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Continuing Medical Education and Patient Safety: An Agenda for Lifelong Learning

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Introduction

Continuing education and improvement of medical practice has long been a tradition in the medical profession. As John Shaw Billings noted over a century ago, "The education of the doctor which goes on after he has his degree is, after all, the most important part of his education."[1] Beyond the extensive array of formal continuing education programs available, physicians have, over the years, developed a variety of informal approaches to improving clinical skills based on review and critique of patient management.[2]

A key ingredient of this tradition has been a focus on recognizing and learning from medical error. The 13th Century Oath of Maimonides advises physicians: "Today he can discover his errors of yesterday and tomorrow he can obtain a new light on what he thinks himself sure of today." Continuing this tradition, Sir William Osler advised young physicians, "Begin early to make a three-fold category—clear cases, doubtful cases and mistakes. . . . It is only by getting your cases grouped in this way that you can make any real progress in your post-collegiate education."[3] Osler himself served as a role model in this regard, as Cushing describes:

> Once in a ward class there was a man whom he demonstrated as showing all the classical symptoms of croupous pneumonia. The man came to autopsy later. He had no pneumonia, but a chest full of fluid. Dr. Osler seemed delighted, sent especially for all those in his ward class, showed them what a mistake he had made, how it might have been avoided and how careful they should be not to repeat it.[4]

Recently the profession's interest in recognizing, learning from, and preventing medical error has been reinvigorated, as the papers in this special issue of *JAMIA* illustrate. In 1998, the President's Advisory Commission on Consumer Protection and Quality in the Health Care Industry presented its final report on quality to the President of the United States. Reduction of medical errors was listed as one of it's top priorities.[5] Although a nascent science in which much remains to be learned, the applications of human factors engineering, systems science, information science, and computer technology are widely acknowledged to hold great promise for reducing medical error and improving patient safety. These converging disciplines, combined with advances in our understanding of how continuing education can be designed to change clinical practice,[6] offer an opportunity to effectively refocus physicians' continuing education on medical error and patient safety.

Organization and Methods

Two key features of modern medical care that must be recognized to understand and address medical error are that it is multidisciplinary and that it occurs within a complex, hierarchically organized system.[7] To be most effective, a program of continuing profes-

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sional education on medical error must also reflect these features. At the VHA National Center for Patient Safety in Ann Arbor, Michigan, participants were faced with the goal of providing training and tools to over 172 healthcare facilities.[8] Their educational efforts enabled healthcare providers to use root cause analysis for adverse events and close calls and to better their statistics by identifying ADEs in 31% of the patients sampled. First, because care is necessarily multidisciplinary, continuing education of professionals independent of one another can have only limited effect. New models of interdisciplinary training, incorporating principles of crew resource management pioneered in aviation, have already been instituted and hold great promise. Second, because patients are cared for in complex, hierarchically organized systems, continuing education must be designed to address learning needs at multiple levels, from individuals to small teams and groups, interacting groups, the larger organization, and so on.

To be helpful to patients, continuing professional education must affect not only the learners' knowledge and skills, but also their actual practices. Although conventional "sit and listen" continuing medical education (CME) has been disappointing in terms of its impact on clinical practice,[6,9] much has been learned in recent years about the elements of CME that do have an impact.[10,11] In particular, according to the review by Davis et al., CME programs that were effective tended to have these features: (1) focused on identified gaps in knowledge or practice (and need to change); (2) addressed barriers to change in the practice environment; (3) included practice enabling strategies; and (4) provided opportunities for rehearsal and reinforcement.[6]

Curriculum Content

The recommendations contained in the IOM Report "To Err is Human" constructed a four-tiered approach:

- Establishing a national focus to create leadership, research, tools and protocols to enhance the knowledge base about safety;
- Identifying and learning from errors through the immediate and strong mandatory reporting efforts, as well as the encouragement of voluntary efforts, both with the aim of making sure the system continues to be made safer for patients;
- Raising standards and expectations for improvements in safety through the actions of oversight organizations, group purchasers, and professional groups; and
- Creating safety systems inside health care organizations through the implementation of safe practices at the delivery level. This level is the ultimate target of all the recommendations.[12]

We suggest that a fifth recommendation be added, which is educating our future clinicians with regard to systematic error as well as how to avoid such error and the associated adverse events. A core patient safety curriculum for education of clinicians needs to be created. Table 1 offers an example of a potential patient safety curriculum. This table contains examples of topics that are likely to be covered in a patient safety CME program.

