MEDICAL ERRORS
GOALS AND OBJECTIVES

COURSE DESCRIPTION
"Medical Errors" is a home study continuing education course for Massage therapy professionals. The course focuses on the issue of medical errors. It includes sections on societal and economic impact, types and causes of errors, prevention strategies, documentation, pharmacological components of therapy, root cause analysis instruction and patient management.

COURSE RATIONALE
The information presented in this course is critical for rehabilitation professionals in all settings. The problem of medical errors impacts all aspects of society. It is imperative that all healthcare professionals educate themselves to facilitate effective strategies to reduce the occurrence of errors in medicine.

COURSE GOALS
1. The student will understand the magnitude of the problem of medical errors.
2. The student will learn about the many types of medical errors.
3. The student will identify the causes of medical errors.
4. The student will learn about the important role that proper documentation and communication plays in decreasing medical errors.
5. The student will learn effective strategies to prevent medical errors.
6. The student will understand what therapy professionals must do to participate in the overall pharmaceutical management of each patient.
7. The student will learn about resources currently available for both healthcare professionals and patients that will assist in the reduction of medical errors.
8. The student will learn about root cause analysis.

COURSE OBJECTIVES
1. Increase therapist’s awareness of medical errors.
2. Identify the many different types of medical errors.
3. Identify the causes of medical errors.
4. Review effective medical record documentation process and rationale.
5. Teach rehabilitation professionals effective strategies to reduce medical errors.
6. Teach therapists the steps they must take to actively participate in each patient’s pharmaceutical management.
7. Provide the student with additional resource information that they and their patient can utilize to help reduce the occurrence of medical errors.

COURSE EDITOR
Michael Niss PT

METHODS OF INSTRUCTION
Self-paced home study course available via written correspondence or internet.

CRITERIA FOR ISSUANCE OF CONTINUING EDUCATION CREDITS
A documented score of 70% or greater on the written post-test.

DETERMINATION OF CONTINUING EDUCATION CONTACT HOURS
"Medical Errors" has been established to be a 2 hour continuing education program. This determination is based on the established standard for home-based self-study courses of approximately 10-12 pages (12 pt font) of text per hour. The complete text of this course is 29 pages (excluding References and Post-test)
# MEDICAL ERRORS

## OUTLINE

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td>3-4</td>
</tr>
<tr>
<td>Unique Aspects of Healthcare Errors</td>
<td>4-5</td>
</tr>
<tr>
<td>Growing Concerns About Medical Errors</td>
<td>5-6</td>
</tr>
<tr>
<td>The Epidemiology of Medical Errors</td>
<td>6</td>
</tr>
<tr>
<td>Definitions and Context</td>
<td>7-8</td>
</tr>
<tr>
<td>Impact of Organizational and Professional Culture</td>
<td>8</td>
</tr>
<tr>
<td>Public Fears</td>
<td>8-9</td>
</tr>
<tr>
<td>Where Errors Occur</td>
<td>9</td>
</tr>
<tr>
<td>Types of Errors</td>
<td>9-12</td>
</tr>
<tr>
<td>Medication Errors</td>
<td>10</td>
</tr>
<tr>
<td>Surgical Errors</td>
<td>10</td>
</tr>
<tr>
<td>Diagnostic Inaccuracies</td>
<td>11</td>
</tr>
<tr>
<td>Human Error</td>
<td>11</td>
</tr>
<tr>
<td>Systems Errors</td>
<td>11-12</td>
</tr>
<tr>
<td>A Global Challenge</td>
<td>12</td>
</tr>
<tr>
<td>Lessons from Other Industries</td>
<td>13</td>
</tr>
<tr>
<td>Preventing Errors</td>
<td>13-14</td>
</tr>
<tr>
<td>Documentation and Communication</td>
<td>14-15</td>
</tr>
<tr>
<td>Why Documentation Is Important</td>
<td>14</td>
</tr>
<tr>
<td>General Principles of Medical Record Documentation</td>
<td>14-15</td>
</tr>
<tr>
<td>Pharmacological Components and Management in Therapy</td>
<td>15</td>
</tr>
<tr>
<td>Improving Patient Safety</td>
<td>16-18</td>
</tr>
<tr>
<td>Computerized ADE Monitoring</td>
<td>17</td>
</tr>
<tr>
<td>Computer Generated Reminders for Follow-up Testing</td>
<td>17</td>
</tr>
<tr>
<td>Standardized Protocols</td>
<td>17-18</td>
</tr>
<tr>
<td>Systems Solutions</td>
<td>18</td>
</tr>
<tr>
<td>Data Collection and the HHS Patient Safety Task Force</td>
<td>18</td>
</tr>
<tr>
<td>Promoting Best Practices to Prevent Errors</td>
<td>19-20</td>
</tr>
<tr>
<td>Improving Drug Labeling</td>
<td>19</td>
</tr>
<tr>
<td>Reducing High Hazard Risks</td>
<td>19</td>
</tr>
<tr>
<td>Developing Quality Measures</td>
<td>19</td>
</tr>
<tr>
<td>Medicare Quality Improvement Organizations</td>
<td>20</td>
</tr>
<tr>
<td>Educating Patients and Healthcare Providers</td>
<td>20-21</td>
</tr>
<tr>
<td>Consumer Guides</td>
<td>20</td>
</tr>
<tr>
<td>Research-based Information for Providers</td>
<td>20</td>
</tr>
<tr>
<td>Outreach to States</td>
<td>20-21</td>
</tr>
<tr>
<td>Medication Errors Information</td>
<td>21</td>
</tr>
<tr>
<td>National Health Information Infrastructure</td>
<td>21</td>
</tr>
<tr>
<td>Root Cause Analysis</td>
<td>21-22</td>
</tr>
<tr>
<td>Appendix A: 20 Tips to Help Patients Prevent Medical Errors</td>
<td>23</td>
</tr>
<tr>
<td>Appendix B: Five Steps to a safer Health Care</td>
<td>26</td>
</tr>
<tr>
<td>References</td>
<td>27-28</td>
</tr>
<tr>
<td>Post-test</td>
<td>29-30</td>
</tr>
</tbody>
</table>
MEDICAL ERRORS

Florida Statute 456.013(7)

The boards, or the department when there is no board, shall require the completion of a 2-hour course relating to prevention of medical errors as part of the licensure and renewal process. The 2-hour course shall count towards the total number of continuing education hours required for the profession. The course shall be approved by the board or department, as appropriate, and shall include a study of root-cause analysis, error reduction and prevention, and patient safety.

