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Medical Students' Exposure and Response to Error on the Wards

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Abstract

Medical errors are common and cause extraordinary costs. Errors should be openly discussed and learned from. Medical schools have been slow to adopt curricula on medical errors, or training in how to respond to errors. Since error disclosure remains incomplete, students may be lacking both formal and informal education in error management. Our aims were to describe students' knowledge about medical errors and error reporting, their attitudes toward medical errors and error reporting, their exposure to various types of errors, and their disclosure patterns. A survey instrument was developed using previously validated questions and new questions developed using the results of a focus group. The survey was refined by leading survey experts and a pilot test with students. The study sample consisted of students who had completed their third year of medical school at a single institution. A total of 99 useable surveys were received for a response rate of 48%. Many students (91.9%) witnessed at least on error during their clerkships resulting in harm to the patient. The most common types of errors witnessed by students included errors from failed medication reconciliation (73.5%), incorrect diagnoses (67.7%), missed diagnoses (66.7%), and poor or incomplete handoff (65.65%). The services where the most students reported witnessing errors resulting in harm were Medicine, OB-GYN, and Surgery. There were significant gaps in students' knowledge about errors and error reporting; For example, 17.2% of students did not feel confident that they know what constitutes a medical error and 69.7% did not feel confident that they know how to report an error. The majority of students (83.84%) said that they had not received training on how to respond to errors they observe. Training was significantly associated with students' knowing how to report an error ($p=.006$) and knowing which errors to report ($p=.02$). None of the 16 students who reported having

formal training said that they did not report an actual error because they were unsure about whether or not something was an error. More than a quarter of students (27.94%) who witnessed an error that remained undisclosed or unacknowledged did not tell anyone about the error. Their reasons for not telling anyone include: unsure of whether or not it was an error (64.3%), fear that their team would be upset with them (42.9%), unsure of who to tell (42.9%), they did not think the information would help the patient (39.3%), and fear of a bad evaluation or grade (28.6%). Over a quarter (27.6%) of the students thought that it would be likely or very likely that their grade and evaluation would have been negatively affected and 61% felt like it would be likely or very likely that their residents and/or attending would have been upset with them if they reported an undisclosed error to the patient/patient's family on their last rotation. The involvement of the attending physician after a minor ($p=.003$) or major ($p<.001$) error significantly predicted positive actions, such as open explanations to the patient and open educational discussion among the team. Medical students frequently witness errors, but perceive a culture in which transparency is not the goal. Because training significantly increased students' comfort with errors, there should be more training and education in errors for physician trainees at all levels. Since active responses to errors by attending physicians lead to positive actions after errors occurred, we should continue to train and recruit faculty who will act as positive role models for medical students with respect to safety and disclosure.

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Introduction

Medical Errors: System or Individual

The Institute of Medicine (IOM) report, "To Err Is Human: Building a Safer Health System" estimated that more than 1 million preventable adverse events occur each year in the United States (1). That report also estimated that, in the United States, up to 98,000 annual deaths can be attributed to medical errors, with errors and preventable deaths costing $30 billion annually in lost income and excess health care expenditures(1). The cost of errors encompasses not only the direct costs of morbidity and mortality, but also costs to families and hospitals, the cost of dissatisfied patients, and the cost of mistrust in the healthcare system.

Historically, errors in medicine were thought to be an unavoidable outcome of learning to practice medicine (2). Traditionally, medical errors were dealt with by blaming or punishing the physician who committed the error, such as critiquing individual decisions in Morbidity and Mortality (M&M) conferences. Many experts agree that a "blame and shame" approach has negative consequences on learning from errors (3). As the IOM's report attests, blaming an individual for an error does little to make the system safer and prevent someone else from committing the same error (1). Advocates of patient safety have called for reducing the emphasis on individual blame in discussions about medical errors. Research suggests that there are many advantages to developing policies that facilitate anonymous error reporting, adopting a systems approach to the analysis of adverse events, and creating collective learning opportunities (4).

Today, most experts agree that a majority of medical errors are attributable to faulty systems, processes, and conditions rather than the failure of individuals. In systems errors, there are faults inherent in the system, that "set up" individuals to make mistakes. Examples of systems errors include a mistake in patient care that occurs because a patient's past records are unavailable, or transfusion error due to the mislabeling of a blood sample.

However, some argue that at the same time we emphasize the way systems can lead to errors, it also is important to create an environment in which medical students and house officers can discuss and learn from individual mistakes, and learn how to report and respond to such mistakes. In an individual error, the primary responsibility for the mistake lies with the physician. For example, administering an NSAID to a patient with renal failure would be considered an individual mistake because the physician giving the medication failed to recall that NSAID's can impair kidney function. Casarett and Helms (4) suggest that such an open environment can best be achieved by not blaming individuals for errors, but instead encouraging housestaff to disclose errors and make constructive changes in their own behaviors.

Research suggests that when errors are viewed as learning opportunities, house officers are more likely to make constructive changes in their practice. A study by Wu, et al. (5), found that house officers in internal medicine who accepted responsibility for, and discussed, a mistake were likely to make constructive changes in practice. The authors argue that, to promote optimal learning, faculty should encourage house officers to accept responsibility for, and discuss, their mistakes. Similarly, a study by Kroll, et al. (6), of 38 house officers across 10 hospitals in the United Kingdom found that learning about errors is maximized when mistakes are discussed formally with colleagues, and

constructive feedback is provided to the physician who was involved in the error. Kroll, et al. (6), also found that many potentially valuable learning opportunities were missed, either because the senior's response was inappropriate or the juniors did not access help.

Error Disclosure

Disclosure of errors is an integral part of a physician's duty, a tenet which is widely agreed upon by physicians, patient safety experts, hospital executives, ethicists, and accreditation organizations (7, 8). There have been many efforts to improve error disclosure and reporting, including the 2005 passage of the Patient Safety and Quality Improvement Act. In addition, there is evidence that disclosure reduces the likelihood of patients changing physicians and increases patient satisfaction, trust, and positive emotional response (9). We also know that patients desire full disclosure, even when the error results in only minor harm (10). Additionally, several reports indicate full disclosure reduces the risk of litigation (11). Nevertheless, full disclosure is far from universal.

There are public and professional expectations for full disclosure of errors, but many physicians do not think all errors should be disclosed. Gallagher, et al. (12) found that, of the 58% of physicians who had disclosed a serious error, only 35% believed errors should be disclosed when there is no harm ("near miss"), 78% when there is minor harm, and 98% when there is serious harm. Thus, it seems that physicians are less likely to disclose errors resulting in less harm. Furthermore, beliefs about error disclosure are often not matched by physician behavior. Kaldjian, et al. (13), found that

while the overwhelming majority of faculty and residents responded that they would disclose a hypothetical error resulting in minor (97%) or major (93%) harm to a patient, 19% of these physicians acknowledged not disclosing an actual minor error and 4% acknowledged not disclosing an actual major error. In a survey of 254 house officers in internal medicine, Wu, et al. (5), found that only 24% of house officers disclosed their most significant mistake to the patient/patient's family. This figure is similar to an earlier study that reported 76% of housestaff had made a serious error that they had not disclosed to the patient or a family member (14).

Physicians in training also frequently fail to disclose errors to their attending physician. In the study by Wu and colleagues (5), only 54% of house officers discussed their most significant medical mistake with their attending physician. Residents' desire to appear competent may discourage them from requesting help or disclosing an error. If only half of all medical errors that housestaff recall as their most significant mistake are disclosed to attending physicians, there are undoubtedly not only many patients who were never informed that they suffered an error, but also many missed educational opportunities for members of the healthcare team to learn from errors. In a study of house officers, Kroll et al. (6), found a norm of selective disclosure. That is, there was a tendency to discuss errors predominantly in an informal manner with team members or peers. Additionally, they found that individualized blaming occurred, which experts agree is counterproductive for learning. Thus, it appears that many errors remain unreported, and the response to errors can be inappropriate.

Factors affecting to Disclosure

There are several widely shared goals that physicians have for disclosing errors to patients. These goals were identified by Kaldjian, et al. (16), from a systematic literature review of 475 publications. The goals were to improve patient safety (expressed by 49% of first authors), to enhance learning (expressed by 23% of first authors), and to inform patients (expressed by 18% of first authors). The same literature review identified 35 factors believed to facilitate disclosure, including well recognized professional values such as accountability, honesty, trust, empathy, informed consent, and altruism as well as some factors representing physician needs such as malpractice risk reduction and need for forgiveness.

However, there are significant barriers to error disclosure. White, et al. (17) found that 87% (774/889) of physician trainees acknowledged at least one possible barrier to error disclosure, including thinking that the patient would not understand the disclosure (59%), the patient would not want to know about the error (42%), and the patient might sue (33%). Kaldjian, et al. (16), identified other barriers to disclosure, including fear of repercussions, attitudinal barriers such as perfectionism, personal reactions such as guilt, doubts that any good will result, medical cultural barriers such as a culture of silence, practical deficiencies such as an absence of a disclosure forum, the feeling of insufficient support, and uncertainties about the causes of error. Additional strong disincentives to error reporting by physicians include shame, fear of liability, loss of reputation, and peer disapproval (11).

