

Teaching Medical Students About Medical Errors and Patient Safety: Evaluation of a Required Curriculum

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Abstract

Purpose

To assess the effectiveness of a brief curriculum about patient safety and medical errors with third-year medical students.

Method

From 2000–03, third-year medical students at New York Medical College, Valhalla, New York, were required to participate in a new curriculum on patient safety and medical errors during their family medicine clerkships. Five hundred seventy-two students participated in a four-hour curriculum that included interactive discussion, readings, a videotape session with a standardized patient, and a small-group debriefing facilitated by a family physician. Before and after participating

in the curriculum, students were asked to complete questionnaires on self-awareness about patient communication and safety. Curriculum evaluations and follow-up surveys were also distributed. Responses to each statement on the before and after questionnaires were compared using the Wilcoxon signed-rank test for matched data.

Results

Five hundred eleven (89%) students reported that the opportunity to present an error to a patient increased their confidence about discussing this issue with patients, and 537 (94%) students reported that they strongly agreed or agreed that the standardized patient and feedback exercise was a useful learning experience. A total of 535 before and

after questionnaires were used in the analysis. A comparison of before and after questionnaire data revealed statistically significant increases in the self-reported awareness of students' strengths and weaknesses in communicating medical errors to patients ($p \leq .01$).

Conclusion

These findings suggest that awareness about patient safety and medical error can be increased and sustained through the use of an experiential curriculum, and the students rated this as a valuable experience.

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In the years since the release of the Institute of Medicine (IOM)¹ report, *To Err is Human: Building a Safer Health System*, in November 1999, there has been a dramatic increase in the number of articles in the medical literature on patient safety and medical error. There has not been the same explosion of publications on educating medical students about these issues although the education of physicians beginning in medical school has been increasingly advocated.^{1–13} From the early 1980s, the literature has included observations of

trainees in relation to medical errors,^{14–20} anecdotes involving medical students and residents,^{21–28} and a few interviews and surveys.^{29–33} However, this literature rarely offers specifics on how this teaching should be done. In fact, commenting on progress made and improvements still needed in the years since the IOM report, Timothy Flaherty, MD, chairman of the Board of the National Patient Safety Foundation, noted in an interview that medical education is an area where patient safety has not made any dramatic improvements.³⁴

In addition to the rapidly expanding literature on safe practice, there has been much activity by the federal and state governments, industry pressure (e.g., The Leapfrog Group³⁵), and new regulation (e.g., the National Patient Safety Goals of the Joint Commission on Accreditation of Health care Organizations [JCAHO]³⁶) for actively addressing medical errors and unsafe practices. We found it surprising that the literature much less frequently addresses the education of medical students on patient safety, even training

on the basics of the JCAHO's National Patient Safety Goals. With the exception of anecdotal reports of teaching activity^{37,38} we found very few published reports of specific curricula on medical error in undergraduate medical education.^{39–41}

There are a multitude of reasons to encourage explicit teaching about patient safety, most importantly the prevention of error and improved quality of care for the patient. Five other motivations point to the need for medical schools and residency programs to integrate education about patient safety and medical error into their training. First, the health effect on society of medical errors is huge and merits dedicated time in the curriculum.^{42,43} Second, academic medicine lags far behind other health care and regulatory bodies such as the JCAHO, the National Quality Forum, and many state governments⁴⁴ and should be leading efforts to address patient safety problems.^{45,46} Third, medical schools should address the concerns of patients and the public, many of whom want physicians to handle

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errors and disclosure differently.^{47–49} Fourth, physicians report that more training in how to handle errors is necessary, including ways to constructively heal themselves and colleagues after making an error.⁵⁰ Finally, there is a need to decrease the emotional and cultural barriers in medicine, to address the “hidden curriculum” in medicine, and to facilitate a change in the culture. Such motivations raise many obstacles, not the least of which is the physician’s fear of malpractice,^{51,52} threats to the autonomy of the profession, reluctance to apply systems theory,⁵³ the lack of expert faculty,⁵⁴ and the competing demands on today’s practitioners and medical educators.