Background

Preventable medical errors can occur in any health care setting from a wide range of causes. Examples of errors include a patient receiving the wrong medication or a medication to which they have a known allergy or a patient not receiving appropriate care after an abnormal test result. Most often, such errors occur as a result of systemic problems rather than poor performance by individual doctors, nurses or other providers. For instance, drugs with similar names or appearances may be easily confused with one another, or abnormal test results may not be quickly shared with those involved in a patient's care.

In the early 1990s, the Agency for Healthcare Research and Quality (AHRQ) funded a series of research studies examining the frequency and causes of medical errors. Based on these studies, the Institute of Medicine (IOM), an independent body that is part of the National Academy of Sciences, estimated that as many as 44,000 to 98,000 Americans die in hospitals each year as a result of medical errors. The IOM further estimated that adverse events cost the nation $37.6 billion each year -- including about $17 billion associated with preventable errors.

In 1998, HHS and other federal agencies formed the QuIC Task Force to coordinate efforts toward improving the quality of care for patients in America. The task force provides a mechanism for agencies to work together to better measure quality of care and to take steps to improve it. In addition to HHS, the QuIC task force includes the departments of Labor, Defense, Veterans Affairs and Commerce; the Office of Personnel Management; the Office of Management and Budget; the U.S. Coast Guard; the Federal Bureau of Prisons; the National Highway Administration; and the Federal Trade Commission.

In November 1999, the IOM issued a comprehensive report, "To Err Is Human: Building A Safer Health System," that focused public attention on the need for research, data and reforms to reduce medical errors and improve patient safety. The report included wide-ranging recommendations for both the public and private sectors for improving patient safety in the areas of leadership, improved
data collection and analysis, and development of effective systems at the level of direct patient care.

Following the report, the QuIC task force issued an action plan in February 2000 that highlighted a series of steps for HHS and other federal agencies to take to reduce medical errors. In addition, HHS continues to expand its efforts to improve patient safety by gathering and analyzing data, conducting relevant research, and educating consumers, businesses and health care providers about preventing medical errors.

Errors may be particularly difficult to recognize in health care because variations in an individual's response to treatment is expected. In addition, medical professionals may not recognize that a particular product or procedure may have contributed to or caused the problem because the patient is already ill, the product is not expected to work perfectly at all times, or the event appears unrelated to the product or procedure. Lack of recognition of a service’s role in adverse events reduces reporting of the association and the opportunity to learn from previous experiences with the product. Because medical errors usually affect only a single patient at a time, they are treated as isolated incidents, and little public attention is drawn to these problems when compared with aviation or nuclear power accidents. Health care errors are also underreported due to liability and confidentiality concerns. These factors explain, in part, the ongoing "invisibility" of medical errors despite the existence of research which has documented their high prevalence.

It is critical to recognize that not all bad outcomes for patients are due to medical errors. Patients may not be cured of their disease or disability despite the fact that they are provided the very best of care. Additionally, not all adverse events that are the result of medical care are, in fact, errors. An adverse event is defined broadly as an injury that was caused by medical management and that resulted in measurable disability. Some adverse events, termed "unpreventable adverse events," result from a complication that cannot be prevented given the current state of knowledge. Many drugs, even when used appropriately, have a chance of side effects, such as nausea from an antibiotic. The occurrence of nausea would be an adverse event, but it would not be considered a medical error to have given the antibiotic if the patient had an infection that was expected to respond to the chosen antibiotic. Medical errors are adverse events that are preventable with our current state of medical knowledge.

**Unique Aspects of Health Care Errors**

Research, much of it sponsored by AHRQ’s predecessor, the Agency for Health Care Policy and Research, documents that the rate of health care errors is far higher than the error rate in other industries. In one study of intensive care units, the correct action was taken 99.0 percent of the time, translating to 1.7 errors per day. One out of five of these errors were serious and/or potentially fatal. If
performance levels even substantially better than those found in the ICU (for example, 99.9%, a 10-fold reduction in errors) were applied to the airline and banking industries, it would still equate to two dangerous landings per day at O'Hare International Airport and 32,000 checks deducted from the wrong account per hour (Leape, 1994). In these industries, such error rates would not be tolerated.

Health care shares a number of characteristics with these other industries. They all rely on systems which include the interaction of humans and technology to perform a number of functions leading to an outcome (e.g., a safe transcontinental flight, a check correctly deducted from the right account, a patient's recovery from breast cancer). However, health care is distinct in its complexity. For example, a patient in an intensive care unit is the recipient of an average of 178 different activities performed per day that rely on the interaction of monitoring, treatment, and support systems (Leape, 1994). One observer noted that many medical errors can be attributed to the simple fact that the knowledge base to effectively and safely deliver health care exceeds the storage capacity of the human brain (Millenson, 1997).

The decentralized and fragmented nature of the American health care industry contributes to the problem of errors, and will make it a challenge to institute the kind of comprehensive strategy to reduce errors and increase patient safety that the IOM recommends in its report. The work of federally-sponsored researchers such as Lucian Leape and David Bates has illustrated the importance of focusing on the systems of health care delivery in efforts to reduce medical errors. Prescription and delivery of medications provides a dramatic example. It requires the successful completion of at least five interdependent steps: ordering, transcribing, dispensing, delivering, and administering. Inattention to system design leads to numerous opportunities for error in any one of these steps. One study on adverse drug events showed that 78 percent of adverse drug events were due to system failures (Leape, 1995).

Organizational factors are also a distinct challenge in addressing medical errors. Within many hospitals, departments are only loosely linked, and communications between primary care doctors and medical specialists are notoriously poor. As a result, information on problems, as well as improved practices to reduce errors and enhance safety, in one department or one facility does not migrate quickly to others. The variety of settings in which health care is provided (including hospitals, nursing homes, clinics, ambulatory surgery centers, private offices, and patients' homes) and the transitions of patients and providers among them provide additional challenges.