A prominent issue in preventing patients from learning about errors that occur is the hierarchy in the clinical system. In fact, it is such a barrier that it has been referred to as "The Berlin Wall" of patient safety. This hierarchy makes residents apprehensive about reporting their errors to senior physicians. Additionally, house officers may be afraid to challenge or report senior doctors when they witness a more senior physician commit an error (6). A study conducted at the University of Massachusetts, which consisted of interviews with 59 medical trainees, found that trainees were reluctant to report errors to supervisors due to fears that reporting an error would negatively affect how they were evaluated by their superiors (15).

Education and Training

In its 1999 report, "*To Err is Human….*" the Institute of Medicine (IOM) proposed that including formal training in quality improvement and safety practices in medical education would improve the quality of medical treatment, enhance the public's view of medicine, and decrease healthcare costs (1). The 2001 IOM report, *"Crossing the Quality Chasm…,"* recommended that, "Colleges of medicine….should build more instruction into their curriculum on patient safety and its relationship to quality improvement (18). Studies suggest that the optimal time to introduce patient safety and systems-based learning of medical errors is in medical school, before students are exposed to the "name, blame, and shame" of providers for adverse events (19). Despite these suggestions, many medical trainees receive little instruction in patient safety, quality improvement, and systems thinking.

Because many medical students and residents have little understanding and knowledge of patient safety matters, there is a need for training about patient safety and errors in medical education. Kerfoot, et al. (20), assessed knowledge of issues addressed in the patient safety curriculum of the Risk Management Foundation in Cambridge, MA to residents at seven Harvard-affiliated residency programs across specialties, and medical students at Harvard. On average, respondents answered only 58.4% of the questions correctly, indicating that knowledge about patient safety issues is limited among medical trainees across all training levels, degrees, and specialties. Other studies indicate the dearth of knowledge about medical errors among physicians and physician trainees alike. In a study of both faculty and resident physicians, only 54.8% of respondents knew how to report an error and only 39.5% know what kind of errors to report (21). Another study, by Kaldjian et al. (13), found that only 62.3% of faculty and 49.5% of residents knew how to report errors. This suggests the need for more education about medical errors at all levels of training since even among faculty, knowledge about errors may be inaccurate or incomplete.

Even though current training in errors is limited, many clinicians are interested in such training. A study of house officers at both the University of Washington and Washington University in St. Louis found that while 92% (808/881) expressed interest in training in error disclosure, yet only 33% (289/880) residents had received such training (17). In addition, Robinson, et al. (22) showed that 92.9% of physicians believed that more training in how to handle medical errors is needed. With formal training in errors insufficient, healthcare professionals have even begun to seek their own education. For example, the Institute for Healthcare Improvement (IHI) offers online curricula in patient

safety and quality improvement issues, and currently has more than 9,000 participants from many different countries.

Students and Errors

Since medical errors occur frequently, medical students will undoubtedly witness or commit errors during clinical clerkships. Medical students on the hospital wards are in an excellent position to observe errors. They often "shadow" the attending, residents, and interns, so it is likely that they will see many types of medical errors while on different services. Vohra, et.al (23), found that 31% of physician trainees (100 of which were senior medical students) reported seeing at least one adverse event. Another larger study found personal involvement with medical errors among 79% of fourth year medical students (21)**.**

Ideally, when medical errors occur in the hospital, students would see appropriate responses to these errors by more senior clinicians. Observing senior physicians is major way in which medical students and young physicians learn appropriate behaviors. Each error is a potential teaching opportunity for all involved. Physician trainees can not only be taught about the scientific and medical issues surrounding the error, but also learn about the appropriate way to disclose and explain errors to patients.

Martinez and Lo (24) analyzed 147 essays written by medical students about a significant medical error they had witnessed or committed, and found that students who witnessed senior doctors take responsibility for errors and candidly disclose errors to patients appeared to recognize the importance of honesty and integrity, and said they

aspired to that standard. However, they also found that many errors had not been disclosed to patients, and some students who wanted to discuss errors with patients were discouraged from doing so by senior doctors (24). A UK study also reported negative role modeling. The authors found that errors appear to be a significant part of a "hidden curriculum," whereby young doctors learned to be non-accountable, with exposure starting in medical school (6).

Seiden, et al. (25) suggest that training medical students about the prevention and reporting of errors can help ensure patient safety. After analyzing a series of case studies in which medical students helped avert errors, they argue that since medical students have sufficient knowledge to recognize most error types and are responsible for the care of fewer patients, they can give greater attention to the details of clinical care and are a valuable, but untapped, resource for improving patient safety.

However, to be used as such a resource, students must feel like they can speak up on the wards. With house officers not yet comfortable discussing errors or pointing out potential errors to their attending physicians, it seems unlikely that students would feel comfortable discussing errors, especially given that the students are given grades for their performance. Speaking up would necessitate the elimination of all intimidation by medical hierarchy that would impede students' error reporting (25). Newell, et al. (26), analyzed themes from an open-ended questionnaire and found that, "medical students voiced dilemmas as to whether to speak up against a superior regarding unaddressed medical errors." Students could, indeed, be a valuable safety check, but without the feeling that students can speak to a member of the healthcare team about errors, it remains unlikely that students will.

When students do speak up, it may be only to their peers. Research suggests that medical students most often disclose errors they witness to their peers. Of the 76% of students reporting observing an error in a study by Madigosky, et al. (27), 71% of these disclosed the error to their peers, 56% to a resident, 46% to faculty, and 7% using the electronic error reporting system.

Newell, et al. (26) found that, "most students expressed an initial fear of committing primary technical medical errors and subsequently causing harm to patients." Thus, many students also have considerable anxiety about committing errors and being personally responsible for patient harm.

Current Medical School Curricula

Medical students enter medical school with limited knowledge of the healthcare system. One study found that only 27.5% of the medical students surveyed had prior experiences with patient safety or quality improvement, including training, compliance or accreditation requirements, allied health job responsibilities, hospital committee work, and research (27). In a UK medical school, Patey, et al. (28), found that students had "little understanding of patient safety matters" and reported "low" or "average" knowledge of patient safety issues and actions to take if they witnessed an error.

Some medical institutions have created medical curricula that address errors and patient safety issues, but it is unclear if these trial curricula have been adopted as an integral part of the broader medical school curriculum. Additionally, these trial curricula address disparate topics and are adopted at different points in medical school.

Starting in 2000, New York Medical College (NYMC) instituted a required curriculum on patient safety for third year clerks, and published this curriculum. The NYMC curriculum included interactive discussions, readings, a videotape session with a standardized patient, and small group debriefings facilitated by a physician (29). Halbach, et al. (29), found that 89% of students reported that having the opportunity to disclose an error to a standardized patient in an informal setting increased their confidence about disclosing future errors to patients. Additionally, the authors found statistically significant increases in students' self-reported awareness of their strengths and weaknesses in communicating medical errors to patients after they had completed the NYMC curriculum ($p < \text{or} = .01$).

Patey, et al. (28) evaluated a 5- hour module designed to teach final year medical students in the UK about adverse events and error mitigation. All students reported that they thought the module was valuable. One year after the module, students' knowledge and perceived personal control over patient safety had improved. Hill-Sakurai, et al. (30), describe a professional development course at UCSF that included medical errors as the third topic. Mount Sinai School of Medicine incorporated readings and discussions of medical errors into the required third year surgery clerkship (26). The University of Missouri-Columbia adopted a 10.5 hour course at the end of the second year of medical school, which covered patient safety, error reporting, system versus human approach, safety tools, and ethics/disclosure (27). Johns Hopkins developed and implemented a multidisciplinary systems-based 10-hour safety curriculum for first year medical students (31). Mayo medical school has had a multidisciplinary systems-based safety curriculum for years (32).

The content of these courses on medical errors and patient safety, and the point in training that students were offered the opportunity to take these courses, varied across medical schools. Some courses were incorporated into preclinical curricula, while others were implemented during the clinical years. Some involved education about the patient safety while others emphasized simulating patient experiences. Patient safety experts believe that an effective patient safety curriculum requires both an introduction to these issues in the preclinical curriculum and reinforcement during clinical years. In response a letter regarding their article "*To Err is Human 5 Years Later*," Drs. Leape and Berwick assert that: "The first two years of medical school may be the most appropriate time to learn error science (types of errors, why people make mistakes, latent errors, human factors theory, systems analysis) and principles of leadership and teamwork." (33). Leape and Berwick argue that this information should be further addressed in the clinical years, with error curricula possibly including systems analyses of adverse events, interviewing victims of medical errors, and training in guilt management, communicating difficult news, apologizing, and providing support to patients (33).