In July 2000, the Department of Family Medicine at New York Medical College (NYMC) in Valhalla, New York, integrated into its required third-year clerkship a curriculum to introduce students to avenues for communication about medical errors, to expose them to the prevalence and origins of errors, and to increase awareness of the physician’s responsibility for patient safety. Standard methods of evaluation were incorporated from the start of the program to evaluate its effectiveness in raising students’ awareness of patient safety and to determine the curriculum’s value. In this article, we present an evaluation of the first three years of this curriculum and discuss patient safety education.

Method

Participants

In 2000–01, 2001–02, and 2002–03, a total of 572 third-year medical students at NYMC were required to complete and evaluate the curriculum during their four-week family medicine clerkship. We sought and were exempted from IRB approval.

The curriculum

In early 2000, we developed a curriculum to raise awareness about medical errors and patient safety and provide students with practice in an essential skill (i.e., communicating an error to a patient and/or family). We chose to focus on third-year students because we assumed some clinical experience was needed to understand and incorporate this awareness. With only limited time available in our four-week family

medicine clerkship, we sought to create a curriculum that might improve the attitudes and skills of medical students more than their knowledge base.

The four-hour curriculum had three parts: an introductory lecture/discussion, brief required readings, and a videotaped simulation with a standardized patient. The students received verbal and written feedback, but were not graded.

A family physician presented the one-hour didactic in an interactive format to a group of 12–24 third-year students during the orientation to the family medicine clerkship. The didactic included a discussion of a medical error, physicians’ reactions to an error, and the epidemiology of medical errors. We used the definition of error proposed by Wu et al: “a commission or an omission with potentially negative consequences for the patient that would have been judged wrong by skilled and knowledgeable peers at the time it occurred, independent of whether there were negative consequences.”^{55, p. 770} In the third year of the curriculum, we added two components to the didactic: the National Patient Safety Goals from the JCAHO⁵⁶ and the Agency for Healthcare Research and Quality Morbidity and Mortality Rounds on the Web.⁵⁶

We distributed three to six articles from a list that was updated annually and that most recently included a one-page commentary on the IOM’s *To Err is Human*⁵³; an article about how errors happen, written by a medical student²⁶; and an article that included specific considerations when disclosing an error to a patient.⁵⁵

Each student participated in a videotaped simulation where an outpatient error was acknowledged and discussed with a standardized patient. The three-hour exercise accommodated four students at a time with two standardized patients and one family medicine faculty member. Beginning with a 20-minute orientation to the case material, the faculty member also provided a review of basic communication skills, techniques for delivering “bad news,”⁵⁷ and suggestions for discussing an error with a patient or a patient’s parent. Two different cases were used each session; the scenarios were outpatient errors that could plausibly be made by a medical student. Each student then had a ten- to 15-minute videotaped

encounter with the standardized patient. The student was asked to incorporate basic interviewing skills as well as specific tasks related to discussing the error, including apologizing for the error, taking responsibility for the error, admitting they did not know something, and making attempts to reestablish trust with the patient. This encounter was followed by a small-group feedback session lasting about two hours that included the four students, the two standardized patients, the family physician, and the behavioral medicine faculty. As each video was reviewed, students were encouraged to give feedback to each other as well as to offer commentary on their own interaction with the patient. The standardized patient gave both verbal and written feedback to each student. In both this session and in the initial didactic, the family medicine faculty member frequently told of his or her own experiences in making and disclosing errors.

Outcome measures

All 572 students were asked to complete the same seven-item questionnaire (see Table 1 for items) on awareness of strengths and weaknesses both at the start of the clerkship and after the videotape feedback session. Students gave responses to the statements using a five-point scale (1 = extremely aware; 5 = not at all aware). We asked the students to complete the questionnaire on the first day of the clerkship just prior to the didactic presentation and discussion of medical errors and again after completion of the videotape and feedback session that is always part of the four-week clerkship. We matched all responses using the last four numbers of the student’s social security number.

