Background

A 65-year-old woman presented to the outpatient surgery department of one of the most respected hospitals in the United States for a relatively routine procedure, a trigger finger release on her left hand. Instead, the surgeon performs a completely different procedure—a carpal tunnel release. How could this happen?

Medicine has traditionally treated errors as failings on the part of individual providers, reflecting inadequate knowledge or skill. The systems approach, by contrast, takes the view that most errors reflect predictable human failings in the context of poorly designed systems (e.g., expected lapses in human vigilance in the face of long work hours or predictable mistakes on the part of relatively inexperienced personnel faced with cognitively complex situations). Rather than focusing corrective efforts on punishment or remediation, the systems approach seeks to identify situations or factors likely to give rise to human error, and change the underlying systems of care in order to reduce the occurrence of errors or minimize their impact on patients.

The modern field of systems analysis was pioneered by the British psychologist James Reason, whose analysis of industrial accidents led to fundamental insights about the nature of preventable adverse events. Reason's analysis of errors in fields as diverse as aviation and nuclear power revealed that catastrophic safety failures are almost never caused by isolated errors committed by individuals. Instead, most accidents result from multiple, smaller errors in environments with serious underlying system flaws. Reason introduced the Swiss Cheese model to describe this phenomenon. In this model, errors made by individuals result in disastrous consequences due to flawed systems—the holes in the cheese. This model not only has tremendous explanatory power, it also helps point the way toward solutions—encouraging personnel to try to identify the holes and to both shrink their size and create enough overlap so that they never line up in the future.

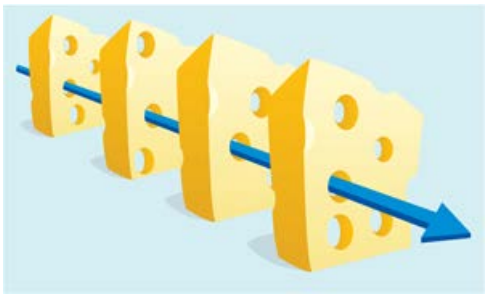

Figure. The Swiss Cheese Model of Medical Errors

Another of Reason's key insights, one that sadly remains underemphasized today, is that human error is inevitable, especially in systems as complex as health care. Simply striving for perfection—or punishing individuals who make mistakes—will not appreciably improve safety, as expecting flawless performance from human beings working in complex, high-stress environments is unrealistic. The systems approach holds that efforts to catch human errors before they occur or block them from causing harm will ultimately be more fruitful than ones that seek to somehow create flawless providers.

Reason used the terms *active errors* and *latent errors* to distinguish individual from system errors. Active errors almost always involve frontline personnel and occur at the point of contact between a human and some aspect of a larger system (e.g., a human–machine interface). By contrast, latent errors are literally accidents waiting to happen—failures of organization or design that allow the inevitable active errors to cause harm.

The terms *sharp end* and *blunt end* correspond to active error and latent error. Personnel at the sharp end may literally be holding a scalpel when the error is committed, (e.g., the surgeon who performed the incorrect

Related Patient Safety Primers

- Checklists
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procedure) or figuratively be administering any kind of treatment. The blunt end refers to the many layers of the health care system not in direct contact with patients, but which influence the personnel and equipment at the sharp end that come into contact with patients. The blunt end thus consists of those who set policy, manage health care institutions, or design medical devices, and other people and forces, which—though removed in time and space from direct patient care—nonetheless affect how care is delivered.

Errors at the sharp end can be further classified into *slips* and *mistakes,* based on the cognitive psychology of task-oriented behavior. Attentional behavior is characterized by conscious thought, analysis, and planning, as occurs in active problem solving. Schematic behavior refers to the many activities we perform reflexively, or as if acting on autopilot. In this construct, slips represent failures of schematic behaviors, or lapses in concentration, and occur in the face of competing sensory or emotional distractions, fatigue, or stress. Mistakes, by contrast, reflect incorrect choices, and more often reflect lack of experience, insufficient training, or outright negligence.