Several studies suggest that the Drs. Leape and Berwick's recommendations for improving error and patient safety curricula are correct. The University of Missouri-Columbia's study of their 10.5 hour course at the end of second year, found improvements in knowledge, comfort, and attitudes after the module, but did not uniformly see these changes sustained a year later when students had spent a year in the hospital as clinical clerks. Thus, they found that their preclinical curriculum alone could not sustain all improvements. Notably, University of Missouri-Columbia medical students' responses to statements about secrecy around medical errors and to two ASGME core competencies were weaker following their third year clerkships than they

had been prior to starting them (27). This finding highlights the need for positive role modeling in the hospital to sustain preclinical education on errors. For example, if students saw faculty role models systematically identifying errors and appropriately disclosing them to patients, the education in the preclinical curriculum would be reinforced. Likewise, negative role modeling by housestaff and attending physicians may undermine preclinical education about medical errors.

What is Still Unknown

While research has shown that students are exposed to medical errors as third year clerks, no study has delineated the types of errors most frequently encountered by students or the rotations where students encounter errors most frequently. Additionally, while various curricula on errors and quality have been adopted, and many studies have evaluated changes in students' knowledge before and after a curricular intervention, no studies have explored the relationship between education and/or training in errors and actual behaviors of error disclosure among medical students.

While many studies have explored attitudes towards errors and errors disclosure in physician trainees, we were unable to find studies that focused on disclosure patterns of senior doctors as witnessed by students or students' disclosure patterns when faced with an undisclosed or unacknowledged error. While we know that error disclosure is not yet universal, to our knowledge no study has yet explored the impact of failing to disclose an error on emerging physicians. We also do not know if students perceive clinical cultures as promoting transparency and error disclosure, or if students worry that they would suffer negative consequences from disclosing an error.

Aims and Hypotheses

A general goal of this study was to describe more completely the errors that are observed by medical students as well as the training and education they have received. By doing so, the study hopes to assess the association between training and attitudes and behaviors. A second goal was to describe and assess the influence of behaviors by more senior physicians on medical students in response to errors.

Our expectation was that medical students frequently witness medical errors beginning in their clerkships, and that they don't have sufficient education and training in the areas of patient safety, errors, and quality improvement. Thus, since they lack formal education in errors, we hypothesized that students would rely on the informal or "hidden" curriculum on the wards to learn how to respond appropriately to an error. Furthermore, since we hypothesize that many errors are not disclosed to patients or are not openly discussed, there are likely many missed opportunities for students to learn appropriate responses to errors and learn the medicine behind these mistakes.

Specifically, our aims and hypotheses were:

Aims	Hypotheses
To describe medical students' knowledge about medical errors and error reporting	• Students' knowledge is related to training in errors. • Students' knowledge is related to education in errors. • Education is related to students' perceived comfort with errors.

	• Training is related to students' perceived comfort with errors. • Education is related to actual error disclosure behaviors of students. • Training is related to actual error disclosure behavior of students.
To describe attitudes toward medical errors and error reporting	• Error reporting beliefs are related to harm incurred by the patient. • Students feel most comfortable disclosing errors to third parties not directly involved in a particular patient's care. • Students perceive that their grade and/or evaluation would be negatively affected if they disclosed errors. • Students perceive that the team would be upset with them if they disclosed errors.
To describe frequency and types of errors witnessed	• Students witness errors that result in harm to patients as clinical clerks. • Students see many types of errors. • Students witness errors on all of their clerkships.

To describe error disclosure patterns witnessed by students	• Students see errors resulting in patient harm not disclosed. • Errors are not uniformly discussed by teams. • Positive actions after an error occurs is related to what team members are aware of the error.

Methods

Questionnaire Design

A survey instrument was developed using questions from previously validated survey instruments on errors. In addition, new questions were developed using information from a focus group with three Harvard Medical School students and discussions with patient safety experts. The new survey questions were reviewed by experts in survey research from the Yale School of Public Health and the Massachusetts General Institute for Health Policy, and were revised based on their suggestions. The revised questionnaire was pilot tested with three students at Harvard Medical School. A final questionnaire was developed based on the results of this pilot test.

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Definitions

In the Institute of Medicine's 1999 publication, "*To Err Is Human: Building a Safer Health System,"* medical errors are defined as the failure of a planned action to be completed as intended or the use of a wrong plan to achieve an aim (1). For the purpose of this study, we amended that definition to be more direct and specific and defined medical error as "The failure to execute treatment plan correctly or the development of an incorrect plan."

Additionally, we defined harms, education, and training as indicated below:

No Harm	No harm or no evident harm

Minor Harm	Limited clinical consequence, such as an event that necessitates more frequent monitoring or causes temporary discomfort; may lead to prolonged hospitalization but no permanent deterioration of clinical condition.
Major Harm	Significant clinical consequences such as deterioration in clinical status, organ dysfunction, prolonged hospitalization, or disability.
Formal Training	Training that occurred in the classroom, in the clinic, or in the hospital on rounds or in teaching conference.
Formal Education	Teaching that occurred in the classroom, in the clinic, or in the hospital on rounds or in teaching conference.

Questionnaire content

The questionnaire asked about attitudes towards errors and error disclosure, past education and training on errors, and personal experience(s) with errors and disclosure. It included a question on error education, a question on error training, four questions about knowledge about errors and error reporting, nine questions about attitudes towards error disclosure, one question on types of errors witnessed, three questions on frequency of error exposure, four questions on results after an error occurred, and seven questions on error reporting behaviors.

After asking students about the errors that they witnessed on the wards, it asked how senior colleagues responded to that error. Specifically, it asked whether they witnessed positive actions or negative actions after an adverse event. We defined positive and negative actions as below:

Positive actions

- Acknowledgement of error directly to patient and/or family.
- Explanation of consequences of error to patient.
- Explanation of actions after error to rectify or treat patient to patient and/or family.
- Completion of Incident Report, involvement of Risk Management.
- Discussion of error in non-punitive, educational way.

Negative actions

- Acknowledge error among junior team without disclosure to attending or patient.
- Acknowledge error among team including attending without disclosure to patient or family.
- No acknowledgement of error.
- Discussion of error involving blame.

Responses to many of these questions were measured on a Likert scale. The questionnaire also asked respondents about their age, gender, months spent on the hospital wards, and future specialty (if known). Definitions were repeated for questions that distinguished between no harm, minor harm, and major harm. Key terms were

bolded or capitalized throughout. The complete survey instrument can be found in the **Appendix** and at the website below**:**

http://www.surveymonkey.com/s.aspx?sm=4e7fAM0REffseFbBKkoliw_3d_3d

Sample and Study Procedures

Students who had completed their third year of medical school at the Yale University School of Medicine were recruited to participate in the survey by email, student mail, and personal solicitation. Those students included students who are dual degree candidates might be in their fifth, sixth, or greater year of training at Yale. The sample included 206 students, excluding the author. Students could complete the survey either online, using a link that was sent to participants by email, or by completing a paper survey that was delivered to the campus mailbox of eligible subjects. The surveys were anonymous and confidential to encourage honest participation. The survey was available for completion from October 25 through November 25, 2008. Three reminder emails were sent via email to encourage participation. To create an incentive to complete the survey, we offered to enter those who completed the survey into a drawing for $500. Respondents indicated survey completion through a post card or email. The study was deemed exempt by the Yale Human Investigations Committee (Exemption No. 0809004220) because it was a questionnaire study that did not collect individual identifiers.

Statistical analysis

We entered data into a MS-Excel spreadsheet and then translated the data into an SPSS dataset (version 16.0) for analysis. We present the distribution of responses in tables and bar charts. The data was either dichotomous or obtained in Likert scaled responses. For some analyses, we dichotomized Likert responses at the scale midpoint (agree vs. disagree). We calculated chi-square tests, Mann-Whitney *U* tests, and nonparametric correlations to assess associations. For correlations, we used Spearman's Rho for variables with a 4-point Likert response scale and Kendall's tau-b for dichotomous variables. We did not adjust nominal significance levels for the number of tests conducted.