In addition, we asked each student to complete a 13-item evaluation of the curriculum at the end of the videotape feedback session (see Table 2 for evaluation statements). Finally, we forwarded a 12-item anonymous, follow-up questionnaire to all students approximately two to eight months after their family medicine clerkship that asked about the students’ experience with medical errors since their clerkship. We also followed the results of a single question on the Graduation Questionnaire (GQ) of the Association of

Table 1

Questionnaire Responses of 535 Third-Year Medical Students Before and After They Participated in a Curriculum on Patient Safety and Error Disclosure, by Academic Year, New York Medical College, Valhalla, New York, 2000–03

Questionnaire item	2000–01 mean (range)* (n = 180)				2001–02 mean (range)* (n = 178)				2002–03 mean (range)* (n = 177)			
	Before curriculum	After curriculum	Change	p Value	Before curriculum	After curriculum	Change	p Value	Before curriculum	After curriculum	Change	p Value
Awareness of your strengths in conducting a medical interview with a patient	2.63 (1–5)	2.28 (1–4)	0.34 (1–3)	<.01	2.61 (1–5)	2.23 (1–5)	0.38 (1–2)	<.01	2.40 (1–4)	2.31 (1–5)	0.09 (1–2)	.09
Awareness of your weaknesses in conducting a medical interview with a patient	2.73 (1–4)	2.28 (1–5)	0.46 (1–3)	<.01	2.70 (1–5)	2.20 (1–4)	0.51 (1–3)	<.01	2.60 (1–5)	2.31 (1–4)	0.29 (1–3)	<.01
Awareness of the incidence/frequency of medical mistakes/errors made by physicians	3.09 (1–5)	2.45 (1–5)	0.64 (1–3)	<.01	3.00 (1–5)	2.48 (1–5)	0.52 (1–3)	<.01	3.01 (1–5)	2.45 (1–5)	0.56 (1–3)	<.01
Awareness of the chance that you, as a practicing physician, will make mistakes, some with serious adverse consequences	2.21 (1–5)	1.77 (1–4)	0.44 (1–3)	<.01	2.22 (1–4)	1.81 (1–4)	0.41 (1–3)	<.01	2.31 (1–5)	1.84 (1–4)	0.47 (1–4)	<.01
Awareness of adverse outcomes to errors in medicine	2.42 (1–5)	2.01 (1–4)	0.41 (1–3)	<.01	2.33 (1–4)	1.95 (1–5)	0.38 (1–3)	<.01	2.43 (1–5)	2.02 (1–4)	0.41 (1–3)	<.01
Awareness of your strengths in communicating a medical error to a patient	3.40 (1–5)	2.41 (1–5)	0.99 (1–4)	<.01	3.32 (1–5)	2.24 (1–5)	1.08 (1–4)	<.01	3.28 (1–5)	2.33 (1–4)	0.94 (1–4)	<.01
Awareness of your weaknesses in communicating a medical error to a patient	3.35 (1–5)	2.33 (1–5)	1.02 (1–3)	<.01	3.28 (1–5)	2.14 (1–5)	1.14 (1–4)	<.01	3.28 (1–5)	2.31 (1–5)	0.97 (1–4)	<.01

* Responses were given on a five-point scale (1 = extremely aware; 5 = not at all aware).

American Medical Colleges (AAMC) that relates to a prescription error.⁵⁸

Data analysis

We compared responses to each statement in the before and after questionnaires using the Wilcoxon signed-rank test for matched data. We present the data from students' evaluations and follow-up questionnaires as numbers and percentages.

Results

For the analysis of the before and after questionnaires we removed respondents who had missing data on either questionnaire. The remaining 535 respondents were distributed among the study period as follows: 2000–01 (n = 180), 2001–02 (n = 178), and 2002–03 (n = 177). A comparison of the mean

scores from the before and after questionnaires by academic year is shown in Table 1.