**Growing Concerns About Medical Errors**

The IOM's release of *To Err is Human* brought medical errors and patient safety the attention it has long needed but never had. The information presented in the
MEDICAL ERRORS (Massage Therapy)

report is not new. Indeed, many studies, some as early as the 1960s, showed that patients were frequently injured by the same medical care that was intended to help them (Schimmel, 1964). While evidence of medical error has existed for some time, the report succeeded in capturing the public’s attention by revealing the magnitude of this pervasive problem and presenting it in a uniquely compelling fashion. Medical errors rank as the eighth leading cause of death, killing more Americans than motor vehicle accidents, breast cancer, or AIDS. Additionally, fear of becoming a victim of medical error may lead patients to delay obtaining potentially beneficial medical care, which may allow their illnesses to worsen.

Experiencing harm as a result of receiving health care is a growing concern for the American public. Front-page articles in newspapers, television exposes, and cover stories in magazine have provided the stark details of the latest and most dramatic examples of medical errors. Until recently, the perception of medical errors among health care providers and the public has been shaped by these anecdotes, and remedies have focused on fixing blame on individual providers, including health plans, hospitals, doctors, pharmacists, nurses, and other caregivers. That approach, however, has proven ineffective in addressing patient safety, as documented by the ongoing problems noted in the IOM report. The IOM’s recommended alternative approaches and other ways in which the Federal agencies can work to reduce medical errors are described in this report.

The Epidemiology of Medical Errors

Errors and other adverse events occur regularly in health care settings, but the causes, frequency, severity, preventability, and impact of these events on patient outcomes are not completely understood. A few studies have found an alarmingly high prevalence of adverse events and medical errors in some hospitals. In two large studies of hospital admissions, one in New York using 1984 data and another in Colorado and Utah using 1992 data, the proportions of admissions in which there were adverse events (defined as injuries caused by medical management) were 2.9 and 3.7 percent, respectively (Leape, 1991; Gawande, 1999). In the New York study, errors (defined as avoidable "mistakes in performance or thought") were determined to have caused more than half of the adverse events. However, the absence of standardized definitions of medical error, the lack of coordination and integration of systems to report and monitor errors, and the difficulty in distinguishing preventable errors from currently unavoidable adverse events hamper our understanding of this problem. It is unlikely that we can ever know the precise frequency with which errors occur in health care settings because we must rely on people to recognize that errors were made, to distinguish them from bad outcomes of appropriate treatment, and then to report them.
Definitions and Context

The lack of standardized nomenclature and a universal taxonomy for medical errors complicates the development of a response to the issues outlined in the IOM report. A number of definitions have been applied to medical errors and patient safety. In To Err is Human, the IOM adopted the following definition:

*An error is defined as the failure of a planned action to be completed as intended or the use of a wrong plan to achieve an aim.*

In an effort to thoroughly consider all of the relevant issues related to medical errors, the QuIC expanded of the IOM definition, as follows:

*An error is defined as the failure of a planned action to be completed as intended or the use of a wrong plan to achieve an aim. Errors can include problems in practice, products, procedures, and systems.*

The explicit acknowledgment of the broad scope of errors reflected in this definition respects the responsibilities and capabilities of the Government agencies and departments contributing to this report. The term "patient safety" as used here applies to initiatives designed to prevent adverse outcomes from medical errors. The enhancement of patient safety encompasses three complementary activities: preventing errors, making errors visible, and mitigating the effects of errors.

It is critical to recognize that not all bad outcomes for patients are due to medical errors. Patients may not be cured of their disease or disability despite the fact that they are provided the very best of care. Additionally, not all adverse events that are the result of medical care are, in fact, errors. An adverse event is defined broadly as an injury that was caused by medical management and that resulted in measurable disability (Leape, 1991). Some adverse events, termed "unpreventable adverse events," result from a complication that cannot be prevented given the current state of knowledge. Medical errors are adverse events that are preventable with our current state of medical knowledge.

The consideration of errors is broadened beyond preventable adverse events that lead to actual patient harm to include "near misses," sometimes known as "close calls." A "near miss" is an event or situation that could have resulted in an accident, injury, or illness, but did not, either by chance or through timely intervention. Experience in other industries, including aviation, manufacturing, and nuclear energy, demonstrates that there is as much to learn from close calls as there is from incidents leading to actual harm.

It is also important to situate medical errors within the broader context of problems in health care quality. These can be classified under three categories: overuse (the service is unlikely to have net benefit), underuse (a potentially
beneficial service is withheld), and misuse (a service is inappropriately used) (Chassin, 1998). The majority of medical errors fall into the category of misuse, but some problems with overuse (e.g., when an unnecessary therapy is prescribed, leading to harm) or underuse (e.g., when an error in diagnosis leads to the failure to apply timely treatment) blur these distinctions. These are related quality problems and may be addressed, in part, by using some of the same approaches. In some cases, however, distinct approaches may be required. That is why the IOM has chosen to deal with the issue of errors separately in its report and plans to issue future reports on underuse and overuse quality problems.

**Impact of Organizational and Professional Culture**

Although the complexity of health care delivery systems is one of the factors distinguishing health care from other industries, the professional culture may pose an even greater challenge than does complexity to improving patient safety. The "naming, blaming, and shaming" approach to dealing with errors has hindered medical error reduction, yet it is the most commonly used approach to addressing errors in health care. In fact, this traditional approach has proven counterproductive—it has driven the patient safety problem underground, leading to an implicit "conspiracy of silence" where problems and close calls are not discussed due to fear of reprisal (Koop, 1999).

**Public Fears**

While there has been no unified effort to address the problem of medical errors and patient safety, awareness of the issue has been growing. Americans have a very real fear of medical errors. According to a national poll conducted by the National Patient Safety Foundation:

- Forty-two percent of respondents had been affected by a medical error, either personally or through a friend or relative.
- Thirty-two percent of the respondents indicated that the error had a permanent negative effect on the patient's health.

Overall, the respondents to this survey thought the health care system was "moderately safe" (rated a 4.9 on a 1 to 7 scale, where 1 is not safe at all and 7 is very safe).

Another survey, conducted by the American Society of Health-System Pharmacists, found that Americans are "very concerned" about:

- Being given the wrong medicine (61 percent).
- Being given two or more medicines that interact in a negative way (58 percent).
- Complications from a medical procedure (56 percent).
Most people believe that medical errors are the result of the failures of individual providers. When asked in a survey about possible solutions to medical errors:

- Seventy-five percent of respondents thought it would be most effective to "keep health professionals with bad track records from providing care."
- Sixty-nine percent thought the problem could be solved through "better training of health professionals."

This fear of medical errors was borne out by the interest and attention that the IOM report generated. According to a survey by the Kaiser Family Foundation, 51 percent of Americans followed closely the release of the IOM report on medical errors.