Why should patient safety be first and foremost in the curriculum of continuing medical education? The steps for ensuring patient safety, as outlined above, are not intended only for medical students, interns, and residents but also for practicing clinicians. Ongoing training with new advances in diagnostic tools and online clinical records can make a difference. A look at the IOM's first report, "To Err is Human: Building a Safer Health System," released in November 1999, identified the following quite startling statistics. Roughly, 44,000 to 98,000 people die in U.S. hospitals each year as a result of medical errors, making them the fifth to eighth leading cause of death in the United States. These errors result in more deaths each year than breast cancer, AIDS and accidents involving motor vehicles. In addition, medication errors cause another 7,000 deaths. The cost to the health care system is also astronomical. The IOM estimates that medical errors will cost the U.S. approximately $38 billion per year, with about $17 billion of those costs associated with preventable errors. Just from this information, it is evident that medical errors are a national public health problem that has resulted in substantial morbidity and mortality. The U.S. healthcare system must address this epidemic in the same manner that it targets diseases such as cancer, diabetes, heart disease, and obesity. The federal government is aggressively taking action to reduce medical errors and improve patient safety, as demonstrated by the efforts of the Quality Interagency Coordination Task Force (QuIC) and recent congressional action to appropriate $50 million in AHRQ's budget to provide for these initiatives.[5] For these reasons, it is obvious and necessary that patient safety must become a large part of continuing medical education for each and every practicing clinician.

Table 1 ■

Proposed Outline and Justification for a Patient Safety CME Curriculum

1. **Adverse drug events**
   This module discusses the known mechanisms by which ADEs occur. Current and innovative methods for identifying sources of systematic errors need to be impressed on clinicians. The differences between error, adverse events, and harm must be taught. Formulas for best practice in medication prescribing (e.g., always check allergies, write legibly, check liver and renal functions when appropriate) need to be analyzed. Order entry for medications, bar coding of medications, and drug administration data collection are an important part of the curriculum.

2. **Errors of omission**
   The method for showing clinicians how they can be certain not to forget what they are supposed to do in health care falls roughly into two categories. The first is knowing what is your personal responsibility (i.e., knowing your medicine and your job); the second is knowing how to organize your life so that you remember to do the things that you are supposed to accomplish. For the former, the curriculum should clearly lay out the responsibility of every member of the team in the patient care process. This must serve as a guide for individual members of the team to know their responsibilities and the responsibilities of their coworkers. The second objective provides guidance in documenting a clinician's to-do list, effectively signing out patients to a coworker when appropriate, transmitting the needed patient information effectively whenever required, and related activities.

3. **Errors of commission**
   How sure is sure? When do you know enough to take responsibility for a decision in medicine? How do you get back-up when you are unsure? How do you recognize that an error has been made? What is your responsibility with regard to correcting an error, if possible? What documentation is required to comply with patient incident and sentinel event reporting? Our curriculum must address these and other critical issues in this arena.

4. **Discharge planning**
   The discharge planning process is discussed in detail. Documenting drugs and their proper use is always of utmost importance. This responsibility is extremely critical when patients are transferring to nursing homes because the discharge summary is used as orders for medications. Selecting a safe environment for a patient leaving the hospital can be challenging, and helpful procedures are discussed during this module.[25] Discharge summaries vary in quality; therefore, essential features of a useful and usable discharge summary are identified.

5. **Transitions in level of care**
   Going from the outpatient setting to the inpatient setting is often haphazard. Courses must be developed that teach the basic principles that should allow clinicians to make cogent judgments about the need for hospitalization. Similarly, transitioning to the outpatient setting in a safe and effective manner has certain associated principles that need to be employed to teach this module (e.g., safe mobility around the home for home-going patients to prevent falls in the elderly).