Results

Response Rate

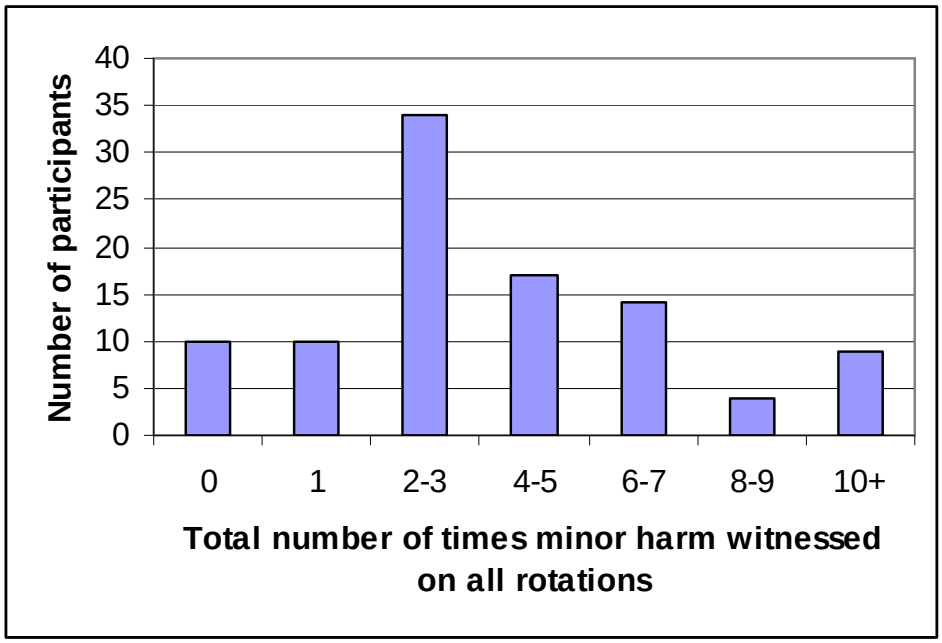
A total of 99 useable surveys were received for a response rate of 48%. Sixty-eight responders were from the Yale School of Medicine original class of 2009 (true fourth years), which had 100 students on entry into the Yale University School of Medicine. Thirty-one responders were from the original class of 2008 and/or dual degree candidates. Since surveys were collected anonymously, and we did not ask responders about their original class of graduation, we were unable to evaluate the surveys from true fourth years separately from those of all responders. This was unfortunate, given that it would have yielded a 68% response rate within one class year. Thirty-two non-responders were from the original class of 2009, and the majority of non-responders (70%) were from other entering classes. Thus, 70% of non-respondents were at least one year removed from their third year clerkship experiences because of involvement with research and/or another degree course.

Number of Errors Witnessed

As expected, students witness many errors on their clinical clerkships. Ninety-one students (91.9%) witnessed at least on error during their clerkships resulting in harm (major or minor) to the patient. The vast majority of respondents (88.9%) witnessed at least one error resulting in minor harm during their core clinical clerkship year (Figure 1). Over one quarter of students (27.27%) witnessed six or more errors resulting in minor

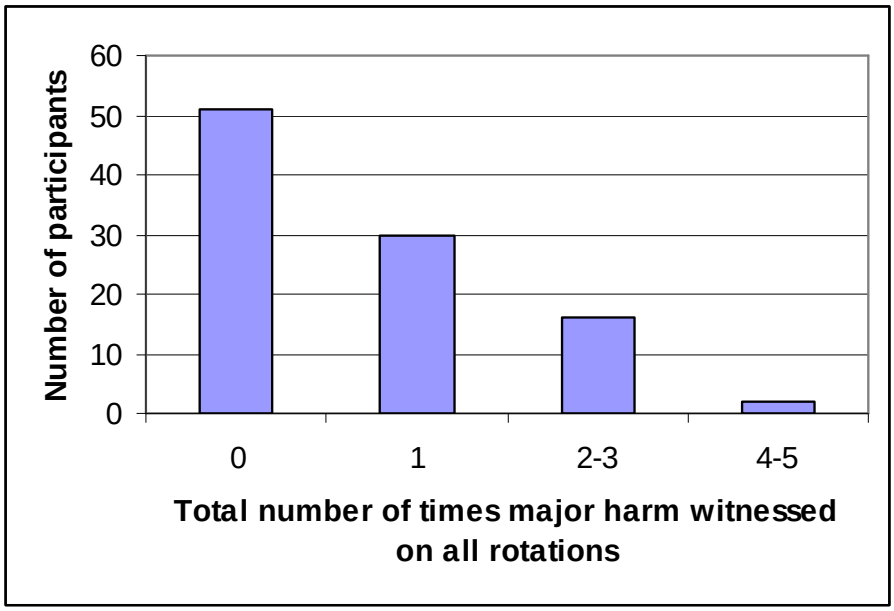
harm and 9/99 (9.1%) reported witnessing 10 or more errors resulting in minor harm. Students reported, on average, witnessing 3.93 (SD 2.90) errors that resulted in minor harm. The median and mode number of witnessed errors resulting in minor harm were 2-3 errors resulting in minor harm witnessed.

Figure 1: Number of errors resulting in minor harm that students witnessed (n=99, mean = 3.93, SD=2.9)



Almost half of all respondents (48.5%) witnessed at least one error resulting in major harm to a patient and 18 students witnessed two or more errors resulting in major harm to a patient (Figure 2). The range of witnessed errors resulting in major harm was from 0 to 4.5. Two students reported seeing 4-5 errors resulting in major harm. The mean number of errors resulting in major harm witnessed was 0.80 with a standard deviation of 1.05.

Figure 2: Number of errors resulting in major harm students witnessed (n=99 Mean=0.8, SD=1.05)



Types of Errors Witnessed

Medical students witnessed many types of errors (Table 1). Types of errors witnessed (with the percent of all students who reported witnessing a certain error in parentheses) included errors due to: failed medication reconciliation (73.5%), incorrect diagnoses (67.7%), missed diagnoses (66.7%), poor or incomplete handoff/signoff (65.65%), medication dosage errors (55.55%), and surgery error of entering an unintended structure (55.55%). Table 1 presents the types of errors that students witnessed during their third year clerkships.

Table 1: Students reporting witnessing different error types, total n=99.

Types of errors witnessed during clerkships	Number (%) of students who witnessed this type of error
Failure to give a regular medication that was prescribed prior to admission to an inpatient unit	72 (72.7)
An incorrect diagnosis	67 (67.7)
A missed diagnosis	66 (66.7)
Failure to pass along critical patient information from one team member to another (e.g. poor or incomplete signoff, handoff)	65 (65.7)
Medication being erroneously dosed (e.g. too much, too little)	55 (55.6)
A surgeon entered a structure not intended (e.g. perforating bowel in abdominal surgery, penetrating the diaphragm in thoracic surgery, cutting the bladder or ureter in pelvic surgery, etc.)	55 (55.6)
Fluids given were too much, too little, or wrong type	54 (54.5)
A major or important blood vessel was unintentionally entered or cut during surgery	41 (41.4)
Medication given without monitoring for side effects	37 (37.4)
A foreign body was unintentionally left in a patient following surgery	18(18.2)
Wrong medication given for condition	14 (14.1)
Medication given that a patient has a documented allergy to	13 (13.1)
A patient had burns from improperly applied surgical electrocautery pad	8 (8)
A major or important nerve was unintentionally severed during an operation	7(7.1)
The wrong side of the patient was operated on	2 (2)
Mismatched blood product transfusion	0 (0)
The wrong operation was performed on a patient	0 (0)

Rotations where Students Witnessed Errors

To see if there were particular rotations where students witnessed the most errors, we asked students about their last rotation and how often they witnessed errors on that last rotation. Rotations at the Yale University School of Medicine are assigned based on student preferences, with half of the third year a "medicine" block (Medicine, Pediatrics, and Neurology) and the other half of third year a "surgery" block (Surgery, OB-GYN, Psychiatry).

The rotations where the most students reported witnessing errors resulting in harm were Medicine, OB-GYN, and Surgery (Figure 3). Rotations where students witnessed errors resulting in minor harm "sometimes" or "often" were Medicine (23.8% of students), Surgery (23.5% of students), and OB-GYN (20.0% of students)(Table 2, Figure 3).

Table 2: Frequency of witnessed minor harm on students' most recent rotation

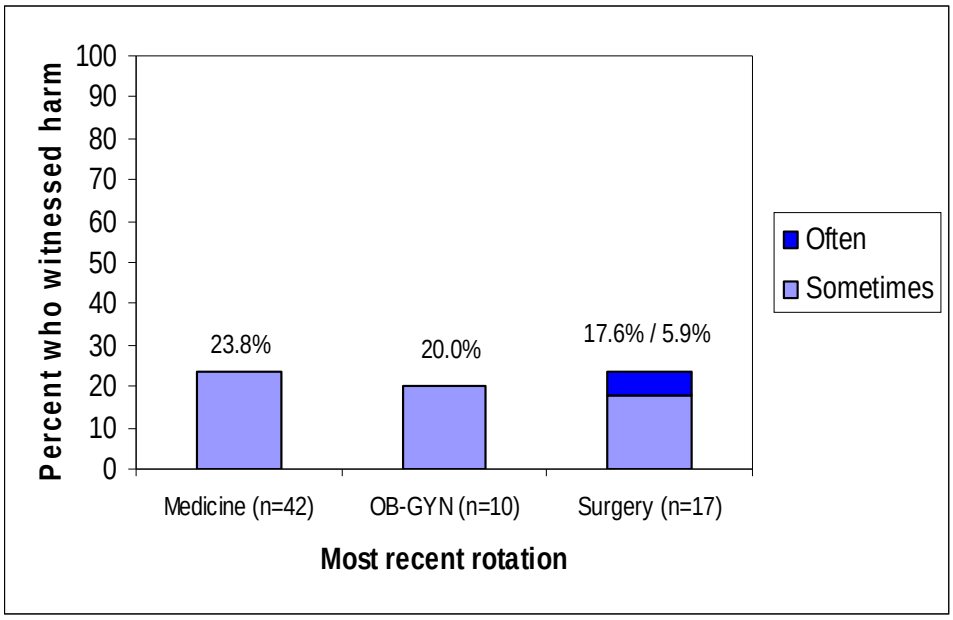
Last Rotation	Never No. (%)	Rarely No. (%)	Sometimes No. (%)	Often No. (%)	Sometimes+ Often No. (%)
Medicine, n=42	11(26.2)	21 (50)	10 (23.8)	0	10 (23.8)
Surgery, n=17	5 (29.4)	8 (47)	3 (17.65)	1 (5.8)	4 (23.5)
OB-GYN, n=10	3 (30)	5(50)	2 (20)	0 (0)	2(20)
Neurology, n=6	2 (33.3)	4(66.6)	0 (0)	0 (0)	0 (0)
Pediatrics, n=12	5 (41.7)	7(58.3)	0 (0)	0 (0)	0 (0)
Psychiatry, n=4	3(75)	1 (25)	0 (0)	0 (0)	0(0)