The work of James Reason and Dr. Charles Vincent, another pioneer in the field of error analysis, has established a commonly used classification scheme for latent errors that includes causes ranging from institutional factors (e.g., regulatory pressures) to work environmental factors (e.g., staffing issues) and team factors (e.g., safety culture). These are discussed in more detail in the Root Cause Analysis Primer.

In the incorrect surgery case, the active, or sharp end, error was quite literally committed by the surgeon holding the scalpel. As in most cases, the active error is better classified as a slip, despite the complexity of the procedure. The surgeon was distracted by competing patient care needs (an inpatient consultation) and an emotionally taxing incident (a previous patient suffered extreme anxiety immediately postoperatively, requiring him to console her). However, analysis of the incident also revealed many latent, or blunt end, causes. The procedure was the surgeon's last of six scheduled procedures that day, and delays in the outpatient surgery suite had led to production pressures as well as unexpected changes in the make up of the operating room team. Furthermore, the patient only spoke Spanish and no interpreter was available, meaning that the surgeon (who also spoke Spanish) was the only person to communicate directly with the patient; this resulted in no formal time-out being performed. Computer monitors in the operating room had been placed in such a way that viewing them forced nurses to turn away from the patient, limiting their ability to monitor the surgery and perhaps detect the incorrect procedure before it was completed.

Analyzing Errors Using the Systems Approach

The systems approach provides a framework for analysis of errors and efforts to improve safety. There are many specific techniques that can be used to analyze errors, including retrospective methods such as root cause analysis (or the more generic term systems analysis) and prospective methods such as failure modes effect analysis. Root cause analysis (and similar retrospective analysis techniques) is discussed in more detail in the dedicated Primer.

Failure modes effect analysis (FMEA) attempts to prospectively identify error-prone situations, or failure modes, within a specific process of care. FMEA begins with identifying all the steps that must occur for a given process to occur. Once this process mapping is complete, the FMEA then continues by identifying the ways in which each step can go wrong, the probability that each error can be detected, and the consequences or impact of the error not being detected. The estimates of the likelihood of a particular process failure, the chance of detecting such failure, and its impact are combined numerically to produce a *criticality index*. This criticality index provides a rough quantitative estimate of the magnitude of hazard posed by each step in a high-risk process. Assigning a criticality index to each step allows prioritization of targets for improvement.

For instance, an FMEA analysis of the medication-dispensing process on a general hospital ward might break down all steps from receipt of orders in the central pharmacy to filling automated dispensing machines by pharmacy technicians. Each step in this process would be assigned a probability of failure and an impact score, so that all steps could be ranked according to the product of these two numbers. Steps ranked at the top (i.e., those with the highest criticality indices) would be prioritized for error proofing.

FMEA makes sense as a general approach, and has been used in other high-risk industries. However, the reliability of the technique and its utility in health care are not clear. Different teams charged with analyzing the same process may identify different steps in the process, assign different risks to the steps, and consequently prioritize different targets for improvement. Similar concerns have been raised about root cause analysis.

Developing Solutions for Active and Latent Errors

In attempting to prevent active errors, the differentiation between slips and mistakes is crucial, as the solutions to these two types of errors are very different. Reducing the risk of slips requires attention to the designs of protocols, devices, and work environments—using checklists so key steps will not be omitted, implementing forcing functions to minimize workarounds, removing unnecessary variation in the design of key devices,

eliminating distractions from areas where work requires intense concentration, and implementing other redesign techniques. Reducing the likelihood of mistakes, on the other hand, typically requires more training or supervision, perhaps accompanied by a change in position if the mistake is made habitually by the same worker, or disciplinary action if it is due to disruptive or unprofessional behavior. Although slips are vastly more common than mistakes, health care has typically responded to all errors as if they were mistakes, resorting to remedial education and/or added layers of supervision. Such an approach may have an impact on the behavior of an individual who committed an error, but does nothing to prevent other frontline workers from committing the same error, leaving patients at risk of continued harm unless broader, more systemic, solutions are implemented.

