using the following specific learning objectives: (1) provide a practical framework to identify systems-based defects and improve patient safety, (2) identify hazards in patient care that pose risks to patient safety, (3) learn how to investigate an adverse event, (4) understand the value of incident reporting for improving patient safety, (5) understand how culture, including teamwork and communication, contributes to patient safety, (6) acquire specific tools to improve teamwork and assertive communication, and (7) learn how to disclose mistakes to patients and their families.[7]

Step 4: Educational Strategies

The course used a variety of teaching methods, including experiential learning, lecture, case investigation, team project, role play, video analysis, and observation. Each hour was devoted to 1 module of the safety curriculum (Table 1). In addition, students shadowed an intensive care unit (ICU) nurse for 4 hours outside of class time between the second and fourth weeks of the course.

Step 5: Implementation

A 10-hour patient safety elective was created as part of the PAS series. This elective spanned 5 weeks, with weekly 2-hour sessions. Instructors included a practicing physician and safety researcher and a doctorally prepared nurse/safety researcher. Several guest lecturers involved in safety and quality care presented in their areas of expertise.

The initial lecture was the science of safety, which outlined the scope of the patient safety problem and highlighted a systems-based approach to understanding medical errors. Paul Bataldin, MD, aptly captured the concept of how systems affect safety or quality when he said, “Every system is perfectly designed to achieve exactly the results it gets.”

During the first lecture, instructors reviewed a sentinel event from the Johns Hopkins Hospital that led to the death of a patient given an antibiotic that was reportedly a drug to which the patient was allergic.

A physician on the team investigating the event stated, “I am not attending the root cause analysis committee meeting. It’s the classic case of a dumb doctor and dumb nurse, just go talk to them.” This comment highlighted the existing safety climate in medicine for the students. Though this view of safety is scientifically bankrupt, it is generally the norm. The RCA committee did identify more than 5 hazardous systems that forced the ICU staff to develop a “work-around” to administer the needed antibiotic quickly. This exemplified for the students that deficits in the systems of care caused this death, not the staff.

A subsequent lecture teaches students to investigate an adverse event from a systems perspective. In this exercise, students are divided into 2 teams and given an adverse event to analyze for homework. Students use the “learning from defects” tool[16] to identify the system factors they believe contributed to their assigned event.

The students viewed the Sorrel King video conference, in which she gave testimony during Medical Grand Rounds regarding the death of her 18-month-old daughter from a total breakdown in the medical care system (www.josieking.org). Providing a human face and a parent’s experience made the problem more personal and indelible for the students. Details of course readings are provided in Appendix A.

We used the video *First, Do No Harm* to direct student’s attention to the 6 national quality aims recommended by the IOM.[5] In addition, 4 of the 5 core competencies recommended after the IOM summit to reform health professionals’ education are highlighted in this video. Indeed, these competencies, specifically patient-centered care, interdisciplinary team collaboration to enhance patient care, evidence-based practice with examples of protocol driven treatment, and standards of care and quality improvement, were depicted and emphasized throughout this course. Students also discussed the benefits and potential hazards of introducing new methods to improve patient safety, such as computerized physician order entry.

After receiving class instruction and practicing effective methods of communication, students were given a shadowing assignment, in which each observed an ICU nurse for 4 consecutive hours. To frame this observation, students were given a structured tool to

complete that asks about communication and teamwork-related problems observed and how these affected caregiver collaboration and patient care. This shadowing experience further emphasized the importance of interdisciplinary teams and effective collaboration in delivering patient-centered care.[8]

Disclosing medical events was presented in a seminar format. A guest lecturer reviewed the Joint Commission requirements and specific elements of an effective apology. Issues of disclosure were linked to the case of a medical student who, when overwhelmed by a patient who was physiologically deteriorating in front of him/her, gave an overdose of narcotics. Throughout the course, effort was made by experienced clinicians to offer concrete examples of safety-related scenarios that occur daily in the hospital.

Step 6: Evaluation and Feedback

The students were given a final project to evaluate how well the course accomplished its goal of increasing students' knowledge of patient safety. For this project, the class was split in half and each group was given a recent sentinel event involving a patient death that occurred at Johns Hopkins.[17] The students applied their knowledge of systems theory to an RCA of their assigned cases. During the last class, students presented their cases and contributing system factors and the instructors critiqued and challenged the reasoning behind their findings.