6. **Consultation**
   Knowing when to consult a subspecialist for a particular medical condition is part of the art of medicine. However, some of the variation in practice is based on a clinician's predispositions rather than the patient's condition. Clinicians must gain a basic understanding of the well-accepted principles that the most seasoned clinicians use in making these decisions. Examples for this module may include determining which test would be best to order, resolving a poorly understood physical finding, and finding the most appropriate well-trained provider to perform a procedure that you are not qualified to perform yourself.

7. **Preoperative evaluation**
   Medical complications, which occur after or during surgery, are one set of often preventable adverse events. Clinicians must be taught the basic principles involved in performing a rigorous preanesthesia medical evaluation.

8. **Safety of herb-drug interactions**
   The safety of prescribing medications to patients who take various herbs is becoming of increasing relevance. The course should stress and outline for clinicians the important principles regarding the prescriptions of medications when patients are on therapies or diets that you, as a clinician, currently do not fully understand. This module must also include advanced search techniques to identify information at the point of care, which will empower clinicians to practice more safely when prescribing medications.

In This Issue

Clinical Information Systems

Examples of the effect of clinical information systems on patient safety abound. In this issue we add to the wealth of information regarding event monitoring and physician order entry. Detecting and preventing adverse events (ADEs) is essential for improving medical quality. Brigham and Women's Hospital in Boston is using an electronic approach to ADE detection. Prior studies have detected ADEs through structured charts reviews; although effective, this approach is costly and time consuming. Boelle et al. describe the classification of adverse events within the subspecialty of anesthesia and how to use process

control charts to monitor adverse events. These charts are one method for setting thresholds for action given a variable clinical baseline, such as heart rate monitoring during surgery. Education regarding the value of process control charts should be part of a robust CME program.

Expert systems form much of the basis for the decision support needed to improve patient safety. Sawa and Machado describe an expert approach to decreasing anesthetic error. They advocate the use of set-covering theory to form an association between the patient's current condition and a set of possible adverse events, which are available to the clinician to serve as an "Intelligent Alarm."

As adverse event monitoring becomes a greater part of clinical practice, clinicians need to be educated in the use and risks of various monitoring systems. Einbinder et al. demonstrate the ability to use a clinical repository to estimate the rates of adverse events and their associated costs. An adverse event rate of 25%, observed in this study, is an eye-opener for most of us as practicing clinicians. Goldstein et al. advocate strongly for all guideline based decision support systems to take into account the patient safety issues associated with their clinical area. For example, the recommendation for the use of drugs that can possibly lead to renal insufficiency should include a warning to clinicians about this risk.

Human Factors Engineering and Communication

Without strict attention to the human factors issues surrounding patient safety systems, their impact will be severely limited. Because we are attempting to influence human behavior, we need to understand that behavior and take strict account of the needs of our users; otherwise, these systems may become expensive paperweights. Moss et al. describe the intensive communication needed between and among operating room (OR) nurses. This communication serves as a challenge to the implementation of patient safety systems in the OR. Only through a clear understanding of the human factors requirements of OR nursing can a technical implementation in this environment occur.

Weinger and Slagle describe the need to understand the work environment and the workload of the anesthesiologist and the constraints on any clinician-oriented patient safety system created for this environment. The principle of user-centered design should be a part of any patient safety CME curriculum. McKnight et al. suggest the use of virtual whiteboards to address some areas of inadequate communication between nurses and physicians in the inpatient setting. As we look toward building a curriculum in patient safety it is clear that we need not only address the types of systems interventions that have been demonstrated to help reduce adverse events but also to educate clinicians regarding unsolved but important problems that threaten to increase adverse event rates, such as miscommunication between physicians and nurses.