Addressing latent errors requires a concerted approach to revising how systems of care work, how protocols are designed, and how individuals interact with the system. Specific solutions thus vary widely depending on the type of latent error, the severity of the error, and the availability of resources (financial, time, and personnel) available to address the problem. An appropriate systems approach to improving safety requires paying attention to human factors engineering, including the design of protocols, schedules, and other factors that are routinely addressed in other high-risk industries but are only now being analyzed in medicine. Creating a culture of safety in which reporting of active errors is encouraged, analysis of errors to identify latent causes is standard, and frontline workers are not punished for committing slips, is also essential for finding and fixing systematic flaws in health care systems.

What's New in Systems Approach on AHRQ PSNet

STUDY
Building bridges: future directions for medical error disclosure research.
Hannawa AF, Beckman H, Mazor KM, Paul N, Ramsey JV. Patient Educ Couns. 2013 Jun 21; [Epub ahead of print].

AUDIOVISUAL
Conversations with...Lucian Leape, MD.
Lundberg G. MedPage Today. July 5, 2013.

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National Healthcare Safety Network.
Centers for Disease Control and Prevention.

COMMENTARY
Close calls in patient safety: should we be paying closer attention?
Wu AW, Marks CM. CMAJ. 2013 Apr 16; [Epub ahead of print].

STUDY
Quantifying and characterizing adverse events in dermatologic surgery.
O'Neill JL, Lee YS, Solomon JA, et al. Dermatol Surg. 2013;39:872-878.

REVIEW
Teaching medical error disclosure to physicians-in-training: a scoping review.
Stroud L, Wong BM, Hollenberg E, Levinson W. Acad Med. 2013;88:884-892.

STUDY
Patient safety in orthopedic surgery: prioritizing key areas of iatrogenic harm through an analysis of 48,095 incidents reported to a national database of errors.
Panesar SS, Carson-Stevens A, Salvilla SA, Patel B, Mirza SB, Mann B. Drug Healthc Patient Saf. 2013;5:57-65.

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In Conversation with...Albert Wu, MD, MPH.
AHRQ WebM&M [serial online]. July 2008

The Soil, Not the Seed: The Real Problem with Root Cause Analysis.

Patrice Spath, BA, RHIT, and William Minogue, MD. AHRQ WebM&M [serial online]. July 2008

Getting to the Root of the Matter.
Scott A. Flanders, MD; Sanjay Saint, MD, MPH. AHRQ WebM&M [serial online]. June 2005

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Chassin MR, Becher EC. Ann Intern Med. 2002;136:826-833.

Error in medicine. CLASSIC
Leape LL. JAMA. 1994;272:1851-1857.

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Vincent C. N Engl J Med. 2003;348:1051-1056.

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Ring DC, Herndon JH, Meyer GS. N Engl J Med. 2010;363:1950-1957.

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Vincent CA, ed. London: British Medical Journal Publications; 2001.

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Guide to Patient and Family Engagement in Hospital Quality and Safety. Rockville, MD: Agency for Healthcare Research and Quality; June 2013.

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Huddling for high reliability and situation awareness. Goldenhar LM, Brady PW, Sutcliffe KM, Muething SE. BMJ Qual Saf. 2013 Jun 6; [Epub ahead of print].

Culture change in infection control: applying psychological principles to improve hand hygiene. Cumbler E, Castillo L, Satorie L, et al. J Nurs Care Qual. 2013 May 10; [Epub ahead of print].

Adoption of electronic health records grows rapidly, but fewer than half of US hospitals had at least a basic system in 2012. DesRoches CM, Charles D, Furukawa MF, et al. Health Aff (Millwood). 2013 Jul 9; [Epub ahead of print].

Office-based physicians are responding to incentives and assistance by adopting and using electronic health records. Hsiao CJ, Jha AK, King J, Patel V, Furukawa MF, Mostashari F. Health Aff (Millwood). 2013 Jul 9; [Epub ahead of print].