The rotations where the most students reported witnessing errors resulting in major harm “sometimes” were OB-GYN (10%), Surgery (10%), and Medicine (2.4%) (Table 3, Figure 3). No student reported witnessing error that resulted in major harm “often.” All remaining students reported that, on their last rotation, errors resulting in major harm occurred “never” or “rarely,” and no student reported that errors resulting in major harm occurred “often.”

Table 3: Frequency of witnessed major harm on students’ most recent rotation

Last Rotation	Never No. (%)	Rarely No. (%)	Sometimes No. (%)
Medicine, n=42	30 (71.4)	11 (26.2)	1 (2.4)
Neurology, n=6	5 (83.3)	1 (16.6)	0 (0)
OB-GYN, n=10	8 (80)	1 (10)	1 (10)
Pediatrics, n=12	11 (91.7)	1 (8.3)	0 (0)
Psychiatry, n=4	4 (100)	0(0)	0(0)
Surgery, n=17	13 (76.5)	2 (11.8)	2 (11.8)

Figure 3: Percent of students witnessing errors resulting in harm sometimes or often



Thus, our data indicates that Yale medical students most commonly encountered both major and minor errors in their Medicine, Surgery, and OB-GYN rotations. This finding should be taken into account when considering the appropriate time in clinical education to include errors education and in appropriately targeting residents and faculty to be positive role models for students in these rotations.

Attitudes towards medical errors

Most students (58.6%) said that all errors should be reported and more than two thirds (67.4%) agreed that disclosing an error would strengthen a patient's trust in them (Table 4). The vast majority (91.9%) said that they would inform the attending physician if they observed an error affecting their patient and that disclosure is the right thing to do (95.9%). Only 35.35% of students said that they would document an error in the patient's record and tell the patient/patient's family.

Table 4: Attitudes towards error

Statement	Agree %	Mean Response [1] (standard deviation)
All errors should be reported.	58.6	2.6 (0.83)
If I personally observed an error affecting one of my patients, I would inform the attending physician.	91.9	3.5 (0.66)
Disclosure of a medical error to a patient/patient's family would strengthen their trust in me.	67.4	2.7 (0.76)
Disclosure of a medical error to a patient/patient's family is the right thing to do.	95.9	3.4 (0.61)
If I personally observed a medical error, I would document it in the patient's record.	35.4	2.2 (0.83)
I personally observed an error affecting one of my patients, I would tell the patient and/or patient's family.	35.4	2.3 (0.83)

[1] Likert scale: 1 strongly disagree, 2 disagree somewhat, 3 agree somewhat, 4 strongly agree

There were seven significant correlations between attitudes towards errors held by students (Table 5). All other correlations among variables were not significant.

Table 5: Significant Correlations for Attitudes towards errors, n=98

Statements	Spearman's rho	Significance
All errors should be reported / I would document it in the patient's record	0.21	p=.04
All errors should be reported / Disclosure of a medical error to a patient/patient's family is the right thing to do	0.25	p=.02
I would document it in the patient's record / I would inform the attending physician	0.24	p=.02
All errors should be reported / I would tell the patient and/or patient's family	0.21	p=.04
I would document it in the patient's record/ I would tell the patient and/or patient's family	0.61	p<.001
I would tell the patient and/or patient's family/ I would inform the attending physician.	0.25	p=.01
Disclosure of a medical error to a patient/patient's family is the right thing to do/ Disclosure of a medical error to a patient/patient's family would strengthen their trust in me	0.28	p=.005

Education and Training

Many students did not feel confident in their knowledge about errors and error reporting. Indeed, 17/99 (17.2%) of students did not feel confident that they know what constitutes a medical error, 69/99 (69.7%) of students did not feel confident that they know how to report an error, 75/99 (75.8%) of students did not feel confident they know which errors to report, and 78/99 (78.8%) of students were not confident they know to whom they should report an error in different circumstances (Table 6).

Table 6: Reported knowledge about medical errors

Statement	Disagree %	Mean response[1] (standard deviation)
I feel confident that I know what constitutes a medical error	17.2	3.0 (0.61)
I feel confident that I know how to report an error.	69.7	2.1 (0.79)
I feel confident that I know which errors to report.	75.8	2.0 (0.74)
I feel confident that I know who I should report errors to in different circumstances.	78.8	1.9 (0.78)

[1]Likert scale: 1 strongly disagree, 2 disagree somewhat, 3 agree somewhat, 4 strongly agree.

The majority of students (83.84%) reported receiving no training on how to respond to errors they observe while 58.6% reported receiving no formal education on medical errors. Prior training in medical errors was significantly associated with students' comfort with errors. Specifically, among those who reported not having received formal training in how to respond to errors, 25.6% felt confident that they knew how to report an error whereas 56.3% of those who had received formal training felt confident that they knew how to report an error (p=.006). Only 19.5% of students who had no formal training felt confident that they knew which errors to report, while 50% of those with training felt confident that they knew which errors to report (p=.02). Prior formal training in medical errors increased students' confidence in knowing who to report errors to in different circumstances from 18.5% to 37.5% (p=.02).

There also was a strong association between prior training in medical errors and student confidence in identifying, and knowing how to respond to, actual observed errors. None of the 16 students who reported having formal training said that they did not report an error because they were unsure about whether or not something was an error. However, among the 82 students who did not have formal training, 9% did not report an error because they were unsure whether something was an error. Of those who had formal training, none failed to report an error because they were unsure of

whom to tell, while 22% of students without training who witnessed an undisclosed error did not report the error because they were unsure who to tell. Thus, training appears to have helped students in this study to identify both actual errors while on the hospital wards, and whom they should speak to about an error. However, formal education about medical errors was not significantly associated with students' actual behaviors when faced with an undisclosed error.

Error Disclosure

When asked about hypothetical error disclosure, 34.3% of the students reported that they would disclose an error that resulted in no harm to a patient, 74.7% of students reported that they would be likely or very likely to disclose an error that resulted in minor harm to a patient, and 83.8% of students reported that they would disclose an error that resulted in major harm to a patient (Table 7).

Table 7: Students' reported likelihood of disclosing errors, total n=99

Type of error	**Likely + Very Likely No. (%)**
No harm	34 (34.3)
Minor harm	74 (74.7)
Major harm	83 (83.8)

Students were asked about errors they witnessed that might have gone unacknowledged or undisclosed. If an error was witnessed by a student and remained undisclosed or unacknowledged, 49/68 (72%) students told someone about the error. However, when asked who they told about the error, the greatest proportion of students disclosed the error to people not directly involved in the patient's care. Specifically,

71.4% told a peer, 18.4% told the clerkship director, and 2% of students each told a faculty mentor, the Dean of Student Affairs, or a family member. Among those involved in patient care, students talked to the resident (55.1%), followed by the intern (32.5%) and the attending (18.4%). Interestingly, although only 18.4% of students who witnessed an undisclosed error told the attending about the error, 91.9% of all respondents reported that, hypothetically, they would tell the attending physician about an error that they witnessed which affected one of their patients.

Over a quarter of students (27.94%) who witnessed an error that remained undisclosed or unacknowledged did not tell anyone about the error. The most common reasons given by these students for not disclosing the error included: unsure of whether or not it was an error (64.3%), fear that team will be upset with you (42.9%), unsure of who to tell (42.9%), they did not think the information would help the patient (39.3%), fear of bad evaluation or grade (28.6%), and fear of negative patient/family reaction (21.4%). Only 10.7% of students who did not report an undisclosed error they witnessed did not report it because of fear of legal consequences and only 1 respondent did not disclose the error because he/she was discouraged by senior doctors. Other reasons for not disclosing a witnessed and undisclosed error included the patient not being the medical students' patient, the medical student being on the consulting (and not primary) team taking care of the patient, and the feeling that it was not the student's place to tell since they are not yet a doctor.