RESULTS

Overall, the first-year medical students who participated in the course evaluated it very positively. The tenor of class discussions shifted over the 5 weeks of the course in terms of student opinions regarding medical errors. In fact, at the beginning of the class, the majority of students demonstrated the traditional "name, blame, and shame" perspective. By the end of the elective, however, students displayed a greater awareness of the negative and positive impact of system factors on patient outcomes.

Students gave highly positive reviews to their nurse-shadowing experiences. They expressed a growing appreciation for the integral role that nurses and other health care workers play in patient care delivery and the need to actively involve these providers in the decision-making process. The sessions before the shadowing exercise (ie, assertion, benefits of collaboration, daily goals checklist) were instrumental in training students to identify communication failures and successes during their shadowing assignment. These communication tools also demonstrated interventions that might be employed to improve communication in the health care setting. During class discussion of their shadowing experiences, students identified many of the teamwork and communication problems entrenched in our current health care culture (Table 2), even though they had no prior clinical experience.

The small group discussions, video analyses, and experiential communication workshops earned high marks from course students. They perceived these interactive learning sessions to be the highlight of the course and suggested that more be added to the curriculum. Several students commented that this course would have direct relevance in their medical careers

and would significantly influence their approach to patient safety and how they practiced medicine.

Although some students initially doubted the importance of RCA and systems theory, many found that the numerous personal vignettes and real-life examples used in the course were helpful in grounding effective systems analysis in reality. Innovative ideas introduced to the students were the use of the daily goals checklist during patient rounds in the ICU,[18] a 5-step checklist to prevent central line infections in the ICU,[19] reconciling medications when patients are transferred or discharged to catch errors,[20,21] and analyzing nonassertive communication and how it directly contributed to catastrophic events.[18,19] These examples, along with discussions of the numerous communication and system problems depicted in the video *First, Do No Harm*, all served to underscore the pivotal role that communication plays in patient safety.[18,20]

During final assignments, the students high-lighted system factors leading to the death of a healthy volunteer. The students frequently identified the same system factors selected by the faculty (DAT, AWW) as relevant to the demise of the volunteer (Table 3). Significant findings identified by both the faculty and students were as follows: (1) lack of a question on the current institutional review board (IRB) form regarding use of a non–Food and Drug Administration (FDA) approved drug or use of a drug as an investigational new drug (IND), (2) unclear IRB guidelines for defining risk in informed consent, and (3) the FDA was not able to respond in a timely manner to queries from the investigator of the study, specifically regarding the lack of procedures for nonmarketed drugs. These findings were impressive considering the students had not yet experienced a single clinical rotation.

Finally, students were engaged by the variety of speakers and their unique perspectives. After one presentation and scenario, a student expressed appreciation for the unique insight from an experienced ICU physician, nurse, and pharmacist. Students were surprised to hear the divergent responses from each provider regarding the same scenario, but recognized the important contribution of each. This session emphasized the need for collaboration and decision making by interdisciplinary teams. Evaluations of the course by the Student Curriculum Committee are described in Table 4.

DISCUSSION

Despite the growing emphasis on patient safety and the recognized need for patient safety education, few schools have formally included this subject in their curriculum. To our knowledge, ours is 1 of just 2 formal systems-based patient safety courses or curriculums in undergraduate medical schools. The second is a quality improvement curriculum that was recently incorporated into the curriculum at the Mayo Medical School.[22] Fortunately, given the ACGME requirements for systems-based learning, this situation is likely to change. Despite these requirements, most residency program directors at the Johns Hopkins Hospital believe they lack the skills needed to teach systems-based learning and more than 70% requested a centralized curriculum. In addition, medical student demand for this important topic has helped capture the attention of the Johns Hopkins School of Medicine Curriculum

Reform Committee. This committee is considering the best method for incorporating patient safety–related issues into the 4-year medical school curriculum.

Our patient safety elective was explicitly designed to address the recommendations of the IOM report, *Health Professions Education: A Bridge to Quality*,[8] and to meet the ACGME requirements for systems-based learning. It focused on the science of patient safety as it relates to patient outcomes and the pivotal role that communication plays in this process.