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The evolution of error: error management, cognitive constraints, and adaptive decision-making biases. Johnson DD, Blumstein DT, Fowler JH, Haselton MG. Trends Ecol Evol. 2013 Jun 17; [Epub ahead of print].

Cost of illness of patient-reported adverse drug events: a population-based cross-sectional survey. Gyllensten H, Rehnberg C, Jönsson AK, et al. BMJ Open. 2013;3:e002574.

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Economic Analysis of Medical Malpractice Liability and Its Reform. Arlen J. New York, NY: New York University School of Law; May 9, 2013. Public Law Research Paper No. 13-25.

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Some doctors questioning whether shorter shifts for interns are endangering patients. Boodman SG. Kaiser Health News. July 9, 2013.

NEWSLETTER/JOURNAL

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Robert M. Wachter, MD
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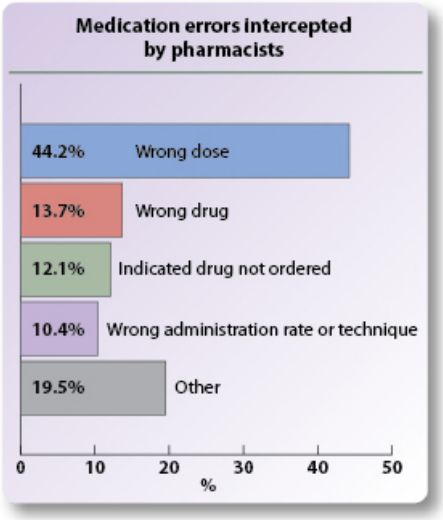

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Commentary by **Nicholas Symons, MBChB, MSc**

CME/CEU credit available for this case

Discharge Instructions in the PACU: Who Remembers?

After changing the type of knee repair being done mid-procedure, a surgeon verbally informed the patient of drastically different discharge instructions in the post-anesthesia care unit but did not provide specific written instructions of the changed procedure or recovery plan to her or her husband.

Commentary by **Kirsten Engel, MD**

Anesthesia: A Weighty Issue

Following general anesthesia for hip repair surgery, an elderly woman with a history of hypertension and obesity developed hypercarbic respiratory failure and was reintubated in the recovery unit. Providers felt the patient had undiagnosed obstructive sleep apnea and questioned whether obese patients undergoing anesthesia should receive formal preoperative screening for it.

Commentary by **Ashish C. Sinha, MD, PhD**

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J. Bryan Sexton, PhD, is director of the Patient Safety Center for the Duke University Health System and an international expert in safety culture and clinician burnout.

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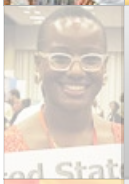

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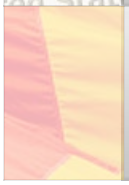

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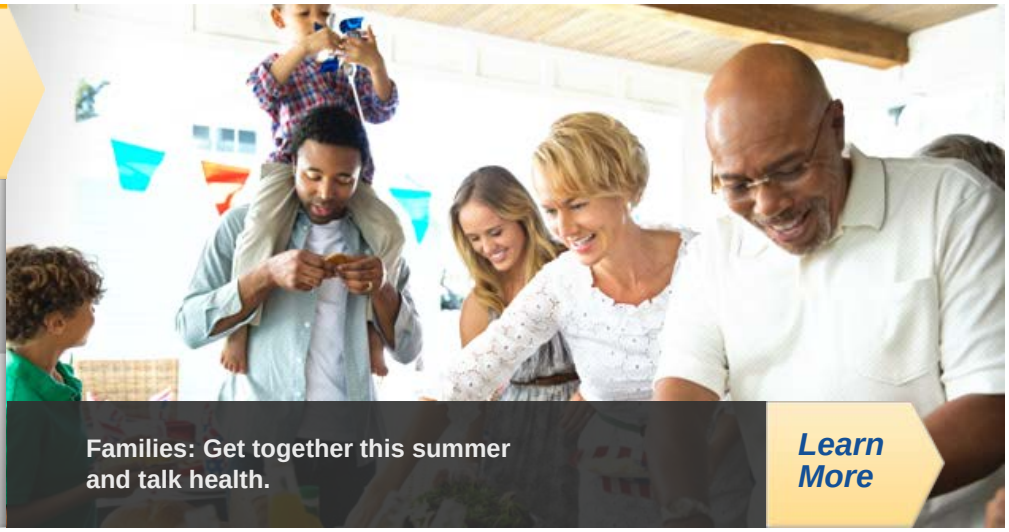

