

## SOUNDING BOARD

## PATIENT SAFETY

Residents' Suggestions for Reducing Errors  
in Teaching Hospitals

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The Institute of Medicine's 2000 report *To Err Is Human* precipitated a firestorm of publicity on the issue of medical errors.<sup>1</sup> On the basis of the Harvard Medical Practice Study<sup>2</sup> and a similar analysis of Utah and Colorado hospitals,<sup>3</sup> the report concluded that as many as 98,000 deaths occur annually in U.S. hospitals as a direct result of medical errors. This figure exceeds the number of deaths attributable annually to AIDS, motor vehicle accidents, or breast cancer.<sup>1</sup> Subsequent critiques have suggested that this estimate might be inaccurate, since some of the deaths documented in the original studies may have been neither attributable to adverse events nor preventable,<sup>4,5</sup> the definition of errors used was overly broad,<sup>6</sup> and the estimates were based on reviews of medical records even though adverse events are often not recorded in medical records.<sup>7</sup> Regardless of the exact number of deaths due to errors, this is a serious public health problem, and new approaches are needed to solve it.

Much of the research on medical errors has focused on teaching hospitals, the site of nearly all graduate medical education in the United States. Nonetheless, there has been little discussion of how the environment in teaching hospitals could be improved to reduce the likelihood of errors made by residents, who provide much of the direct patient care in such hospitals. In this article, we identify eight remediable problems in teaching hospitals that we believe on the basis of our experience as residents contribute to errors. Many of these problems could be addressed with minimal financial expenditures.

## TYPES OF ERRORS

It is important to recognize that medical errors are often related to the design of systems and are not directly the fault of persons on the front lines. Such errors, known as latent errors, reflect organizational flaws that increase the risk of errors. Active errors,

on the other hand, can be thought of as directly attributable to the actions of persons. The two types of errors are not mutually exclusive; many errors are the result of both systemic problems and individual actions.<sup>8-11</sup>

Errors routinely attributed to persons, such as administering the wrong dose of a medication because of an illegible order, are often rooted in unrecognized problems in the design of systems. To date, our health care system has largely focused on corrective actions at the individual level and has failed to look at system-level approaches to preventing errors. It is striking how little effort has been made to prevent errors in medicine, as compared with the aviation industry, in which concern about safety is paramount and work hours are carefully regulated.<sup>9</sup>

For each of the eight problems discussed below, we suggest changes that can be made to reduce error rates. These suggestions fall into three categories: using technology, improving the work environment, and changing the academic culture.

## USING TECHNOLOGY

## FREQUENT INTERRUPTIONS WITH PAGING

"My pager has gone off five times in the past 15 minutes, while I've been trying to take Mr. Jones's history. I can't keep his complicated history straight."

Frequent paging of residents in teaching hospitals interrupts patient care.<sup>12,13</sup> Such interruptions, and the distraction they cause, are an important cause of active errors.<sup>8</sup> Residents must always respond immediately when they are paged, because the urgency of the information is unknown.

With the use of alphanumeric pagers, messages could easily be designated as emergency (E), urgent (U), or routine (R) communications. Alternatively, paging for routine matters could be limited to a

certain portion of each hour, such as the first 10 minutes, with the rest of the hour reserved for uninterrupted attention to patient care (except in emergencies). E-mail systems could also be used for nonurgent communication about patients, allowing house staff to respond after they have completed other tasks.

#### ORDERS AND MEDICAL RECORDS

“The nurse couldn’t read my writing and gave the patient 10 mg of morphine instead of 1 mg. Now Mr. Smith is oversedated and needs naloxone stat.”

