Competence in Patient Safety: A Multifaceted Experiential Educational Intervention for Resident Physicians

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Abstract

Background The need to provide efficient, effective, and safe patient care is of paramount importance. However, most physicians receive little or no formal training to prepare them to address patient safety challenges within their clinical practice.

Methods We describe a comprehensive Patient Safety Learning Program (PSLP) for internal medicine and medicine-pediatrics residents. The curriculum is designed to teach residents key concepts of patient safety and provided opportunities to apply these concepts in the "real" world in an effort to positively transform patient care. Residents were assigned to faculty expert-led teams and worked longitudinally to identify and address patient safety conditions and problems. The PSLP was assessed by using multiple methods.

Results Resident team-based projects resulted in changes in several patient care processes, with the potential to improve clinical outcomes. However, faculty evaluations of residents were lower for the Patient Safety Improvement Project rotation than for other rotations. Comments on "unsatisfactory" evaluations noted lack of teamwork, project participation, and/or responsiveness to faculty communication. Participation in the PSLP did not change resident or faculty attitudes toward patient safety, as measured by a comprehensive survey, although there was a slight increase in comfort with discussing medical errors.

Conclusions Development of the PSLP was intended to create a supportive environment to enhance resident education and involve residents in patient safety initiatives, but it produced lower faculty evaluations of resident for communication and professionalism and did not have the intended positive effect on resident or faculty attitudes about patient safety. Further research is needed to design or refine interventions that will develop more proactive resident learners and shift the culture to a focus on patient safety.

Editor's Note: The online version of this article contains a table showing examples of patient safety improvement projects and a figure depicting the levels of a high-risk organization.

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Background

In 1999 the Institute of Medicine's (IOM's) report that medical errors result in 44 000 to 98 000 annual deaths brought patient safety to the forefront of public concern.[1–3] Concurrently, the Accreditation Council for Graduate Medical Education defined a competency-based framework for physicians, specifying the domains of systems-based practice and practice-based learning and improvement as relevant to patient safety and quality improvement.[4–6] A decade later, many health care organizations have not yet completely addressed the IOM's recommendations.[7–9] As front-line providers, residents are in an excellent position to analyze adverse events and help prevent their recurrence,[4,10–15] and many of the patient safety goals specified by accrediting and national safety organizations focus on clinical problems largely handled by residents.[5,7,16] Residency programs in surgery, emergency medicine, and family medicine have developed educational programs using small-group didactics, morbidity and mortality conferences, patient chart reviews, case presentations, and observed structured clinical examinations to enhance resident knowledge and skills in safety and quality

TABLE 1	PATIENT SAFETY LEARNING PROGRAM (PSLP) LEARNING OBJECTIVES AND COMPETENCY MAP		
ACGME Competency	**Learning Experience**	**Learning Objectives**	**Assessment Strategy**
Patient care	PSIP	To treat patients with safe, effective, evidence-based care To identify, analyze, and propose solutions to prevent future adverse events from occurring	PSIP outcomes
Medical knowledge	Seminar series Adverse event self-reflective exercises	To improve residents' knowledge and skills in recognizing, solving, and analyzing common adverse events/near misses To apply an evidence-based conceptual model to the analysis of common adverse events To identify and apply existing tools used to analyze adverse events (eg, value stream map, root cause analysis) To identify, analyze, and propose solutions to prevent future adverse events from occurring	Faculty feedback on adverse event self-reflection Seminar series feedback (qualitative) Patient safety culture survey Postgraduate survey
Interpersonal and communication skills	Adverse event self-reflective exercises PSIP	To develop communication skills and working relationships to promote effective exchange of information between patients and health professionals	Faculty feedback on adverse event self-reflection Academy faculty evaluation of individual contributions to PSIP Evaluation of PSIP team presentation at research symposium by PSLP core faculty (qualitative)
Professionalism	Adverse event self-reflective exercises PSIP	To recognize professional responsibilities to provide a proactive role in improving the safety and quality of patient care To meaningfully work with colleagues, patients, and health care professionals through collaboration	Faculty feedback on adverse event self-reflection Academy faculty evaluation of individual contributions to PSIP Feedback on resident performance from meetings between PSLP core faculty and academy faculty (qualitative)
Practice-based learning and improvement	Adverse event self-reflective exercises PSIP	To evaluate patient care strategies and to identify practices that may place patients at risk for adverse outcomes To appraise and assimilate scientific evidence into practice with the goal to improve patient care	Faculty feedback on adverse event self-reflection Patient safety culture survey PSIP outcomes
Systems-based practice	Adverse event self-reflective exercises PSIP	To demonstrate an awareness of the health care system and how it influences patient care practices To identify and create resources within the health care system to improve the quality and safety of patient care	Faculty feedback on adverse event self-reflection Patient safety culture survey PSIP outcomes