We used responses from all 572 students' forms in the analysis of the evaluations; nonresponses are noted for each item (see Table 2). In the students' evaluations of the patient safety curriculum after the videotape exercise, 511 (89%) students agreed or strongly agreed that "the opportunity to present an error to a patient increases my confidence about discussing this issue with patients." On the same evaluation, the didactic session "provided a good introduction to the issue" according to 470 (82%) students; however, only 331 (58%) agreed or strongly agreed that "the readings provided on this issue were helpful." Finally, 537 (94%) students reported the

standardized patient exercise to be "a valuable LEARNING experience."

The response rates for the follow-up questionnaire were 42% (82/193) for 2000–01, 36% (68/188) for 2001–2002, and 82% (157/191) for 2002–03. We do not have an explanation for the markedly high response rate in the third year. A total of 307 students, out of 572 students who participated in the curriculum, responded to the follow-up questionnaire. Eighty-four percent (259/307) of respondents who completed the follow-up questionnaire reported that they strongly agreed or agreed that they had an increased awareness of errors in medicine, with 67% (207/307) reporting strong agreement or agreement that they were more aware of patient safety issues. Only 9% (29/307) noted "the issue of medical errors has been formally addressed in my

Table 2

Summary of Curriculum Evaluations of 572 Third-Year Medical Students Who Participated in a Curriculum on Patient Safety and Error Disclosure, New York Medical College, Valhalla, New York, 2000–03

Evaluation statement	No. (%) of students who					
	Strongly agreed	Agreed	Neither agreed nor disagreed	Disagreed	Strongly disagreed	No response
In general . . .						
Instructions were clear.	340 (59)	217 (38)	10 (2)	0 (0)	2 (<1)	3 (<1)
The "patient" was realistic.	328 (57)	214 (37)	16 (3)	8 (1)	1 (<1)	5 (<1)
There was sufficient time to attend to the medical error during the interview.	395 (69)	158 (28)	8 (1)	4 (<1)	2 (<1)	5 (<1)
The opportunity to present an error to a patient increases my confidence about discussing this issue with patients.	236 (41)	275 (48)	46 (8)	8 (1)	2 (<1)	5 (<1)
The orientation to medical errors, during the first day of the clerkship, provided a good introduction to the issue.	180 (31)	290 (51)	70 (12)	16 (3)	4 (<1)	12 (2)
The readings provided on this issue were helpful.	95 (17)	236 (41)	210 (37)	13 (2)	1 (<1)	17 (3)
Feedback from the standardized patient . . .						
Was consistent with MY OWN assessment of my performance.	118 (21)	371 (65)	51 (9)	18 (3)	0	14 (2)
Was constructive.	316 (55)	225 (39)	11 (2)	6 (1)	1 (<1)	13 (2)
Helped me to identify areas that I need to improve.	317 (55)	213 (37)	20 (3)	8 (1)	0 (0)	14 (2)
Feedback from the preceptor . . .						
Was consistent with MY OWN assessment of my performance.	160 (28)	347 (61)	41 (7)	11 (2)	0	13 (2)
Was constructive.	328 (57)	220 (38)	8 (1)	2 (<1)	0	14 (2)
Helped me to identify areas that I need to improve.	336 (59)	203 (35)	18 (3)	3 (<1)	0	12 (2)
Overall, the standardized patient exercise was a valuable LEARNING experience.	327 (57)	210 (37)	19 (3)	1 (<1)	0	15 (3)

other third year clerkships." Twenty-eight percent (85/307) had "witnessed a colleague make a medical error" often or very often; 17% (53/307) had themselves "made a medical error" often or very often in the course of other clerkships. Seven percent (21/307) reported having "discussed an error with a patient or a patient's family." Ninety-seven percent (297/307) agreed or strongly agreed that "it is important to teach students about medical errors," with 87% (267/307) agreeing that "the third year is the more appropriate time to discuss medical errors."

Finally, we examined another potential measurement of the change in students' confidence regarding error in medicine. Every spring, most fourth-year medical students in the United States answer the AAMC's GQ.⁵⁹ The results are provided to each school with a comparison to the national average. In 2001, all graduating students began responding for the first time to the statement, "I am confident that I have the appropriate knowledge

and skills to discuss a prescription error I made with a patient," using a five-point Likert scale (1 = strongly agree, 5 = strongly disagree). Because the 2001 graduating class at NYMC did not participate in the curriculum, but all subsequent classes did, we chose to follow the responses of the students in our study and the national average.