Over one quarter (27.6%) of the students thought that it would be likely or very likely that their grade and evaluation would have been negatively affected if the student reported an undisclosed error to the patient/patient's family on their last rotation, and 61% thought that it would be likely or very likely that their residents and/or attending

would have been upset with them if they reported an undisclosed error to the patient/patient's family on their last rotation.

We assessed the actions of senior colleagues that were observed by students after an error occurred by asking whether positive actions or negative actions occurred after an adverse event. Again, we defined positive and negative actions as below:

Positive actions

- Acknowledgement of error directly to patient and/or family
- Explanation of consequences of error to patient
- Explanation of actions after error to rectify or treat patient to patient and/or family
- Completion of Incident Report, involvement of Risk Management
- Discussion of error in non-punitive, educational way

Negative actions

- Acknowledge error among junior team without disclosure to attending or patient
- Acknowledge error among team including attending without disclosure to patient or family
- No acknowledgement of error
- Discussion of error involving blame

Among 84 students who reported witnessing minor errors, they said that the attending physician was informed of 61 of these errors (73%). The involvement of the attending

physician after a minor error significantly predicted positive actions ($p=.003$). Similarly, for errors resulting in major harm, attending physician involvement predicted positive actions ($p<.001$). Thus, when a negative action occurred following major harm, the attending physician was not significantly more or less likely to have been involved. When a positive action occurred following major harm, the attending physician was significantly more likely to have been involved in the situation.

Discussion

Context and Implications

We know that students will witness errors resulting in patient harm during their clerkships. In fact, all but eight students in our study were exposed to error resulting in patient harm, and often students will witness many errors resulting in minor harm (27.27% witnessed six or more errors, 9.1% witnessed 10 or more). This study reports data similar to that of a previous study, which found that 79% of fourth year medical students had been exposed to an error during medical school (17).

The types of errors commonly witnessed by students can inform us of common areas where we can make systems-based improvements to improve patient safety. Our study found frequent student exposure to errors due to medication reconciliation, signoff/handoffs, medication dosing, and surgical errors. This suggests that we should devote more resources towards reducing systems errors. Evidence has motivated many institutions to shift M&M conferences in focus to go beyond traditional case-based medical knowledge and patient care to include reflection on systems failures (34). Previous studies have also shown that these are areas requiring attention, and reform and safety experts suggest that perhaps a majority of errors lie at interface such as at handoffs (35). Researchers are currently working on improving sign-outs and minimizing the number of handoffs that take place. At the Yale University School of Medicine, Horwitz, et al (36), developed a sign- out skill curriculum, which included discussion, modeling, and practice, for Internal Medicine housestaff. Medication errors, which are the most common and most frequent cause of adverse events, are being addressed

through systems improvements including increased pharmacist checks and using computers for prescription-writing tools, order entry, alerts and checks (37). Additionally, adding or altering training could help minimize medication systems errors. For example, Northwestern University's Feinberg School of Medicine utilized simulation to teach second year medical students about medication reconciliation (38). Many researchers are working to create systems to decrease surgical error. Systems now in place to decrease wrong site, wrong procedure, and wrong patient procedures include the preoperative verification process, marking the surgical site (such as with surgeon's initials or a "yes"), and the "time-out," which is an independent check to potentially identify and correct errors (39). Additional process improvements continue to be studied, such as the recent publication of a surgical safety checklist decreasing morbidity and mortality (40).

Our data showing that medical students most commonly encountered errors resulting in patient harm in their Medicine, Surgery, and OB-GYN rotations can be used when considering the appropriate time in medical education to include errors education and/or training. Additionally, knowing that students most commonly encountered errors in Medicine, Surgery, and OB-GYN can help clinical educators to seek out residents and faculty in these specialties to be active, positive role models.

Attitudes towards disclosure in this study were dissimilar in some areas to that reported previously. Only 35.4% of students agreed that they would document an error in the patient's record if they were personally involved. In a prior study (23), 96% of respondents would document an error in the patient's record. Also, only 35.4% of students would tell the patient and/or patient's family if they personally observed an error affecting one of their patients. A prior study (23) found 87% of physician trainees would

tell the patient. Observed differences could be due to the fact that all of our survey participants were students while students only comprised 37 of the 114 respondents (32%) in the study by Vohra, et al. (23). A few comments written in by students indicated that they did not feel like it was their place to tell the patient/patient's family or document errors since they were not the M.D. in charge.

Almost 92% of students would inform the attending physician if they personally observed an error affecting one of their patients, similar to the 96% of respondent who would inform the attending physician in a prior study (23). Students that would tell the patient about an error were significantly likely to tell the attending physician (Rho =.25, p=.01). This is important given our finding that attending involvement predicted positive actions occurring after an error. Thus, encouraging error disclosure to patients could have the additional benefit of attending awareness of error and positive educational opportunities.

Our study also found that students believe that response to error should depend on severity of outcome. Our students would report errors resulting in no harm, minor harm, and major harm 34%, 57%, and 84% of the time, respectively. Gallagher, et al. (12), reported respondents would report errors resulting in no harm, minor harm, and major harm 35%, 78%, and 98% of the time, respectively, while Kaldjian, et al. (21), reported respondents would report errors resulting in minor harm and major harm 73% and 92% of the time, respectively.

Students' self-reported knowledge about error reporting was better than reported in other studies. Almost 70% of students said that they knew how to report an error and 76% of students said they knew which kind of error to report. This level of reported knowledge is much higher than was found in a prior study of faculty and resident

physicians, in which only 49.5% of residents (62.3% of faculty) respondents said that they knew how to report an error and 30% (53.6% of faculty) knew what kind of errors to report (21). Another study (23) found that 19% of all respondents, who were physician trainees, did not know how to report an error using the hospital's reporting system. Yet, despite the large proportion of students who felt comfortable with errors and error reporting, when an actual error occurred, 64.3% of the students who did not tell anyone about an error said the reason for not reporting it was that they were unsure of whether or not it was an error, and 42.9% did not tell anyone because they were unsure of who to tell. Thus, though it would seem that the problem does not lie with students understanding errors and how to report them, education is still needed in this area since confusion still exists.

There is an emerging consensus that errors and patient safety are important topics to cover explicitly during medical education. Only 83.84% of students reported receiving no training and 58.6% reported receiving no formal education on how to respond to errors they observe. Given that most students reported no training and education, and that all respondents were from a single institution, those with training and/or education likely received it in smaller group settings in the clinical years. At the Yale University School of Medicine, there is no organized preclinical curriculum in medical errors or patient safety. Yale does, however, have a 3-hour session on errors for students at the end of fourth year, during a 3-week mandatory course called *Integrative Clinical Medicine*. Had this survey been given to the same group six months later, 100% of students would have reported education in medical errors. However, it is unclear whether 3 hours provides sufficient time to cover the relevant topics, or if

students should receive formal education in medical errors and patient safety prior to the end of the fourth year, especially given their prior exposure to errors.

Whatever the content of the training students had, it was significantly associated with students' self-reported confidence in understanding and reporting errors. Indeed, training was found to increase students' comfort with error identification and reporting and also was significant to students' actual response after error that they witnessed.

When there is no structured training in medical errors, students will learn about how to interpret and respond to errors as part of their informal education on the hospital wards. Providing medical students with opportunities to observe and ask about the actions and behaviors of interns, residents, and attending physicians is a major part of medical education. The role modeling that takes place on the wards can have a profound influence on students' future attitudes and behaviors. Many errors that students witnessed were not discussed, particularly those errors which were not disclosed to the attending. When providers do not discuss errors, they set a poor example for medical students. Much has been written about the need for medical schools to train and recruit faculty members who can serve as positive role models and there is a recognized need to create time for students to discuss negative behaviors that they observe on the wards.

The disclosure patterns found in this study are similar to those reported by Madigosky and colleagues (27). In that study, an undisclosed error was discussed most frequently with a peer (71.4%), followed by a resident (56%), and less frequently with a faculty member (46%). While our study also indicates that most students discuss errors with their peers (71.4%), our study showed a much smaller proportion of students who discussed undisclosed errors with a faculty member (18%) than in the Madigosky study.

Whether or not students are provided formal education in error reporting and patient safety, the hierarchy of medical authority, and the power differential between students and supervising physicians, makes it difficult for students to speak up about errors. Many students (42.9%) did not disclose an undisclosed error because of a fear that team members would be upset with them. This finding implies that disclosure was not a goal of the team. Over a quarter of students (28.6%) did not disclose an undisclosed error because of a fear of receiving a bad evaluation or grade. Students are being evaluated by members of the healthcare team, and unless there is a norm of error discussion and transparency, students will not feel comfortable openly discussing errors. This finding is in line with previous studies that cited residents not admitting their errors to the attending because they feared that reporting their mistake to an attending might lead to a poor evaluation (11,16).