Abbreviations: ACGME, Accreditation Council for Graduate Medical Education; PSIP, Patient Safety Improvement Project.

improvement.[10,16–25] Yet, implementation of safety education programs has been variable and many residents and faculty remain with little or no formal training in these concepts.[7,9,23,26,27]

In 2006, the University of Michigan implemented a Patient Safety Learning Program (PSLP) in its internal medicine and medicine-pediatrics residency training programs. Recognizing we had few qualified faculty members,[23,28–30] few "formal" learning experiences,[7,8,23,24] and limited precedent for resident-driven safety and quality projects, we defined 3 primary goals for our PSLP: (1) to teach residents key patient safety concepts; (2) to transform our cultural environment; and (3) to provide experiential opportunities for residents to apply the patient safety and quality improvement concepts. We describe our PSLP and how our experiences reshaped the program to enhance our residents' learning experiences.

Methods

Instructional Program

We began by defining key learning objectives that residents would achieve on completion of the PSLP (TABLE 1). Beyond knowledge, we felt the program should improve resident communication, reflection, problem solving, and teamwork, and we designed 3 curricular elements and an assessment program that mapped to our learning objectives.

First, postgraduate year–1 (PGY-1) residents participated in 2 small-group seminars that presented core concepts of patient safety (PS)/quality improvement. The aim was to (1) help residents understand and identify the etiology of adverse events[2,3,31–33] and (2) provide a hierarchy of the effectiveness of solutions to reduce them (TABLE 2).[34] The models were developed locally by work groups with expertise in the areas of quality and safety,

TABLE 2	TREATMENT HIERARCHY[a]		
Stronger Actions		**Intermediate Actions**	**Weaker Actions**
Architectural/physical plant changes Engineering control or interlock (force functions) Simplification of process; removal of unnecessary steps Standardization of equipment, processes, or care maps		Application of checklists, cognitive aids Eliminate/reduce environmental distractions Eliminate look-alikes, soundalikes Increase in staffing; decrease workload Read back Redundancy	Development of new policy Double-checks Education and training Warnings and labels

[a] Efficacy of potential solutions to a patient safety intervention may be generally classified according to their relative strength in preventing adverse outcomes. Stronger actions are defined as those that are less prone to human error, simplify processes, and are more easily sustainable over time and across different environments. Conversely, weaker actions tend to focus on individuals and behaviors, but often lack additional mechanisms to adequately protect against an adverse event(s). Importantly, weaker actions have value and stronger actions are not infallible. In many instances, the most effective solutions include multiple interventions across several categories.

human factors engineering, medical sociology, and educational assessment.

Second, residents (PGY-1 through PGY-4) participated in self-guided reflection exercised on adverse events, to develop their reflection, analysis, and problem-solving skills. Expert faculty provided feedback on the self-reflections.

Third, residents (PGY-1 through PGY-4) participated on Patient Safety Improvement Project (PSIP) teams that pursued team-based projects to address important patient safety issues. To enhance the PSIP teams' success, we developed (1) an academy of faculty mentors to guide resident teams through the projects; (2) a plan to facilitate longitudinal resident participation; and (3) criteria and processes for project selection, implementation, and dissemination.