The national average remained unchanged at 1.9 during 2001–04, but the first NYMC student class to participate in our curriculum improved in their assessment of their confidence to discuss a prescription error with the patient. The average response of the NYMC students to this statement in 2001 was 2.1, and the averages in 2002, 2003, and 2004 were 1.7, 1.8, and 1.7, respectively.⁵⁸ We also examined trends in the other interviewing questions on the GQ to try to determine if there was some larger unknown change happening to NYMC students, but we found no trend. While this is only one question, and a shift of 0.3–0.4 on a five-point

Likert scale is of unclear clinical significance, it does suggest that NYMC students who participated in the brief curriculum expressed increased confidence in discussing a prescription error with a patient when asked 12–24 months after the curriculum. It should be noted that fourth-year students nationally expressed a surprisingly high level of confidence in this area and this confidence remained unchanged over a period in which so much changed in the patient safety and error disclosure movement.

Discussion

The limitations of our study include the single institution focus, the before and after questionnaire design, and the self-report follow-up. For several reasons, we believe our findings can be generalized to other medical schools that do not have formal patient safety curricula: undergraduate medical education tends to have a similar structure across the United States, our class size is large (190

per year) and includes students from around the country; and finally, our students' clinical work takes place in multiple and varied teaching settings, making it less likely that our students are unique or uniquely trained. The findings from our before and after questionnaires would have been strengthened with the inclusion of a control group of students from either our own or one or more other institutions. This was not financially feasible; however, a randomized controlled trial of an educational intervention should be considered in future research. The self-report follow-up suggests an effect among respondents but does not account for students who did not respond.

In spite of these limitations, our findings suggest that education about patient safety and medical errors can be successfully implemented and maintained in undergraduate medical education. While a relatively small number of students reported that they themselves discussed an error with a patient, it is important to note that we told them that it was not a medical student's responsibility to do so. A brief, experiential educational intervention was shown to increase and sustain awareness of patient safety issues and medical error disclosure to patients.

We believe that this brief curriculum may work because it allows for instruction on many levels. First, students were required to actively practice and then review their own performances in the disclosure of an error with a patient. Most students were successful in honestly disclosing the error, taking responsibility, and apologizing for the error. Many students were relieved after participating in the curriculum, commenting that it was not as bad as they had expected. Second, faculty members modeled discussing medical errors as an integral part of practicing medicine. The students hear the faculty member's own experiences in the matter, and they prepare how they may intervene with the patient. Third, the students' witnessed a forum where faculty encouraged disclosure of individual and system vulnerabilities and gave a human context to the issues. Fourth, professional responsibility and ethics were reinforced and demonstrated in the faculty feedback to the videotapes. Finally, a small-group process of reviewing the videotapes and offering

feedback allowed students to begin a dialogue with colleagues about how they managed the disclosure of an error.

Much of the content of a curriculum about medical errors and patient safety is best suited to experiential teaching methods such as standardized patients and simulators. In the literature, simulations have been advocated for potentially improving safety performance or patient safety.^{59,60} An additional factor in the success of our curriculum was the participation of a stable cadre of committed faculty who were willing to disclose their own experiences with medical errors in practice and openly and frankly discuss the issue with medical students. Such faculty role models discuss not only the knowledge and skills required for safe practice, but also demonstrate the attitudes required.