Medication errors account for a substantial proportion of reported medical errors.<sup>2,14</sup> Although the use of computerized ordering systems helps prevent medication errors,<sup>15</sup> many hospitals still use handwritten orders. In addition to eliminating the problem of illegible handwriting, computerized systems reduce adverse-event rates by screening orders for potential drug interactions and a history of allergy or other contraindications and by cross-checking prescriptions with a patient’s laboratory values.<sup>15,16</sup> Errors could be further prevented by using computerized systems that provide decision-making assistance, dose recommendations, and adjustment of doses for specific characteristics of a patient, such as renal failure or advanced age.<sup>15,16</sup>

The development of standardized, evidence-based order sets for use in common situations, such as ruling out myocardial infarction, could help ensure that the most efficient and effective procedures are followed, even by inexperienced interns. Some may argue that such order templates amount to “cookbook medicine,” which could undermine training in medical practice. However, well-designed order sets with modular components could be used to teach interns the appropriate orders for a given clinical presentation, instead of relying on individual variations in the ability to write suitable orders for multiple admissions under the pressure of time. The interns would be responsible for modifying the components as needed.

Wider use of electronic medical-record systems would also help reduce medical errors. With electronic records, providers within a hospital or health care system would have access to a common data base of medical information, including but not limited to previous laboratory and diagnostic studies,

previous electrocardiograms, notes about outpatient visits and hospitalizations, and records of drug allergies. The ensuing reductions in medical errors, redundant testing, and procedures performed on the wrong patient,<sup>17</sup> as well as improvements in efficiency, would result in cost savings that would offset, at least in part, the cost of implementing the system. Automatic instant notification of dangerously abnormal laboratory values from the electronic medical record to house-staff beepers would facilitate prompt corrective action.

#### SIGN-OUT PROCEDURES

“I just got called by the nurse about Ms. Davis, who is hypotensive. All I know about her from the sign-out information is that she is an 82-year-old woman with a urinary tract infection who is scheduled to go home tomorrow. The information does not indicate her code status.”

Despite the long hours that residents work, at some point, information about patients must be transferred to on-call physicians who are less familiar with the patients. Although this transfer of information can be critical, it often happens in a remarkably haphazard manner. The extent of the information transmitted to the on-call physician varies considerably, and handwritten information may be illegible. Furthermore, it is often unclear to the nursing staff which member of the house staff is providing coverage for a particular patient at night.

Computerized sign-out procedures should be adopted that are universally applicable within a particular specialty. At the Brigham and Women’s Hospital in Boston, a computerized sign-out system automatically includes up-to-date information on drug allergies, current medications, results of recent laboratory tests, relevant medical history, and code status. Interns are expected to enter into the system daily updates on a patient’s current clinical condition and the basic treatment plan. All this information is available to attending staff, covering house staff, and nursing staff. Furthermore, interns sign their beepers out to covering interns electronically, so there is no ambiguity about who is providing coverage. Such a system is likely to reduce medication errors<sup>15</sup>; minimize handwritten information, which can be difficult to interpret<sup>18</sup>; and improve the continuity of care.

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 IMPROVING THE WORK ENVIRONMENT
 

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## HOURS OF WORK

“I have been awake for 30 hours and still have at least 5 more hours of work, not to mention three procedures. Every time I sit down to figure out why Mrs. Long’s kidney function is deteriorating, I fall asleep.”

Studies have demonstrated that cognitive function declines with sleep deprivation.<sup>19,20</sup> After 24 consecutive hours without sleep, cognitive psychomotor function declines to a level equivalent to that associated with a 0.1 percent blood alcohol level.<sup>21</sup> Residency schedules that include on-duty periods of 36 hours and inadequate rest between shifts leave workers on the front line in a state of fatigue, which is a common cause of serious errors.<sup>22</sup> Modification of schedules to reduce consecutive duty hours and distribute workloads more evenly results in fewer medication errors and better use of resources.<sup>23</sup>