Development of the Faculty Academy

Faculty was recruited from different disciplines within internal medicine and had demonstrated excellence in teaching, mentorship, clinical care, research, as well as administrative experience and a commitment to patient safety and quality improvement. Participating faculty members had 7% of their time protected and funded. The 9 academy members participated in a 5-session program led by a nationally recognized patient safety expert (J.W.G.). Sessions focused on the content covered during the resident patient safety seminars, project management, and team facilitation. Throughout the year, periodic academy meetings were held to continue faculty development and serve as a forum for discussion.

Resident Group Logistics and Project Selection

Postgraduate year–2 (PGY-2) and PGY-3 residents in our residency programs were assigned to 1 of 9 PSIP teams. Each team consisted of 10 to 11 residents and 1 academy mentor. A total of 141 residents participated during a 2-year period. Each PSIP team developed projects, and a committee composed of 4 faculty members familiar with the institution's safety and quality infrastructure provided feedback on the projects, highlighting their importance, feasibility, and multidisciplinary potential. Teams worked on their projects longitudinally; one

half day was provided for each resident during every elective/ ambulatory month, such that each resident received between 3 and 6 half days of protected time during the year. The protected half days were uniform across all PSIP teams (eg, the second Thursday afternoon of each month) to facilitate team collaboration. In addition, we created access to a centralized web-based archive to foster information sharing in recognition that it would be necessary for the teams to work asynchronously and between the scheduled and protected PSIP meetings to advance their projects. Additional resources, such as institutional collaborators, were identified to enhance the project's likelihood of success. At the end of the academic year, teams presented their project at a Patient Safety Symposium, which included residents, faculty, and leaders across the institution, to promote dissemination.

We used multiple methods to assess the impact of the PSLP. Each method mapped directly to the relevant learning objectives (TABLE 1). Approval for the assessment program was obtained from the University of Michigan Institutional Review Board.

Patient Safety Culture Survey

As an initial step, we developed a comprehensive survey to explore resident and faculty perceptions of patient safety, medical error, and attitudes toward recognizing, reporting, and discussing medical errors in our institution. Content was adapted from the Agency for Healthcare Research and Quality's Hospital Survey on Patient Safety Culture,[35] the Leapfrog Hospital Survey,[36] the HIMSS (Healthcare Information and Management Systems) Leadership Survey,[37] and our institutional patient safety survey. Content validity was promoted through review by faculty, program leadership, and chief medical residents. The survey was administered in 2007 and 2008 to all internal medicine and medicine-pediatrics residents, academy faculty, and internal medicine faculty hospitalists. Comparisons between survey responses were analyzed by Fisher exact test.

Resident Evaluations by Academy Faculty

Academy faculty evaluated each resident's performance annually by using a standard evaluation form that

assessed systems-based practice, practice-based learning and improvement, communication (effective information exchange), and professionalism (carrying out professional responsibilities). Scores ranged from 1 to 9 (unsatisfactory, 1–3; satisfactory, 4–6; and superior, 7–9). A score of 5 was considered expected level of performance. This assessment is analogous to our "standard" rotation evaluation and has not been formally validated. Faculty development focuses on standard interpretation of the anchors, but we have not further measured reliability or validity.

Assessment

Assessment of the PSLP included evaluation of the residents and faculty and assessment of the impact of the safety projects managed by the PSIP teams. In 2008 and 2009, all PGY-3 and PGY-4 residents completed anonymous surveys to assess the perceived educational value of their learning experiences, including those in the PSLP. Curricular experiences were rated relative to each other. Academy faculty feedback was collected in twice yearly meetings, grouped by theme and analyzed.

Three to 6 months following each symposium, the PSLP leadership followed up with the PSIP teams to assess how the projects impacted patient care processes and outcomes. The results are provided as online supplemental material. In addition, the leadership team collected data on characteristics previously demonstrated to correlate with successful project outcomes.[30]

Results

Curriculum—Patient Safety Culture Among Residents and Faculty

The results of the initial and follow-up surveys is summarized in TABLE 3. We did not find any changes in resident or faculty perceptions of our culture after implementation of the PSLP, with the exception of a slight increase in resident-reported comfort with discussing errors with peers/colleagues, and a slight reduction in reported concern that discussing errors may negatively impact their careers, though neither reached statistical significance. Similarly, faculty attitudes and behaviors did not change, except for a slight increase in reported comfort with discussing medical errors with peers/colleagues.