**Where Errors Occur**

Errors occur not only in hospitals but in other health care settings, such as physicians' offices, nursing homes, pharmacies, urgent care centers, and care delivered in the home. Unfortunately, very little data exist on the extent of the problem outside of hospitals. The IOM report indicated, however, that many errors are likely to occur outside the hospital. For example, in a recent investigation of pharmacists, the Massachusetts State Board of Registration in Pharmacy estimated that 2.4 million prescriptions are filled improperly each year in the State.

**Types of Errors**

Most people believe that medical errors usually involve drugs, such as a patient getting the wrong prescription or dosage, or mishandled surgeries, such as amputation of the wrong limb. However, there are many other types of medical errors, including:

- Diagnostic error, such as misdiagnosis leading to an incorrect choice of therapy, failure to use an indicated diagnostic test, misinterpretation of test results, and failure to act on abnormal results.
- Equipment failure, such as defibrillators with dead batteries or intravenous pumps whose valves are easily dislodged or bumped, causing increased doses of medication over too short a period.
- Infections, such as nosocomial and post-surgical wound infections.
- Blood transfusion-related injuries, such as giving a patient the blood of the incorrect type.
- Misinterpretation of other medical orders, such as failing to give a patient a salt-free meal, as ordered by a physician.

Errors can occur at any point in the health care delivery system. The following details some of the more common types of errors.
Medication Errors

These are preventable mistakes in prescribing and delivering medication to patients, such as prescribing two or more drugs whose interaction is known to produce side effects or prescribing a drug to which the patient is known to be allergic.

Research by AHRQ-supported investigators is helping to characterize these errors (called preventable adverse drug events, or ADEs) and suggest how to prevent them.

- In a study of inpatient care in two tertiary care hospitals, errors in ordering and administering medicines accounted for 56 and 34 percent, respectively, of preventable adverse drug events.
- Findings from a second study showed that dosage errors, in particular, were primarily due to the physician's lack of knowledge about the drug or about the patient for whom it was prescribed.

An attempt to identify risk factors for preventable adverse drug reactions among patients admitted to medical and surgical units at two large hospitals found few such factors, which suggested to the researchers that a focus on improving medication systems would prove more effective.

The American Hospital Association lists these as some common types of medication errors:

- incomplete patient information (not knowing about patients' allergies, other medicines they are taking, previous diagnoses, and lab results, for example)
- unavailable drug information (such as lack of up-to-date warnings)
- miscommunication of drug orders, which can involve poor handwriting, confusion between drugs with similar names, misuse of zeroes and decimal points, confusion of metric and other dosing units, and inappropriate abbreviations
- lack of appropriate labeling as a drug is prepared and repackaged into smaller units
- environmental factors, such as lighting, heat, noise, and interruptions that can distract health professionals from their medical tasks.

Surgical Errors

In contrast to ADEs, surgical adverse events (1 in 50 admissions in Colorado and Utah hospitals during 1992), accounted for two-thirds of all adverse events and 1 of 8 hospital deaths in a recent retrospective study of these institutions by an AHRQ fellow.
Diagnostic Inaccuracies

Incorrect diagnoses may lead to incorrect and ineffective treatment or unnecessary testing, which is costly and sometimes invasive. Also, inexperience with a technically difficult diagnostic procedure can affect the accuracy of the results. Here, too, AHRQ-funded researchers have made major contributions.

- One study showed that physicians who performed 100 or more colposcopies (a test used to follow up abnormal Pap smears) a year had more accurate findings than physicians who performed the procedure less often.
- Another study demonstrated that measuring blood pressure with the most commonly used type of equipment often gives incorrect readings that may lead to mismanagement of hypertension.

Human Error

Adverse medical events have existed since the beginning of organized medical practice, but may not have been recognized at the time of their occurrence. Bloodletting and toxic “therapies,” such as mercurials, led to premature deaths, but these deaths were seen as a reflection of the patient’s underlying illness rather than of harmful practice. To some extent, that culture still persists in health care. Although advances in medical technology and knowledge have eliminated these historic practices, errors and mistakes continue to occur at an unacceptably high rate in the delivery of health care. Contrary to popular expectations, doctors, nurses, and other health care professionals are inherently fallible—as are all humans.

Systems Errors

The IOM report notes that the majority of medical errors today are not produced by negligence, lack of education, or lack of training. Rather, errors occur in our health care systems due to poor systems design and organizational factors, much as in any other industry. Health care workers are placed in systems and settings where errors are bound to happen. That is, the systems are designed to achieve a particular set of goals, but inadvertently produce a certain level of errors. For example, health care workers are sometimes expected to work 24-hour shifts to ensure patients are cared for and have some continuity of care, although it is known that overwork and fatigue lead to decreased mental concentration and alertness. These caregivers are expected to function in an environment that is not ergonomically designed for optimal work performance. They are expected to rely on their memories and deliver safe care without substantial investments in information technology or even the simple
application of checklists. They often deliver care through a set of complex processes, although industry has shown that the probability of performing a task perfectly decreases as the number of steps in the process increases. Finally, they are expected to work in a climate where one error, even if not preventable, may mean a catastrophe or the end of a career.

- Investigators discovered that failures at the system level were the real culprits in over three-fourths of adverse drug events.
- Failures in disseminating pharmaceutical information, in checking drug doses and patient identities, and in making patient information available are system errors that accounted for adverse drug events in over half of the hospitals studied.
- One system-level factor, staffing levels of nurses (adjusted for hospital characteristics), was found to influence the incidence of adverse events following major surgery, such as urinary tract infections, pneumonia, thrombosis, and pulmonary compromise.

This research on systemic problems leads investigators to conclude that any effort to reduce medical errors in an organization requires changes to the system design, including possible reorganization of resources by top-level management.