New York is currently the only state that limits residents’ work hours to 80 hours per week, but compliance with this regulation has been suboptimal.<sup>24</sup> Similar legislation is pending in New Jersey and in Congress; according to the provisions of the federal bill, hospitals would have to comply with the congressional limits to participate in Medicare. In part to forestall federal regulation,<sup>24</sup> the Accreditation Council for Graduate Medical Education released a plan in June 2002 to limit residents’ work schedules to 80 hours per week, restrict shifts to a maximum of 24 hours, and require at least 10 hours of time off between shifts. This plan is slated to take effect in July 2003 and will apply to teaching hospitals throughout the country.<sup>25</sup> There is concern that the costs associated with implementing these measures, loopholes that allow exemption from the 80-hour limit, and the difficulty of enforcing the provisions may preclude full compliance.<sup>26</sup> However, this new mandate should force residency programs to think creatively and critically about how residents’ work hours are best spent.<sup>27</sup> Responses to this mandate may not only reduce errors but also improve training in general.<sup>28</sup>

## LOCATION OF MEDICAL CHARTS AND EQUIPMENT

“Where is Ms. Tilly’s chart? I can’t remember where they keep the charts on this floor. I am covering her care for the regular resident and

don’t know her well. I was called to see her for respiratory distress, but I can’t find a pulse oximeter or an Ambu-Bag.”

It is not uncommon for medical staff to spend a large amount of time looking for charts and equipment. Often, each floor and unit have their own rules about the placement of charts and equipment. In addition, the organization of charts and equipment may vary within the hospital, making expeditious use of information or tools difficult for house staff who care for patients on multiple floors, especially in emergencies. Each hospital should develop a single system for chart storage, placement of vital-sign flow sheets, location and type of equipment, storage and composition of procedure kits, and examination-room layout so that valuable time is not lost looking for equipment or determining how to use unfamiliar equipment.

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 CHANGING THE ACADEMIC CULTURE
 

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## REPORTING OF ERRORS

“I gave extra fluids to the wrong patient last night, which caused acute respiratory failure. I hope no one finds out, because I don’t want my fellow residents and the attending physician to think I’m a bad doctor.”

Leape has described most extensively the medical profession’s deeply rooted resistance to open discussion of errors.<sup>11,29</sup> The traditional focus on active errors by individual people, as opposed to the systemic problems that lead to such errors, has led to punitive measures or “remedies” that consist of suggesting that the resident was “not careful enough,” “didn’t try hard enough,” or “needs to do more reading.” The morbidity and mortality conference is an attempt to provide a forum for the discussion of bad clinical outcomes, many of which are due not to error but rather to the course of the underlying disease. However, the presence of many senior faculty members at these conferences inhibits frank discussion among house staff of the possible role of errors in a bad outcome.

In the absence of a forum for frank discussion or even anonymous reporting of errors, silence prevails, and errors tend to be concealed. One study showed that only 54 percent of house officers had told their attending physician about the most serious errors they had committed in the previous year.<sup>22</sup> Of

the errors reported in the study, 31 percent had resulted in death. It is troubling that errors with such grave consequences were frequently not discussed with the faculty members who were directly overseeing patient care — and who were legally responsible for the patients. House officers who accepted responsibility for their errors and discussed them were more likely to report constructive changes in practice than were house officers who did not openly acknowledge their errors.<sup>22</sup>

If residents are not encouraged to discuss their errors, it will be impossible to develop effective surveillance systems. These systems collect large amounts of data in an anonymous manner. Analysis of aggregate surveillance data often reveals patterns associated with errors. These patterns, in turn, point to systemic flaws and vulnerabilities that must be addressed in order to reduce the risk of errors.

#### TRAINING IN PROCEDURES

“I put in a central line today that was complicated by a pneumothorax. I had never done this procedure before, and I am not sure the resident who was supervising me had much more experience than I do.”