When we studied the events that transpired after an error occurred, we found that, for both minor and major errors, making the attending aware of the error predicted positive actions. Thus, attending involvement predicted positive role modeling in error handling. The implication of this finding is that, if we can create an environment where errors are openly discussed in a non-judgmental way between house officers and attending physicians, more errors will be responded to in an appropriate fashion, and students will experience more positive role modeling. Prior studies have shown that the positive actions we described after an error occurs do not happen uniformly. Gallagher, et al. (41), concluded, through study of focus groups, that even when physicians disclosed an adverse event, they avoided stating that an error occurred, why the error happened, or how recurrences would be prevented.

This study provides us with more evidence of the importance of physicians disclosing errors and creating a culture of transparency. The culture of medicine must change so that physician trainees at all levels can disclose and discuss errors. Medicine must overcome, "the combination of complexity, professional fragmentation, and a tradition of individualism, enhanced by a well-entrenched hierarchical authority structure and diffuse accountability" that creates a barrier to creating a safe culture (42). To date, few hospitals have prioritized creating a transparent medical system (43).

Lastly, we should continue to provide or begin education in errors and quality early in medical education and continue this education throughout post-graduate medical education. We must increase students' awareness of medical errors and error reporting. Without formal curricula devoted to quality improvement and patient safety, students will learn primarily from their ward experiences. This has motivated some students to seek out alternative avenues for educating themselves, such as the Institute for Healthcare Improvement's open school.

We should try to change the ward culture into one where students and housestaff do not fear negative reaction and punishment if they make a mistake. Additionally, students should be included in the Quality Improvement effort at large. As Seiden, et al., (25), initially suggested, students could be an asset to the patient safety movement and in our study, over a quarter of our students witnessed an error resulting in patient harm that was not disclosed or acknowledged at all.

Educating the next generation of doctors is not the sole answer. Most experts agree we have to first change attending and residents. Without comprehensive changes, the education of students in patient safety and errors will be easily extinguished because the system does not currently have the right role models and

judgers (44). Working towards these changes will help to bring about a unified front of transparency and error disclosure and a medical school and hospital system committed to patient safety and quality improvement.

Limitations of study

Our data came from a single institution, so they may not generalize to other settings. Some of the questions asked were comparable to questions asked by other studies and one question was from the AAMC Graduation questionnaire (45) so that we could compare results to a larger national sample.

We asked one question exactly as it was asked in the AAMC questionnaire that was given to students graduating from medical school in 2008, and our results indicate that the culture at Yale is similar to the culture at other medical schools (Table 8). The AAMC questionnaire does not currently include any question on errors, so we chose to replicate a question that shows what the culture of the wards is like for medical students. The culture at Yale Medical School is perhaps more supportive and humane than other medical schools because the percentage of medical students at Yale were who reported being publically belittled or humiliated at least once (55%) was significantly lower than the all-institution average from a 2008 AAMC survey (85%)($p = .011$).

Table 8: Students who have been publically belittled or humiliated

As a student on the wards, I have been publicly belittled or humiliated.	**Never**	**Once**	**Occasionally**	**Frequently**
Our study (n=99)	45.0%	22.0%	31.0%	2.0%
AAMC Graduation questionnaire 2008 (all medical schools, n=2,230)	15.5%	28.9%	50.7%	4.8%

All data was self-reported. Additionally, this study is subject to non-response bias since our response rate was just under 50%. Unfortunately, this study was conducted during a busy time of fourth year of medical school and students were on away rotations, working or studying abroad, studying for board exams, and applying for residency. Additionally, since our survey did not ask the entering year in the Yale University School of Medicine, we could not identify surveys submitted by true fourth years, which would have given us a response rate of 68%. Responses may have been affected by recall bias and social desirability bias, although we tried to limit the effect of social desirability by making the survey anonymous.

Questions for Future Study

This study has identified several important questions for future research. First, what is the best way to teach about errors and patient safety? When should this education begin, and how should it be reinforced? What aspects of medical student education or training in errors are most at odds with how residents and attending physicians currently respond to errors? Should students be encouraged to be present for error disclosure discussions? How can a culture be adopted to encourage disclosure? Additionally, how should medical students be included in the patient safety effort? Should medical students be allowed to report errors through anonymous reporting systems? Is this method of reporting really anonymous, or will students still fear their team will know and be upset with them or their attending will know and give them a poor evaluation or grade? We still do not know what kind of distress witnessing or committing errors causes. What is the extent of emotional or moral conflict physician

trainees experience after witnessing an error going unaddressed on the wards, or after committing an error? Does the desire to always tell patients the truth and disclose errors extinguish over time, and does this vary among specialties?

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Appendix

1.

Thank you for completing this survey as part of a study I am conducting on medical students' awareness of medical errors and how they are responded to. The responses you provide will be anonymous. Participation is voluntary.

Please respond as honestly and accurately as possible. Please only respond about errors which you have had personal experience with. Do not respond about errors you have heard about from others.

Completion of this survey entitles you to be entered in a drawing for $500. Since completion of the survey is anonymous, to be entered in the drawing, you must inform Kimberly Gold that you have completed the survey by returning the enclosed postcard, or by email (kimberly.gold@yale.edu) or phone call/text message (617-834-7862).

The survey will be active October 14-November 14. There will be a survey party either Thursday, November 13 or Friday, November 14. The drawing for $500 will take place at that time.

If you have questions, please call me anytime at 617-834-7862.

HIC exemption #0809004220

DEFINITIONS:

Medical error- A failure to execute treatment plan correctly or the development of an incorrect plan.

No harm- No evident harm

Minor Harm- Limited clinical consequence, such as an event that necessitates more frequent monitoring or causes temporary discomfort; may lead to prolonged hospitalization but no permanent deterioration of clinical condition

Major Harm- Significant clinical consequences such as deterioration in clinical status, organ dysfunction, prolonged hospitalization, or disability

1. Have you received any formal training on how to respond to errors you observe?

- [ ] Yes
- [ ] No

2. Have you received any formal education on medical errors?

- ◯ Yes
- ◯ No

3. Please indicate the extent to which you agree or disagree with each of the following statements.

	Strongly Disagree	Disagree Somewhat	Agree Somewhat	Strongly Agree
I feel confident that I know what constitutes a medical error.	☐	☐	☐	☐
I feel confident that I know how to report an error.	☐	☐	☐	☐
I feel confident that I know which errors to report.	☐	☐	☐	☐
I feel confident that I know who I should report errors to in different circumstances.	☐	☐	☐	☐
All errors should be reported.	☐	☐	☐	☐
If I personally observed a medical error, I would document it in the patient's record.	☐	☐	☐	☐
If I personally observed an error affecting one of my patients, I would tell the patient and/or patient's family.	☐	☐	☐	☐
If I personally observed an error affecting one of my patients, I would inform the attending physician.	☐	☐	☐	☐
Disclosure of a medical error to a patient/patient's family would strengthen their trust in me.	☐	☐	☐	☐
Disclosure of a medical error to a patient/patient's family is the right thing to do.	☐	☐	☐	☐

4. How much do you know about Yale-New Haven Hospital's...

	A lot	A little	Nothing
Anonymous reporting system for medical errors?	☐	☐	☐
Counseling services for clinical staff for those involved with a medical error?	☐	☐	☐

5. Please indicate below whether or not you have witnessed the following types of errors during your third year clinical clerkships.

I have witnessed an error that resulted from…

	Yes	No
Medication being erroneously dosed (e.g. too much ,too little)	◯	◯
Medication given that a patient has a documented allergy to	◯	◯
Medication given without monitoring for side effects	◯	◯
Wrong medication given for condition	◯	◯
A missed diagnosis	◯	◯
An incorrect diagnosis	◯	◯
Failure to pass along critical patient information from one team member to another (e.g. poor or incomplete signoff, handoff)	◯	◯
Fluids given were too much, too little, or wrong type	◯	◯
Mismatched blood product transfusion	◯	◯
Failure to give a regular medication that was prescribed prior to admission to an inpatient unit	◯	◯
A surgeon entered a structure not intended (e.g. perforating bowel in abdominal surgery, penetrating the diaphragm in thoracic surgery, cutting the bladder or ureter in pelvic surgery, etc.)	◯	◯
A major or important blood vessel was unintentionally entered or cut during surgery	◯	◯
A major or important nerve was unintentionally severed during an operation	◯	◯
The wrong operation was performed on a patient	◯	◯
The wrong side of the patient was operated on	◯	◯
A foreign body was unintentionally left in a patient following surgery	◯	◯
A patient had burns from improperly applied surgical electrocautery pad	◯	◯

6. Where was your most recently completed inpatient clinical rotation?

- ◯ Yale-New Haven
- ◯ West Haven VA
- ◯ Waterbury Hospital
- ◯ Bridgeport Hospital
- ◯ Hospital of St. Raphael's
- ◯ Other (please specify)in comment field below

Other (please specify)

7. What was your most recently completed inpatient clinical rotation?

- ◯ Surgery
- ◯ OB-GYN
- ◯ Medicine
- ◯ Pediatrics
- ◯ Neurology
- ◯ Psychiatry
- ◯ Other (please specify in comment field below)

Other (please specify)

8. DEFINITIONS:

No harm- No evident harm

Minor Harm- Limited clinical consequence, such as an event that necessitates more frequent monitoring or causes temporary discomfort; may lead to prolonged hospitalization but no permanent deterioration of clinical condition

Major Harm- Significant clinical consequences such as deterioration in clinical status, organ dysfunction, prolonged hospitalization, or disability

In your most recently completed inpatient rotation, how often did you encounter medical errors that resulted in ...