**A Global Challenge**

The medical errors epidemic is a global problem. The United Kingdom, for example, has had some well-publicized difficulties with pediatric surgery outcomes in Bristol. British authorities estimate that 40,000 hospitalized patients die annually as a result of errors, which translates to a 3.7 percent overall rate of errors. The Australian Review of Professional Indemnity Arrangements for Health Care Professionals (Commonwealth Department of Human Services and Health, 1995) also found error to be a serious cause of morbidity and mortality. Australia, the United Kingdom, and Sweden are among the countries that have begun to address this issue. The British Ministry of Health is in the process of making funds available to researchers to investigate medical errors, and is re-engineering its clinical governance programs to provide mechanisms to improve patient safety. Australia has included medical errors as part of its focus on quality, and is initiating a national system for error reduction with enhanced reporting mechanisms. However, efforts to actually translate the limited research available into practice are still at an early stage, at best. Approaches are likely to vary across nations because of differences in health care organization, attitudes toward regulation, and views on patient information and confidentiality. The evidence informing those approaches, however, is likely to be more universal. As a global leader, the United States has a responsibility to the many countries that do not have the resources to devote to the study of this issue.
Lessons from Other Industries

A review of the experience in non-health-care industries offers some lessons that may be applicable to reducing medical errors. Characteristics of error-reducing industries include:

- Not tolerating high error rates, and setting ambitious targets for error reduction initiatives.
- Developing tracking mechanisms that expose errors.
- Relying on the abundant reports of errors and "near misses."
- Thoroughly investigating errors, including a root causes analysis.
- Applying to error reduction a systems approach that embraces a wide array of human factors, technical, and organizational remedies.
- Focusing on systems solutions that do not seek to find individual fault and blame.
- Changing the organizational culture so that it enhances safety and error reduction.
- Allocating adequate resources to error prevention initiatives and the development of the knowledge base to support them.
- Recognizing that solutions often come from unexpected sources, "out of the box" thinking, and new combinations of disciplines (e.g., human factors psychology with aeronautical engineering).

Preventing Errors

Research clearly shows that the majority of medical errors can be prevented:

- One of the landmark studies on medical errors indicated 70 percent of adverse events found in a review of 1,133 medical records were preventable; 6 percent were potentially preventable; and 24 percent were not preventable.
- A study released last year, based on a chart review of 15,000 medical records in Colorado and Utah, found that 54 percent of surgical errors were preventable.

Other potential system improvements include:

- Use of information technology, such as hand-held bedside computers, to eliminate reliance on handwriting for ordering medications and other treatment needs.
- Avoidance of similar-sounding and look-alike names and packages of medication.
- Standardization of treatment policies and protocols to avoid confusion and reliance on memory, which is known to be fallible and responsible for many errors.
The IOM report estimates that 44,000 to 98,000 people each year die from medical errors. Even the lower estimate is higher than the annual mortality from motor vehicle accidents (43,458), breast cancer (42,297), or AIDS (16,516), thus making medical errors the eighth leading cause of death in the United States.

These and other findings of the IOM report are based on research sponsored by a variety of organizations, including the Agency for Healthcare Research and Quality (AHRQ).

For example, a study by AHRQ found that just one type of error—preventable adverse drug events—caused 20% of the yearly patient injuries or deaths in the hospitals that were studied.

**Documentation and Communication**

Poor documentation and communication significantly increase the likelihood of medical errors occurring. It imperative that all medical professionals recognize the necessity for thorough, meaningful, insightful, and legible documentation. In 1997, The Department of Health and Human Services published the following general principles for medical record documentation.

**Why Documentation is Important**

Medical record documentation is required to record pertinent facts, findings, and observations about an individual’s health history including past and present illnesses, examinations, tests, treatments, and outcomes. The medical record chronologically documents the care of the patient and is an important element contributing to high quality care. The medical record facilitates:

- The ability of the physician and other health care professionals to evaluate and plan the patient’s immediate treatment, and to monitor his/her health care over time;
- Communication and continuity of care among physicians and other health care professionals involved in the patient’s care;
- Appropriate utilization review and quality of care evaluations;
- Collection of data that may be useful for research and education

**General Principles of Medical Record Documentation**

1. The medical record should be complete and legible.
2. The documentation of each patient encounter should include:
• Reason for the encounter and relevant history, physical examination findings, history, and prior diagnostic test results;
• Assessment, clinical impression or diagnosis;
• Plan for care;
• Date and legible identity of the healthcare provider

3. Rationale for services
4. Health risk factors should be identified.
5. The patient’s progress, response to treatment, changes in treatment, and revisions in diagnosis should be documented.
6. The CPT and ICD-9CM codes should be supported by the documentation in the medical record.

Pharmacological Components and Management in Therapy

Therapists can play a vital role in reducing the frequency and severity of medical errors. The following recommendations outline some of the many ways that rehabilitation professionals can assist referring physicians with the pharmacological management of their patients.

1. Take a complete and accurate subjective history from each patient that includes:
   A. All previous and current medical problems, noting any inconsistencies or omissions from previously reviewed medical records.
   B. All current medications including dosage, frequency, and subjective side effects.
2. Collection of objective data which includes an assessment of all common therapy relevant pharmacological side effects associated with the medications the patient is taking.
3. Design safe and effective rehabilitation programs that address or accommodate for possible common pharmaceutical side effects.
4. Continuous monitoring and documentation of each patient’s overall condition throughout their entire rehabilitation process.

Undoubtedly, the most important thing that any therapist can do is continuously communicate with physicians. Because therapists often times see the patient much more frequently than the physician does, it is imperative that they act as the doctor’s eyes and ears concerning pharmaceutical management. Therapists should always notify the physician immediately if they suspect that the patient has not provided the doctor with complete or accurate information, if the patient appears to be experiencing side effects from the medication, or the medication is not effectively achieving the desired outcome.
Improving Patient Safety

Research funded by AHRQ and others has been important in identifying the extent and causes of errors. Now, additional research is needed to develop and test better ways to prevent errors, often by reducing the reliance on human memory. Some areas of past research that have shown promise in helping to reduce errors include computerized ADE monitoring, computer-generated reminders for follow-up testing, and standardized protocols.

Computerized ADE Monitoring

Although chart review was found in an AHRQ-funded study to be more accurate than computer tracking and voluntary reporting in identifying adverse drug events, it required five times more personnel time. Researchers concluded that the computerized method was the most efficient means of tracking drug errors.

Computer-Generated Reminders for Follow-up Testing

Some diagnostic tests must be repeated to follow up certain conditions, but a small number of such repeat tests are done too early to yield useful results. In contrast, laboratory results showing that a patient needs critical care may not be communicated in a timely manner.

- One study funded by AHRQ found that a computerized reminder system to alert physicians to the proper timing of repeat tests reduced the number of patients who were subjected to unnecessary repeat testing.
- The same research group subsequently reported that an automatic alerting system for communicating critical laboratory results reduced the time until appropriate treatment when compared with the existing hospital paging system.