“See one, do one, teach one” has been a long-standing mantra of medical education. Although this philosophy promotes autonomy and education through experience, it falls far short of guaranteeing proficiency and improving the safety of patients. There are few data on either the level of competence of residents<sup>30</sup> or the number of times a procedure should be performed to achieve competence, and the Accreditation Council for Graduate Medical Education does not have standards for training in the use of procedures in different specialties.<sup>31</sup> The American Board of Internal Medicine requires the directors of residency programs to certify that residents are proficient in performing a number of procedures. Although the board provides guidelines for the minimal number of procedures required to certify competence, the ultimate determination of proficiency is left to the discretion of each institution.<sup>32</sup>

There is evidence that workshops and training improve competence in performing procedures.<sup>33,34</sup> Given the variation in skill levels and experience among house staff and attending physicians, there is a need for standardized training, so that residents at each hospital are taught to perform procedures for appropriate indications and in an appropriate

manner. To ensure competence, teaching hospitals should provide formal training programs and refresher courses for procedures, resuscitation (“codes”), and other specialty-specific responsibilities rather than rely on individual instruction, which is highly variable, and “learning by doing.”

#### LEADERSHIP

“I was on call yesterday, and I can’t keep up with all the details on our team’s new patients. Other caregivers are doing things for our patients that we didn’t know about. The two interns I supervise duplicate work and neglect important issues.”

In academic medical centers, health care is delivered by teams of health care professionals. To function well and minimize the risk of error, these teams require good leadership, communication, and coordination.<sup>10</sup> There is often little coordination among medical staff, nurses, pharmacists, respiratory therapists, social workers, and other team members, with no system of organized interaction. The aviation industry long ago recognized the need for formal training in team management and now requires training and frequent refresher courses. The ability to lead a team effectively is a skill that often has to be learned, and residents would almost certainly benefit from formal training in leadership and management similar to the training provided in the aviation industry and in business. A planned approach to coordination and communication among caregivers should be the rule rather than the exception.

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#### CONCLUSIONS

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The Institute of Medicine’s report in 2000 brought the issue of medical errors into the public spotlight. However, the medical profession has long been aware of this issue and has failed to develop any unified corrective action.<sup>2,9,11</sup> To improve the safety of patients in U.S. teaching hospitals, specific attention must be paid to the work environment of house staff. Addressing errors that are rooted in organizational design requires a systems approach rather than a focus on particular persons considered to be at fault.<sup>8,11</sup>

Concern has been expressed that if errors are attributed primarily to systemic causes, residents may not learn from their errors.<sup>35</sup> A balance must be

achieved that allows residents to take personal responsibility for their errors and to discuss them constructively as a means of facilitating collective learning and improving clinical practice.<sup>22</sup>

The eight areas of concern that we have discussed are a few examples of potential sources of error. On the basis of our experience as medical house staff, these areas offer clear opportunities for improving systems in order to reduce the risk of errors in hospitals. With the exception of new information systems, the cost of implementing the improvements we suggest would be small. The chiefs of services at academic medical centers and the directors of residency programs must take the lead in making the systemic and environmental changes that are required to address this pressing public health problem.

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Volpp, K. G, Grande, D. M.D. Residents' Suggestions for Reducing Errors in Teaching Hospitals. *N Engl J Med* 2003; 348:851-855. A medical mistake can mean everything from stomach operation complications that go unnoticed, to giving a patient her roommate's medicine instead of her own, to removing the wrong foot during an operation. These teaching innovations integrated key behavioral and social skills, including communication, for the most effective on-the-ground doctor-patient practice. The Behavioral and Social Science Consortium for Medical Education (BSS Consortium) convened, last April, the workshop Integrating Behavioral and Social Sciences (BSS) into Health Education. Residents face special risks of involvement in medical errors since they have tremendous responsibility for patient care, yet they are novice practitioners in the process of learning and mastering their profession. The present study explores the relationships between residents' error rates and three clinical training methods (1) progressive independence or level of autonomy, (2) consulting the physician on call, and (3) familiarity with up-to-date medical literature, and whether these relationships vary among the specialties of surgery and internal medicine and between novice and experienced residents. Residents' suggestions for reducing errors in teaching hospitals. *New England Journal of Medicine*, 348(9), 851-855. CrossRefGoogle Scholar.

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