Curriculum—Attending Physicians' Evaluation of Residents

Academy faculty completed 126 evaluations of assigned residents (90%). Although direct comparisons across learning experiences are difficult, evaluations of residents were lower for the PSIP rotation than for other rotations (3.18% versus 0.18% rated as "unsatisfactory," $P < .001$; mean rotation score, 6.90 versus 7.34 of 10, $P < .001$). Qualitatively, "unsatisfactory" evaluations generally focused on residents' poor performance in the domains of professionalism and communication, and noted lack of

teamwork, project participation, and/or responsiveness to faculty communication. In spite of lower mean scores for the PSIP rotation, more than 50% of residents were rated "superior" in professionalism, communication, practice-based learning and improvement, and systems-based practice.

Curriculum—Program Evaluation

On the 2008 and 2009 graduation surveys, residents rated the PSIP in the lowest of 5 quintiles of their educational experiences (2008 mean quintile, 1.55; range, 1–4; and 2009 mean quintile, 1.63; range, 1–4). Qualitative evaluation of the PSLP, specifically the team-based projects, revealed logistic difficulties. First, most academy faculty and residents felt that longitudinal resident participation on PSIP teams was unsustainable owing to scheduling problems and competing responsibilities. Second, faculty and residents questioned the engagement of some of the other resident team members and their accountability to the team. Third, academy faculty noted that the PSIP teams were too large, making communication and coordination difficult. Finally, perceived lack of progress in some of the projects was attributed to the unrealistic scope of the proposals. Despite these logistic issues, academy faculty and many residents indicated the PSLP was important and worth maintaining, but suggested a need for significant program restructuring.

Patient Safety Projects

In spite of the challenges highlighted by residents and faculty, the PSIP teams' projects addressed a number of patient safety problems (provided as online supplemental material). Commonly explored domains included communication and transitions of care, device-related complications, and complications of hospitalization. PSIP teams had variable success implementing lasting interventions, but most were able to pilot small changes and analyze the impact on patient care processes and clinical outcomes.

For example, a team focusing on the rising incidence of *Clostridium difficile* infection identified delays in recognition and test turnaround time as key contributing factors. Working with nursing, infection control officers, and the Office of Clinical Affairs, the residents improved testing methods and turnaround times. The team also implemented a unit-based trial of preemptive isolation precautions, the results of which led to an institution-wide program.

Discussion

We designed and implemented a comprehensive program to communicate the priority of patient safety, address preidentified barriers within our curriculum, and intentionally involve learners early in their training.[7,28,38,39] This produced some improvements in patient safety conditions, but received a low evaluation from residents, and did not result in a change in resident or faculty

TABLE 3	PATIENT SAFETY CULTURE SURVEY: RESIDENTS AND FACULTY PHYSICIANS[a]			
	Residents Unexposed to PSLP 2007, % (n = 35)	**Residents Exposed to PSLP 2008, % (n = 26)**	**Faculty Academy and Hospitalists Preimplementation of PSLP 2007, % (n = 28)**	**Faculty Academy and Hospitalists Postimplementation of PSLP 2008, % (n = 22)**
Residents/faculty feel that their mistakes are held against them.	31	28	43	50
I feel comfortable talking about my medical errors.	68	63	66	76
If I made a medical error that could (or did) harm a patient, I would feel comfortable talking with my:				
(Co)residents, faculty	91	92	82	65
Attending physician (colleague), even if not directly involved in the case	79	88	93	75
Supervisor[b]	59	68	39	45
Nurses	53	33	50	35
I feel that my colleague(s) will think less of me/not respect me as a physician by talking about a medical error.	59	40	39	35
By talking about medical errors, I worry that it will be put on my permanent record or may impact my career negatively.	35	16	26	40

Abbreviation: PSLP, Patient Safety Learning Program.

[a] Our response rates were 57.1% and 80.0% for the resident and faculty 2007 surveys, respectively. Our response rates were 25.7% and 59.5% for the residents and faculty 2008 surveys, respectively. Responses were recorded on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5); the midpoint (3) was defined as neutral. Results shown above are based on responses classified as either "agree" or "strongly agree."