Standardized Protocols

An AHRQ-sponsored study of patients in intensive care units who had severe respiratory disease found a four-fold increase in survival rate with the use of computerized treatment protocols.

Still other investigators are testing computerized decision support systems in various patient populations. All of these research efforts reflect AHRQ's commitment to improving patient safety by providing new tools to augment provider judgment.

AHRQ-funded research continues to create and test methods to help clinicians avoid errors in health care delivery. An investigation funded by
AHRQ and the National Institute on Aging will address the incidence and preventability of adverse drug events in elderly patients receiving ambulatory care.

The Agency has recently funded four Centers for Education and Research in Therapeutics (CERTs) as part of a 3-year demonstration program. The CERTs will conduct research to increase understanding of ways to improve the appropriate and effective use of drugs, biologicals, and devices in treatments and to avoid adverse events. These centers will also add to our knowledge of the possible risks of new uses of drugs, and combinations of drugs, as they are prescribed in everyday practice.

In addition, the Agency has recently announced that it will enter into cooperative agreements with nonprofit and for-profit health care organizations to test the effectiveness of the transfer and application of systems-based best practices to reduce medical errors and improve patient safety. This research will help identify high-risk patients or patient groups, providers, health care processes and settings, as well as developing generalizable methods for error reduction.

**Systems Solutions**

The IOM emphasized that most of the medical errors are systems related and not attributable to individual negligence or misconduct. The key to reducing medical errors is to focus on improving the systems of delivering care and not to blame individuals. Health care professionals are simply human and, like everyone else, they make mistakes. But research has shown that system improvements can reduce the error rates and improve the quality of health care:

- A 1999 study indicated that including a pharmacist on medical rounds reduced the errors related to medication ordering by 66 percent, from 10.4 per 1,000 patient days to 3.5 per 1,000 patient days.
- The specialty of anesthesia has reduced its error rate by nearly sevenfold, from 25 to 50 per million to 5.4 per million, by using standardized guidelines and protocols, standardizing equipment, etc.
- One hospital in the Department of Veterans Affairs uses hand-held, wireless computer technology and bar-coding, which has cut overall hospital medication error rates by 70 percent. This system is soon to be implemented in all VA hospitals.
Data Collection and the HHS Patient Safety Task Force

Federal and state agencies, accrediting bodies and other organizations collect data that can provide insights into the causes of medical errors and strategies to increase patient safety, but these separate sources of information are difficult to compare and analyze. In April 2001, Secretary Thompson created the HHS Patient Safety Task Force to coordinate the efforts of these various data-collection sources to promote more consistent, effective use of the information.

Promoting best practices to prevent errors

Since March 1998, the QuIC task force has worked to coordinate the quality of care activities in federal agencies involved in health care. In September 2000, the task force sponsored a national summit on medical errors and patient safety research that included health care providers, administrators, purchasers, policymakers, oversight groups and consumers to address future research needs.

AHRQ included the input from the summit in developing a research agenda to guide funding decisions of public- and private-sector organizations that support patient safety research. The agenda includes efforts to design and test "best practices" for reducing errors, develop the science base to inform these efforts, improve provider education to reduce errors, capitalize on advances in information technology, and build the capacity to further reduce errors.

HHS agencies are also involved in a number of other projects to promote patient safety:

**Improving drug labeling.** The FDA in December 2000 proposed a new, user-friendly format for prescription drug labeling designed to reduce the chances of making medication errors, such as giving the wrong dose or causing adverse interactions between drugs. The system would include a bulleted "highlights" section with information that clinicians are likely to need and review frequently.

**Reducing "high-hazard" risks.** The QuIC task force is working with the Institute for Healthcare Improvement to test strategies for reducing the number of errors committed, particularly in emergency rooms, operating rooms, intensive care units and on-site rescue operations. This is the first such initiative targeted at error reduction in these "high-hazard" environments.

**Developing quality measures.** In 2001, CMS launched a quality initiative to help people who rely on Medicare and Medicaid programs and their family members find the best nursing homes for their needs. Initially, CMS will identify, collect and publish nursing home quality information in
Colorado, Florida, Maryland, Ohio, Rhode Island and Washington, and then will work to expand the demonstration nationally. Over the next several years, CMS will work to develop and publish similar, meaningful consumer information for home health agencies, and eventually hospitals and other types of providers. This information will give beneficiaries, their families and their physicians the information they need to make informed choices of their providers. CMS and AHRQ continue to work with the National Quality Forum, a private group of major employers and other purchasers of health care, to identify and evaluate quality measures.

**Medicare Quality Improvement Organizations (QIOs).** Through State Quality Improvement Organizations (QIOs), formerly known as Medicare’s Peer Review Organizations (PROs), CMS is conducting 14 local pilot projects aimed at improving patient safety. Successful efforts will be expanded in order to improve quality of care across larger groups of patients. CMS already has established a number of national priorities for PROs to improve patient safety, including reducing the use of contraindicated treatments and eliminating unnecessary treatment delays.

**Educating patients and health care providers**

Well-informed patients and health care providers can play a critical role in preventing medical errors. HHS devotes a wide array of resources to education materials targeted at consumers and providers alike. These efforts include:

**Consumer guides.** HHS has numerous pamphlets and guides on preventing medical errors for consumers in both English and Spanish, including "20 Tips to Help Prevent Medical Errors," (Appendix A) a practical guide with research-based recommendations involving potential safety risks related to medications, hospital stays and surgery, and "Five Steps to Safer Health Care," (Appendix B) highlighting ways that patients and their families can take more control over the quality of their health care. These and other consumer publications are available at [http://www.ahrq.gov](http://www.ahrq.gov)

**Research-based information for providers.** AHRQ shares evidence-based information from research about best practices to avoid medical errors in easy-to-use formats for doctors, other clinicians and health care providers. "Making Health Care Safer: A Critical Analysis of Patient Safety Practices," an AHRQ evidence report, is a review of 79 patient safety practices with a list of 73 that are likely to improve patient safety and a description of 11 that the researchers considered highly proven to work but are not performed routinely in the nation's hospitals and nursing homes. HHS agencies also hold interactive workshops and satellite
broadcasts to share important research findings and other information about patient safety. Other efforts include summaries of best practices, including a general guide to promote patient safety, as well as other documents geared to specific topics, such as reducing adverse drug events in hospitals. AHRQ's evidence report on patient safety practices and many other reports are available at http://www.ahrq.gov

**Outreach to states.** AHRQ has partially funded a series of reports to educate state policymakers, including legislators and state health officials, to highlight steps that states can take in order to improve patient safety and reduce medical errors. The reports, prepared by the National Academy of State Health Policy, deal with topics such as state-mandated reporting of medical errors and working with the private sector to improve patient safety. The reports are available at http://www.nashp.org.