Knowledge Representation

The importance of unambiguous communication about adverse events in improving patient safety, is paramount. Nebeker et al. show how the same terms (such as the definition of an adverse event) in the field are defined differently by organizations that care deeply about patient safety. Some of the major authors in the field are no more consistent in their definitions of these central concepts than World Health Organization and the Food and Drug Administration. It seems clear that this fundamental issue needs to be settled before effective knowledge management can begin (i.e., the development of a standardized vocabulary for safety-related events and concerns). Stetson et al. employ the model of human performance to suggest extensions to the UMLS to improve its ability to represent core patient safety concepts in the Metathesaurus. This is a positive step in the path toward of accurate and complete data representation for patient safety.

Advani et al. propose an innovative terminology, named the Quality Indicator Language, to assist in representing information about the qualitative value of decisions and outcomes. Accurate encoding of the marginal utilities of different health outcomes is an important part of building patient specific decision support systems. This manuscript uses the JNC VI guideline on Hypertension (Sheps, Sheldon, et al.), which is a comprehensive and complex guideline for management of hypertension. The authors approach the difficult issue of modeling both the guideline authors' intentions and the clinician's intentions in applying guideline-based patient care.

Protecting Confidentiality

Data privacy is essential for patient safety, given that misused data can lead to unsafe patient care. Con-

sider that, without anonymous data, patients would not consent to participate in research, and without research we could not perform the root cause analyses necessary for patient safety. The study by Dreiseitl et al. demonstrates that it is possible to disambiguate data that have been "anonymized" with the currently available algorithms which use the cell suppression technique,to demonstrate the potential threat to confidentiality even in "sanitized" research data.[24] Ohno-Machado et al. take this one step further by showing that an expert system that can predict diagnoses (and rank them by frequency) is capable of filling in missing data (ambiguated data), thereby identifying so-called "anonymized" records. Techniques need to be developed that can truly anonymize records and still have enough content to allow researchers to perform sufficient analyses to improve patients' safety.

Applicability of This Issue to CME and the Development of a Health Informatics Patient Safety Curriculum

Each of these important subjects alerts us to health informatics concepts that are important considerations for inclusion in a detailed patient safety curriculum for continuing medical education. Our suggested curriculum organizes topics within the framework of the traditional categories of patient safety work as it affects the patient and weaves the technological issues into that framework. We believe that this method of organization is preferable to focusing on each technological problems outside the context of specific patient care issues. This focus provides the advantage of built-in real-world examples of the practical applicability of health informatics to relevant patient safety issues.

References ■

1. Billings JS. Cited in Manning PR, Debakey L. Medicine: Preserving the Passion. New York, Springer-Verlag, 1989.
2. Manning PR, DeBakey L. Analysis of practice. In Medicine: Preserving the Passion. New York, Springer-Verlag, 1989.
3. Osler W. The Student Life. Aequanimitas. With Other Addresses to Medical Students, Nurses, and Practitioners of Medicine, 3rd ed. Philadelphia,Blakiston, 1932, p 412.
4. Cushing H. The Life of Sir William Osler. Oxford, Clarendon Press, 1925.
5. Ortiz E, Meyer G, Burstin H. Clinical Informatics and Patient Safety at the Agency for Healthcare Research and Quality. Rockville, MD, Agency for Healthcare Research and Quality, 2001.
6. Davis DA., et al. Changing physician performance. A systematic review of the effect of continuing medical education strategies. JAMA. 1995;274: 700-5.
7. Zhang J, Patel VL, Johnson TR. Medical error: Is the solution medical or cognitive? JAMIA (published in this issue).
8. Williams L, Grayson D, Gosbee J; "Patient Safety—Incorporating Drawing Software into Root Cause Analysis Software. Ann Arbor, MI, VHA National Center for Patient Safety, 2002.
9. Oxma, AD, et al. No magic bullets: A systematic review of 102 trials of interventions to improve professional practice. Can Med Assoc J. 1995;153:1423-31.
10. Grol R. Improving the quality of medical care: Building bridges among professional pride, payer profit, and patient satisfaction. JAMA. 2001;286:2578-85.
11. Grimshaw JM, Shirran L, Thomas R, et al. Changing provider behavior: An overview of systematic reviews of interventions. Medical Care. 200139(Suppl):112-45.