	Never	Rarely	Sometimes	often
No harm to the patient	◯	◯	◯	◯
Minor harm to the patient	◯	◯	◯	◯
Major harm to the patient	◯	◯	◯	◯

9. Thinking about ALL of your clinical experiences as a third year clerk, how many errors resulting in MINOR harm have you/did you witness?

- ◯ 0
- ◯ 1
- ◯ 2-3
- ◯ 4-5
- ◯ 6-7
- ◯ 8-9
- ◯ 10+

10. Thinking about ALL of your clinical experiences as a third year clerk, how many errors resulting in MAJOR harm have you/did you witness?

- ◯ 0
- ◯ 1
- ◯ 2-3
- ◯ 4-5
- ◯ 6-7
- ◯ 8-9
- ◯ 10+

11. If you were NOT exposed to any errors resulting in MINOR harm while a clinical clerk, skip to #13.

During your experience as a 3rd year clinical clerk, after you became aware of an error resulting in MINOR harm, please estimate how often the following actions occurred.

	Never	Rarely	Sometimes	Often
Acknowledgement of error directly to patient and/or patient's family.	○	○	○	○
Explanation of the consequences of the error to patient and/or patient's family.	○	○	○	○
Explanation of actions being taken after error to rectify error and/or treat patient to patient and/or patient's family.	○	○	○	○
Acknowledgement of error among junior team members without disclosure to attending or patient and patient's family.	○	○	○	○
Acknowledgement of error among team including the attending without disclosure to patient and patient's family.	○	○	○	○
No acknowledgement of error.	○	○	○	○
Completion of an Incident Report and involvement of Risk Management Department.	○	○	○	○
Discussion of error among team or service in a non-punitive, educational way.	○	○	○	○
Discussion of error among team or service in a way that directly or indirectly blames a member of the team.	○	○	○	○

12. Thinking about ALL of your experiences as a third year clinical clerk, when an error resulting in MINOR harm occured and the patient and/or patient's family was informed an error occured, how often was it the following team members that disclosed the error?

	Never	Rarely	Sometimes	Often
Attending physician	◯	◯	◯	◯
Senior resident physician	◯	◯	◯	◯
Junior resident physician	◯	◯	◯	◯
Intern	◯	◯	◯	◯
Medical student	◯	◯	◯	◯
Nursing staff	◯	◯	◯	◯
Other (please specify)	◯	◯	◯	◯

Other (please specify)

13. If you were NOT exposed to any errors resulting in MAJOR harm while a clinical clerk, skip to #15.

During your experience as a 3rd year clinical clerk,after you became aware of an error resulting in MAJOR harm, please estimate how often the following actions occurred.

	Never	Rarely	Sometimes	Often
Acknowledgement of error directly to patient and/or patient's family.	◯	◯	◯	◯
Explanation of the consequences of the error to patient and/or patient's family.	◯	◯	◯	◯
Explanation of actions being taken after error to rectify error and/or treat patient to patient and/or patient's family.	◯	◯	◯	◯
Acknowledgement of error among junior team members without disclosure to attending or patient and patient's family	◯	◯	◯	◯
Acknowledgement of error among team including the attending without disclosure to patient and patient's family	◯	◯	◯	◯
No acknowledgement of error	◯	◯	◯	◯
Completion of an Incident Report and involvement of Risk Management Department	◯	◯	◯	◯
Discussion of error among team or service in a non-punitive, educational way	◯	◯	◯	◯
Discussion of error among team or service in a way	◯	◯	◯	◯

that directly or indirectly blames a member of the team.	

14. Thinking about ALL of your experiences as a third year clinical clerk, when an error resulting in MAJOR harm occured and the patient and/or patient's family was informed an error occured, how often was it the following team members that disclosed the error?

	Never	Rarely	Sometimes	Often
Attending physician	◯	◯	◯	◯
Senior resident physician	◯	◯	◯	◯
Junior resident physician	◯	◯	◯	◯
Intern	◯	◯	◯	◯
Medical student	◯	◯	◯	◯
Nursing staff	◯	◯	◯	◯
Other (please specify)	◯	◯	◯	◯

Other (please specify)

15. How likely is it that you would disclose to the patient and/or patient's family an error that resulted in ...

	Very Unlikely	Unlikely	Likely	Very Likely
No harm to the patient?	◯	◯	◯	◯
Minor harm to the patient?	◯	◯	◯	◯
Major harm to the patient?	◯	◯	◯	◯

16. Who would you feel most comfortable speaking with about an error you witnessed? Please rank (#1 most comfortable-#10 least comfortable)

A Peer	
Dean of Student Affairs	
Clerkship Director	
Attending in charge	
Housestaff	
Anonymous reporting	
Risk Management/Legal	
Yale-New Haven Hospital arranged counseling services	
Other faculty member (please specify)	
Other counselor/advocate/ombudsman (please specify)	

17. Thinking about ALL your experiences as a third year clinical clerk, if an error you witnessed remained undisclosed or unacknowledged, did you tell anyone about the error?

- ◯ Yes
- ◯ No
- ◯ N/A

18. If you answered “Yes” in 17 above, who did you report the error to (check all that apply)?

- ☐ Attending
- ☐ Resident
- ☐ Intern
- ☐ Anonymous reporting system
- ☐ Patient and/or patient’s family
- ☐ Risk management/Legal
- ☐ Peer
- ☐ Dean of Student Affairs
- ☐ Clerkship director
- ☐ Other faculty (please specify below)
- ☐ Other counselor/Advocate/Ombudsman (please specify below)

Other (please specify)

19. If you answered “No” in #17 above, why didn’t you report the error (check all that apply)?

- ☐ Unsure of who to tell
- ☐ Fear of bad evaluation or grade
- ☐ Discouraged by senior doctors
- ☐ Fear that team will be upset with you
- ☐ Fear of legal consequences
- ☐ Unsure of whether or not it was an error
- ☐ Fear of negative patient/family reaction
- ☐ I did not think the information would help the patient
- ☐ Other (please explain

Other (please explain)

20. If you reported an undisclosed error to the patient/patient's family on your last rotation, how likely do you think the following are to have occurred...

	Very Unlikely	Unlikely	Likely	Very likely
Your grade and evaluation would have been negatively affected	◯	◯	◯	◯
Your residents and/or attending would have been upset with you	◯	◯	◯	◯

21. If you reported an undisclosed error to the anonymous reporting system on your last rotation , how likely do you think the following are to have occured?

	Very unlikely	Unlikely	Likely	Very likely
Your grade and evaluation would have been affected	◯	◯	◯	◯
Your residents and/or attending would have been upset with you.	◯	◯	◯	◯

22. If you reported an undisclosed error to Risk Management/Legal on your last rotation, how likely do you think the following are to have occured?

	Very unlikely	Unlikely	Likely	Very likely
Your grade and evaluation would have been negatively affected.	◯	◯	◯	◯
Your residents and/or attendding would have been upset with you.	◯	◯	◯	◯

23. As a student on the wards...

	Never	Once	Occasionally	Frequently
I have done something unethical to fit in with the team	◯	◯	◯	◯
I witnessed unethical behavior on the part of other doctors	◯	◯	◯	◯
I lied to a patient	◯	◯	◯	◯
I heard medical professionals refer to patients in a derogatory manner	◯	◯	◯	◯
I have been personally mistreated	◯	◯	◯	◯
I have been publicly belittled or humiliated	◯	◯	◯	◯

24. I felt bad or guilty about something I have done as a clinical clerk

◯ Yes

◯ No

◯ I don't know

25. After being on the wards, at least some of my ethical principles have been eroded or lost.

- ◯ Yes
- ◯ No
- ◯ I don't know

26. Your gender

- ◯ Male
- ◯ Female

27. Your age

28. How many months have you spent on the wards?

29. What specialty are you going into?

- ◯ Neurology
- ◯ Psychiatry
- ◯ Pediatrics
- ◯ Medicine
- ◯ Surgery
- ◯ OB-GYN
- ◯ Ophthalmology
- ◯ Dermatology
- ◯ Radiology
- ◯ Anesthesiology
- ◯ Emergency medicine
- ◯ I don't know

30. Please use this space for any comments, experiences, or error specifics you wish to share. Comments are also welcome by email, phone conversation, or interview.