**Medication errors information.** The FDA provides updated information about medication errors, including specific drugs that have been confused with one another. The information reflects analysis of voluntary reports from consumers, doctors and other clinicians, as well as mandatory reports from manufacturers. Details are at http://www.fda.gov/cder/drug/MedErrors/. FDA also runs the "Take Time to Care" awareness campaign to educate women and families about taking medications correctly. The effort includes consumer literature, as well as local, interactive educational sessions led by pharmacists and other health professionals. More information is available at http://www.fda.gov/womens/tttc.html.

**National health information infrastructure.** In 2001, the National Committee on Vital and Health Statistics, which advises HHS on health information policy, issued a report outlining a strategy for developing a comprehensive national health information infrastructure that would help reduce medical errors. The committee's report is available at http://www.ncvhs.hhs.gov/nhiilayo.pdf.

**Root Cause Analysis**

A retrospective approach to error analysis, called root cause analysis (RCA), is widely applied to investigate major industrial accidents. RCA has its foundations in industrial psychology and human factors engineering. Many experts have championed it for the investigation of sentinel events in medicine. In 1997, the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) mandated the use of RCA in the investigation of sentinel events in accredited hospitals.
RCA provides a structured and process-focused framework with which to approach sentinel event analysis. Its cardinal tenet is to avoid the pervasive and counterproductive culture of individual blame. Systems and organizational issues can be identified and addressed, and active errors are acknowledged. Systematic application of RCA may uncover common root causes that link a disparate collection of accidents (i.e., a variety of serious adverse events occurring at shift change). Careful analysis may suggest system changes designed to prevent future incidents.

To be credible, RCA requires rigorous application of established qualitative techniques. Once a sentinel event has been identified for analysis (e.g., a major chemotherapy dosing error, a case of wrong-site surgery, or major ABO incompatible transfusion reaction), a multidisciplinary team is assembled to direct the investigation. The members of this team should be trained in the techniques and goals of RCA, as the tendency to revert to personal biases is strong. Multiple investigators allow triangulation or corroboration of major findings and increase the validity of the final results. Based on the concepts of active and latent error described above, accident analysis is generally broken down into the following steps:

1. **Data collection**: establishment of what happened through structured interviews, document review, and/or field observation. These data are used to generate a sequence or timeline of events preceding and following the event.

2. **Data analysis**: an iterative process to examine the sequence of events generated above with the goals of determining the common underlying factors:
   i. Establishment of how the event happened by identification of active failures in the sequence.
   ii. Establishment of why the event happened through identification of latent failures in the sequence which are generalizable.

In order to ensure consideration of all potential root causes of error, one popular conceptual framework for contributing factors has been proposed based on work by Reason. Several other frameworks also exist. The categories of factors influencing clinical practice include institutional/regulatory, organizational/management, work environment, team factors, staff factors, task factors, and patient characteristics. Each category can be expanded to provide more detail. A credible RCA considers root causes in all categories before rejecting a factor or category of factors as non-contributory. A standardized template in the form of a tree (or "Ishikawa") may help direct the process of identifying contributing factors, with such factors leading to the event grouped (on tree "roots") by category. Category labels may vary depending on the setting.

At the conclusion of the RCA, the team summarizes the underlying causes and their relative contributions, and begins to identify administrative and systems problems that might be candidates for redesign.
APPENDIX A

20 Tips to Help Patients Prevent Medical Errors

1. The single most important way you can help to prevent errors is to be an active member of your health care team.

That means taking part in every decision about your health care. Research shows that patients who are more involved with their care tend to get better results.

2. Make sure that all of your doctors know about everything you are taking. This includes prescription and over-the-counter medicines, and dietary supplements such as vitamins and herbs.

At least once a year, bring all of your medicines and supplements with you to your doctor. "Brown bagging" your medicines can help you and your doctor talk about them and find out if there are any problems. It can also help your doctor keep your records up to date, which can help you get better quality care.

3. Make sure your doctor knows about any allergies and adverse reactions you have had to medicines.

This can help you avoid getting a medicine that can harm you.

4. When your doctor writes you a prescription, make sure you can read it.

If you can't read your doctor's handwriting, your pharmacist might not be able to either.

5. Ask for information about your medicines in terms you can understand—both when your medicines are prescribed and when you receive them.

- What is the medicine for?
- How am I supposed to take it, and for how long?
- What side effects are likely? What do I do if they occur?
- Is this medicine safe to take with other medicines or dietary supplements I am taking?
- What food, drink, or activities should I avoid while taking this medicine?

6. When you pick up your medicine from the pharmacy, ask: Is this the medicine that my doctor prescribed?

A study by the Massachusetts College of Pharmacy and Allied Health Sciences found that 88 percent of medicine errors involved the wrong drug or the wrong dose.

7. If you have any questions about the directions on your medicine labels, ask.
Medicine labels can be hard to understand. For example, ask if "four doses daily" means taking a dose every 6 hours around the clock or just during regular waking hours.

8. Ask your pharmacist for the best device to measure your liquid medicine. Also, ask questions if you're not sure how to use it.

Research shows that many people do not understand the right way to measure liquid medicines. For example, many use household teaspoons, which often do not hold a true teaspoon of liquid. Special devices, like marked syringes, help people to measure the right dose. Being told how to use the devices helps even more.

9. Ask for written information about the side effects your medicine could cause.

If you know what might happen, you will be better prepared if it does—or, if something unexpected happens instead. That way, you can report the problem right away and get help before it gets worse. A study found that written information about medicines can help patients recognize problem side effects and then give that information to their doctor or pharmacist.

10. If you have a choice, choose a hospital at which many patients have the procedure or surgery you need.

Research shows that patients tend to have better results when they are treated in hospitals that have a great deal of experience with their condition.

11. If you are in a hospital, consider asking all health care workers who have direct contact with you whether they have washed their hands.