Despite the apparent success of this course, many questions remain unanswered. For example, at what point in the medical school curriculum should this material be taught? Is the first year optimal, or should it be a part of the 4-year medical school curriculum as the Mayo Medical School has done?[22] One fear in limiting the safety curriculum to first-year students is their limited opportunity to rehearse the skills and remember the core concepts. We believe that the curriculum, especially the teamwork and communication material, should be reinforced throughout their education and clinical practice. Providing students, residents, and physicians with an opportunity to reflect on and discuss their experiences should be a longitudinal career objective.

The new ACGME requirement for systems-based learning also will help to ensure that residents are trained in patient safety. Additionally, the safety curriculum described here will serve as the foundation for the systems-based learning curriculum at our institution. As more health care professionals are trained in patient safety, more trained participants (eg, students, residents, attending doctors, nurses, and support staff) will open up and discuss both positive and negative experiences. Similar to the requirements for many airline pilots in training, medical students could be responsible for developing personalized codes of conduct. These personal codes could include both behaviors they promise never to practice and goals they hope to fulfill. Inspiration may come from their experiences with good and bad mentors during clerkship and residency. Meetings with mentors about these codes of conduct could foster discussion of additional qualities and skills that contribute to patient safety and lead to opportunities for supplemental workshops.[23]

Ideally, at least some of the material on patient safety should be taught in settings that include medical students, nurses, pharmacists, and other disciplines involved in patient care. This interdisciplinary approach would provide an early opportunity for teamwork and foster a greater understanding and appreciation for the different ways in which providers from each discipline communicate and contribute to patient care. We recognize that the logistic barriers to accomplish this goal are significant. Moreover, programs must ensure that the individuals teaching the material are well trained, knowledgeable, have adequate experience in this field, and are able to effectively educate and mentor. Sadly, the current pool of qualified instructors is limited.

An important issue is how best to evaluate the effectiveness of such a course. It is relatively easy to measure a defined skill set, but measuring the outcome of an intervention is challenging. We will follow students who took this course and compare them with their peers for any long-term changes in behavior and perceptions using the Safety Attitudes Questionnaire (SAQ). The SAQ has been used extensively in critical care settings in the

United States and Europe. The 6 domains of the SAQ are teamwork climate, safety climate, perceptions of management, job satisfaction, working conditions, and stress recognition. With Cronbach's α ranging from .74 to .93, the SAQ has demonstrated good psychometric properties, reliability, and validity.[24]

Ultimately, we would like to demonstrate that patient safety training can improve behaviors upstream (ie, teamwork, communication, safety climate) and, in turn, improve patient safety. Safety climate represents a group's attitude about safety and can be used to predict performance, identify problem areas in which the group needs additional training and education, and demonstrate improvements in subsequent performance and attitudes.

Last, the issue of patient safety in the 21st century also highlights an age-old concern: How can we train inexperienced clinicians without placing patients at risk of harm? Our students openly discussed their concerns about making mistakes and how the rest of the medical community reacts to such an event. We must work to break down the expectations that physicians are perfect and do not make mistakes.[25] Such a concept is flawed and harmful for those who operate under these assumptions. We must strive to make health care safe, effective, efficient, equitable, timely, and patient centered, while acknowledging that mistakes will always be made. At the same time, as pressures to treat more patients with fewer resources increase, we must learn how to balance these constraints with the quality indicators identified by the IOM. This course demonstrated that in 10 class hours, students can learn that faulty systems—not bad people—cause mistakes, and gear improvement efforts to focus on the systems in which care is delivered.

SUMMARY

The necessity to introduce a patient safety curriculum into undergraduate and graduate medical education is recognized, but not yet realized. We have described our experience with a 10-hour patient safety course for first-year medical students at the Johns Hopkins University School of Medicine. Because the course was well received by the students and highly effective in changing their attitudes about medical harm and patient safety, it will be offered to second-year medical students as part of the new systems-based learning curriculum at the Johns Hopkins University in the fall of 2007.