In addition to an initial curriculum like ours, other useful methods for teaching about patient safety and medical errors include case-based conferences like Grand Rounds and Morbidity and Mortality review improved to incorporate explicit discussion of error and systems,^{61–63} or even a Patient Safety Conference.⁶⁴ However, curricula on patient safety should not be primarily delivered through lecture-discussion and large-group formats. Methods must be used which facilitate self-reflection and mindfulness, discussion of feelings,⁶⁵ acquisition of specific skills in many specialties, and improvement in communication skills not only with patients but also with nurses, other health care professionals, and physicians throughout the hierarchy. Specific team-training skills² are essential in settings like intensive care units, operating rooms, and emergency departments; improved skills in teamwork may also become essential in many other settings and specialties, including primary care.⁶⁶ The ideal educational strategy with regard to patient safety would be to view the entire undergraduate curriculum as an opportunity to teach students how to prevent mistakes in clinical practice. Many in medical education believe this teaching already occurs; however, the standard approaches to error prevention and response to errors in medicine are not consistent with the methods used in high-reliability organizations. Some authors advocate a more fundamental restructuring of medical education to

improve quality of care and to establish a safety culture in medical education.^{45,67,68} Short of these systemic endeavors, "one small but very visible step would be for educational leaders to introduce the subject of error prevention and patient safety into undergraduate and postgraduate medical curriculums and examinations."^{4, p. 583} As Timothy Flaherty, MD, has noted, "until you change the tests, you don't change the curriculum."^{34, p. 3} Beyond that initial step, the best methods of incorporating specifics about safe practice into medical education have not been clearly identified although some groups have delineated goals and objectives, the content, domains, and the competencies needed.^{10,68–70}

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Teaching and Learning Moments

The Patient–Caregiver Cycle

In the emergency department, Mrs. Eagley's husband lifts up his shirt as he describes his bypass surgery while I attempt to obtain information regarding his wife's recent episode of unresponsiveness. "What about your wife's heart history?" I ask trying to redirect him to his wife's cardiac resuscitation of a few moments ago. As an internal medicine intern with less than two months experience in this role, I am repeatedly baffled by these family interactions. As I am working with the person designated "my patient," a spouse or another family member seems more interested in discussing their ailments than in assisting in their relative's care. This type of encounter is not unique to the emergency department.

In a family meeting for Mrs. Patel, who is in intensive care for an anoxic brain injury, Mrs. Patel's niece asks about high blood sugars because she has had diabetes for a few years and maybe her aunt has undiagnosed diabetes as well. She focuses on a blood sugar of 200 that a nurse had mentioned while she was in the room and describes her own symptoms when her sugar is elevated. After an explanation of increased blood sugars under stressful situations, the palliative care specialist refocuses the discussion to options for a brain dead patient status post

delayed resuscitation. Once again, a family member seems to shift the conversation to her own disease process even in a terminal situation. Is this a way to avoid confronting the gravity of her loved one's illness?

In the outpatient neurology clinic, Mr. Hernandez's wife snickers as her husband names the wrong month during his mini-mental status exam but admits she would not do much better because she has been having memory problems recently. As my attending continues with Mr. Hernandez's examination, his wife locks my glance in her direction and then, points from her mouth to pelvis and says, "I have a yeast infection from here to here." I am forced to wonder why she tries to refocus the medical discussion to center on her own issues. Is it a search for empathy by a person with limited social contacts outside of her spouse? Is it a hope for legitimization of her own illnesses that may not be as critical as her loved one's illness, but nonetheless debilitating for the individual?

Furthermore, how am I to handle these situations? In a specialist clinic with 30-minute time slots, it is not possible to expand Mr. Hernandez's appointment into a one-hour meeting encompassing his Alzheimer's dementia as well his wife's

neurological and infectious disease issues. It is not beneficial to Mrs. Patel's care to discuss her niece's symptoms of hyperglycemia. And Mrs. Eagley's husband's cardiac history will not aid in making decisions regarding the external pacemaker that is acutely sustaining her life. In all of these situations, I have listened to the family member and acknowledged their complaint or piece of history. Just listening and acknowledging their difficulty without offering a treatment plan or any further discussion of the ailment usually leads to a mutual agreement that the individual should discuss this issue with his or her primary care physician. I temporarily relieve the caregivers of the mental burden of their illnesses and we can try once again to focus on my patient. Ultimately, balancing the caregiver's personal needs with the needs of my current patient can be a challenging aspect of medicine that I will continuously refine throughout my career.

Names in this essay have been changed to protect the confidentiality of individuals.

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