Hand washing is an important way to prevent the spread of infections in hospitals. Yet, it is not done regularly or thoroughly enough. A recent study found that when patients checked whether health care workers washed their hands, the workers washed their hands more often and used more soap.

12. When you are being discharged from the hospital, ask your doctor to explain the treatment plan you will use at home.

This includes learning about your medicines and finding out when you can get back to your regular activities. Research shows that at discharge time, doctors think their patients understand more than they really do about what they should or should not do when they return home.

13. If you are having surgery, make sure that you, your doctor, and your surgeon all agree and are clear on exactly what will be done.

Doing surgery at the wrong site (for example, operating on the left knee instead of the right) is rare. But even once is too often. The good news is that wrong-site
surgery is 100 percent preventable. The American Academy of Orthopaedic Surgeons urges its members to sign their initials directly on the site to be operated on before the surgery.

**Other Steps You Can Take**

14. **Speak up if you have questions or concerns.**

You have a right to question anyone who is involved with your care.

15. **Make sure that someone, such as your personal doctor, is in charge of your care.**

This is especially important if you have many health problems or are in a hospital.

16. **Make sure that all health professionals involved in your care have important health information about you.**

Do not assume that everyone knows everything they need to.

17. **Ask a family member or friend to be there with you and to be your advocate (someone who can help get things done and speak up for you if you can't).**

Even if you think you don't need help now, you might need it later.

18. **Know that "more" is not always better.**

It is a good idea to find out why a test or treatment is needed and how it can help you. You could be better off without it.

19. **If you have a test, don't assume that no news is good news.**

Ask about the results.

20. **Learn about your condition and treatments by asking your doctor and nurse and by using other reliable sources.**

For example, treatment recommendations based on the latest scientific evidence are available from the National Guidelines Clearinghouse at http://www.guideline.gov. Ask your doctor if your treatment is based on the latest evidence.
APPENDIX B

Five Steps to Safer Health Care

1. **Speak up if you have questions or concerns.** Choose a doctor who you feel comfortable talking to about your health and treatment. Take a relative or friend with you if this will help you ask questions and understand the answers. It's okay to ask questions and to expect answers you can understand.

2. **Keep a list of all the medicines you take.** Tell your doctor and pharmacist about the medicines that you take, including over-the-counter medicines such as aspirin, ibuprofen, and dietary supplements like vitamins and herbals. Tell them about any drug allergies you have.
   
   Ask the pharmacist about side effects and what foods or other things to avoid while taking the medicine. When you get your medicine, read the label, including warnings. Make sure it is what your doctor ordered, and you know how to use it. If the medicine looks different than you expected, ask the pharmacist about it.

3. **Make sure you get the results of any test or procedure.** Ask your doctor or nurse when and how you will get the results of tests or procedures. If you do not get them when expected—in person, on the phone, or in the mail—don't assume the results are fine. Call your doctor and ask for them. Ask what the results mean for your care.

4. **Talk with your doctor and health care team about your options if you need hospital care.** If you have more than one hospital to choose from, ask your doctor which one has the best care and results for your condition. Hospitals do a good job of treating a wide range of problems. However, for some procedures (such as heart bypass surgery), research shows results often are better at hospitals doing a lot of these procedures. Also, before you leave the hospital, be sure to ask about follow-up care, and be sure you understand the instructions.

5. **Make sure you understand what will happen if you need surgery.** Ask your doctor and surgeon:
   
   - Who will take charge of my care while I'm in the hospital?
   - Exactly what will you be doing?
   - How long will it take?
   - What will happen after the surgery?
   - How can I expect to feel during recovery?

Tell the surgeon, anesthesiologist, and nurses if you have allergies or have ever had a bad reaction to anesthesia. Make sure you, your doctor, and your surgeon all agree on exactly what will be done during the operation.
References


Gordon P. Diagnostic accuracy of community physicians performing colposcopy. AHCPR Grant HS07162 Final Report; 1996.

Hla KM. Impact of errors in blood pressure measurement. AHCPR Grant HS07301 Final Report; 1994.


Kovner C, Gergen PJ. Nurse staffing levels and adverse events following surgery. *Image J Nurs Sch* 1998;30(4):315-


www.cms.hhs.gov/medlearn/master1.pdf


MEDICAL ERRORS

POST-TEST

1. Which one of the following agencies is part of the federal government's QuiC task force to improve the quality of care for patients in America?
   A. The National Highway Administration
   B. The Institute of Medicine
   C. Agency for Healthcare Research and Quality
   D. National Academy of Sciences

2. According to a study done by Leape in 1995, 78 percent of adverse drug events are due to:
   A. Human Failure
   B. Manufacturing errors
   C. System failures
   D. Patient errors

3. What is defined as “an injury that was caused by medical management and that resulted in measurable disability”?
   A. Medical Error
   B. Adverse Event
   C. Misuse
   D. Malpractice

4. Which of the following causes the greatest number of deaths each year in the United States?
   A. Medical errors
   B. Motor vehicle accidents
   C. Breast cancer
   D. AIDS

5. A study by AHRQ found that preventable adverse drug events caused _____ of the yearly patient injuries or deaths in the hospitals that were studied.
   A. 5%
   B. 10%
   C. 15%
   D. 20%

6. Which of the following is NOT one of the HHS general principles of medical record documentation?
   A. Rationale for services
   B. The patient’s response to treatment
   C. Objective error assessment and analysis
   D. Documentation to support the ICD-9CM code utilized
7. The most important thing that a therapist can do to assist a physician with the pharmacological management of a patient is:
   A. Carefully examine the patient’s medication
   B. Continuously communicate any adverse findings or responses with the referring physician.
   C. Provide information about pharmaceutical alternatives
   D. Alter the patient’s medication dosage if side effects become too great.

8. According to the IOM, the key to reducing medical errors is to focus on:
   A. Holding individuals accountable
   B. Placing more responsibility on the physicians
   C. Increasing patient participation
   D. Improving the systems of delivering health care

9. In 2001, which organization issued a report outlining a strategy for developing a comprehensive national health information infrastructure that would help reduce medical errors?
   A. National Committee on Vital and Health Statistics
   B. The Food and Drug Administration
   C. The Department of Health and Human Services
   D. National Academy of State Health Policy

10. Root cause analysis is
    A. A systemic evaluation to determine blame
    B. A retrospective approach to error analysis
    C. A government mandated prospective error initiative
    D. No longer utilized in the health care industry