[b] Supervisors were defined as program/associate program directors (residents) or division chiefs/department chair (faculty). Data were analyzed with Fisher exact test. $P > .05$ for all comparisons of responses between the 2 time periods that the survey was administered.

perceptions of the local patient safety culture. These outcomes are not surprising. Achieving cultural change faces significant obstacles, including long-standing cultural norms on handling error,[31,32,40] residents as a vulnerable learner population,[13] and the need to develop programs de novo.[41]

Examination of our safety projects revealed themes that predicted a project's likelihood of success: project scope, alignment with institutional goals, presence of an identified champion, and solutions that went beyond education and training. A focused, realistic project scope, developed at inception by the team, driven by a detailed up-front analysis of the problem, clearly improved a project's chance of success.[6,38,42,43] Projects that were too broad in scope often needed to compromise their goals, which limited their

effectiveness. Projects aligned with institutional goals (such as reducing the rate of STAT [emergency] laboratory orders) were more likely to gain traction, involve interdisciplinary partners, and receive resources.

Identifying a consistent champion outside of the PSIP team was critical to the lasting impact of a project.[32,44] One team attempted to improve communication of abnormal findings between radiologists and primary care physicians. The radiologist "champion" departed the university mid project and no replacement was identified. As a result, the project stopped and the proposed improvements were not implemented. This underscores the reality present in many health care settings, one in which the expertise and motivation to lead safety interventions is concentrated in a small number of individuals.[45–47]

Finally, our teams consistently faced the temptation to propose mostly educational and training interventions, consistent with their role as learners. While these offer opportunities for improving knowledge, our treatment hierarchy reflects their general ineffectiveness when implemented in isolation (T A B L E 2).[6,7,40]

Changes to the Program

As we finished the second year of the PSLP, we needed to reconcile the conflicting results of our intervention. We had worked to create a culture of safety, had developed faculty PS mentors, and many residents had immersed themselves in patient safety and quality initiatives. Yet, program evaluation revealed inconsistent resident engagement in the safety teams and low faculty and learner satisfaction. Our steering committee undertook a comprehensive reexamination and redesign of the PSLP, which was implemented in July 2009. We retained certain key elements, including our conceptual model, resident team-based project selection/participation, and open discussion in public forums.

To balance the PSLP with concurrent educational responsibilities, we consolidated the PSIP project experience into a more intensive experience within a 1-month block. This increased the protected time for residents to work on their projects, placed the PSLP on equal footing with other rotations, and facilitated team interactions. This structural change also addressed a significant obstacle in our earlier model by decreasing the amount of asynchronous and additional work that team members needed to complete outside of time specifically protected to advance their project. In addition, team size was reduced to 4 to 5 residents to enhance individual accountability. At the end of the rotation, teams present their work at a monthly departmental PS conference.

To date, preliminary analysis shows much higher resident and faculty satisfaction, and improved resident engagement and observed teamwork behavior. Challenges remain, including the shorter project duration, which reduces the likelihood that residents can see a project through to implementation.[16,19,30] As the new model evolves, we anticipate teams may build on work completed by other teams, through piloting previously proposed solutions, for example. We do not anticipate a reduction in project scope or impact of projects and, thus far, this prediction has held true. Further research is needed to refine the PSLP, to develop more proactive resident learners in the area of quality and safety, and to further our program and institutional culture of safety.

Conclusions

We have laid the foundation to create a culture of patient safety in our residency programs and will continue our assessment of the magnitude of this change over time. Although many of our results are thematic and qualitative in nature, we feel the conclusions, drawn from 2 years of experience involving nearly 150 residents, can serve as guidance for others who attempt to tackle this important issue. The lack of a positive impact on safety culture findings highlights the difficulty educators face when attempting to change culture and speaks to the inherent methodologic challenges of quantifying attitudinal and behavioral change. The trend of increased comfort with reporting errors and patient safety incidents is encouraging, and we believe our intervention created an environment that enabled our residents to understand the importance of patient safety and provided opportunities to effect change.

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