APPENDIX A: Course Readings

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Table 1

Safety Elective Class Schedule

Module	Topic	Educational Methods
Module 1	The science of safety	Reading, lecture, video review
Module 2	Investigating a defect	Lecture, discussion, learning projects
Module 3	Measuring safety and teamwork culture	Lecture, discussion, reading
Module 4	Teamwork and communication: Situational awareness, structured communication	Lecture, discussion, reading, simulated experience, problem-based learning
Module 5	Medical and surgical briefings and debriefings: improvements in process of care and patient outcomes	Demonstration, lecture, discussion, role play
Module 6	Measuring patient safety and quality improvement	Lecture, discussion, problem-based learning, readings
Module 7	A systems perspective of medication errors	Lecture, discussion
Module 8	Disclosing adverse events to patient and families	Lecture, role play, discussion

Table 2

Teamwork and Communication Factors Observed During Shadowing Exercise

Communication Issues Identified[a]	Teamwork Issues Identified
Nurses working 4-hour shifts increased the number of handoffs, and increased the risk that information about the patient would not be reported.	One resident placed a new central line without supervision, despite the nurse saying he had to be supervised. This situation is also a communication issue because the resident did not tell the nurse he was going to insert the line, so the nurse did not have a new line ready.
During morning rounds, the resident presented a patient that he had rounded on hours earlier. When the dayshift nurse [that I shadowed] came on, the patient had suffered a GI bleed, of which the resident was not aware. As a result, the nurse had to update almost the entire review of systems for the patient. The nurse tried to tell the resident, but he just continued collecting information on his other patients. She was assertive but he did not listen.	Nurses who worked 4-hour shifts usually had patients to transfer. Some of the house officers paged for transfer orders did not return their pages. This situation affected patient flow for the day. Because of this, transfer orders not written resulted in the nurse [I was with] signing off her patient to another nurse, who now had 3 patients to discharge before his/her new admission.
I was totally blown away at how much responsibility the nurse had. The nurse I was with kept everyone informed. The surgical team only stopped by once, but she had to run orders the surgical team wanted by the ICU team, who was actually taking care of the patient. The nurse was superb, but anyone could make a mistake when they are in the middle. When I asked the resident why he didn't talk to the team directly, he said it was easier to leave the information with the nurse.	One resident was difficult to approach and reportedly had been sarcastic the entire month on the unit. He seemed to have a bad attitude. I asked the nurse I was shadowing what they did in this type of situation. She said they ran important information by the other house officer still there from the day before, or approached the fellow on the unit for help. This definitely impacted patient care.
There were many pages that were not answered quickly. "Definitely a barrier to communication in the ICU and timely patient care."	The surgeons did not round on their patients in the ICU on a regular basis. The patients were managed by intensivists and house officers, who relied heavily on the nurses' assessment skills and experience.
Multiple shift changes and multiple reports are opportunities to forget pertinent patient information.	
The nurse and residents were so rushed they simply said things like, "I am going to be at lunch. Could you watch my patient? They should not need anything." This is dangerous knowing what I know now. You can't even see into the room next door to you.	
When the staff got an admission, the anesthesia resident had just started giving report, and the new patient was unstable so the nurse essentially heard nothing and, before you knew it, the anesthesia resident was gone.	

[a] Direct quotes from students.

Table 3

Student Presentation: System Factors Identified in a Healthy Volunteer Sentinel Event

Systems Identified Case 1	Number of Errors/ Near Misses Identified by Students	Examples	Number of Errors/ Near Misses Identified by Faculty	Percentage Agreement
FDA	1	The FDA was not able to function in a timely way to respond to queries	1	100
Institutional	2	IRB approval for a drug that was no longer FDA approved	2	100
Team factors	5	Did not notify IRB of adverse events or discuss with coinvestigators	7	71
Provider factors	4	Failing to seek supervision from principal investigator	4	100
Task factors	5	Did not adhere to research protocol	5	100
Patient factors	0		0	100

Abbreviations: FDA, Food and Drug Administration; IRB, institutional review board.

Table 4

Student Curriculum Committee Evaluations

Strengths of the Course	Areas for Improvement
Organized with clear learning objectives for each session	There was some redundancy between lectures
Courses presented by national leaders in patient safety and quality	The first lecture covered too much material
Sorrell King video succeeded in emphasizing the importance of patient safety issues	The material on quality measurement could be deleted or moved to an elective
Highly informative and relative to their training as physicians	Shadowing experience was not as beneficial in identifying defects in non-ICU areas
Lectures incorporated the physician and nursing perspective with a nice mix of teaching techniques	
Simulation was an effective way to demonstrate good and bad communication	

Abbreviation: ICU, intensive care unit.