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- **Adverse Events after Hospital Discharge**
  Being discharged from the hospital can be dangerous for patients. Nearly 20% of patients experience an adverse event in the first 3 weeks after discharge, including medication errors, health care–associated infections, and procedural complications.
- **Checklists**
  Though a seemingly simple intervention, checklists have played a leading role in the most significant successes of the patient safety movement, including the near-elimination of central line–associated bloodstream infections in many intensive care units.
- **Computerized Provider Order Entry**
  Computerized provider order entry systems ensure standardized, legible, and complete orders, and—especially when paired with decision support systems—have the potential to sharply reduce medication prescribing errors.
- **Detection of Safety Hazards**
  Health care organizations use a variety of established and emerging methods to prospectively identify safety hazards before errors have occurred and to retrospectively analyze errors to prevent future harm.
- **Diagnostic Errors**
  Thousands of patients die every year due to diagnostic errors. While clinicians' cognitive biases play a role in many diagnostic errors, underlying health care system problems also contribute to missed and delayed diagnoses.
- **Disruptive and Unprofessional Behavior**
  Popular media often depicts physicians as brilliant, intimidating, and condescending in equal measures. This stereotype, though undoubtedly dramatic and even amusing, obscures the fact that disruptive and unprofessional behavior by clinicians poses a definite threat to patient safety.
- **Error Disclosure**
  Many victims of medical errors never learn of the mistake, because the error is simply not disclosed. Physicians have traditionally shied away from discussing errors with patients, due to fear of precipitating a malpractice lawsuit and embarrassment and discomfort with the disclosure process.
- **Handoffs and Signouts**
  Discontinuity is an unfortunate but necessary reality of hospital care. No provider can stay in the hospital around the clock, creating the potential for errors when clinical information is transmitted incompletely or incorrectly between clinicians.
- **Health Care-Associated Infections**
  Although long accepted by clinicians as an inevitable hazard of hospitalization, recent efforts demonstrate that relatively simple measures can prevent the majority of health care–associated infections. As a result, hospitals are under intense pressure to reduce the burden of these infections.
- **Human Factors Engineering**
  Human factors engineering is the discipline that attempts to identify and address safety problems that arise due to the interaction between people, technology, and work environments.
- **Medication Errors**
  Adverse drug events are likely the most common source of preventable harm in both hospitalized and ambulatory patients, and preventing ADEs is a major priority for accrediting bodies and regulatory agencies. Medication errors can occur at any stage of the medication use pathway, and a growing evidence base supports specific strategies to prevent ADEs.
- **Medication Reconciliation**
  Unintended inconsistencies in medication regimens occur with any transition in care. Medication reconciliation refers to the process of avoiding such inadvertent inconsistencies by reviewing the patient's current medication regimen and comparing it with the regimen being considered for the new setting of care.
- **Never Events**
  The list of never events has expanded over time to include adverse events that are unambiguous, serious, and usually preventable. While most are rare, when never events occur, they are devastating to patients and indicate serious underlying organizational safety problems.
- **Nursing and Patient Safety**
  Nurses play a critical role in patient safety through their constant presence at patient's bedside. However, staffing issues and suboptimal working conditions can impede nurses' ability to detect and prevent adverse events.
- **Patient Safety in Ambulatory Care**

The vast majority of health care takes place in the outpatient, or ambulatory, setting, and a growing body of research has identified and characterized factors that influence safety in office practice, the types of errors commonly encountered in ambulatory care, and potential strategies for improving ambulatory safety.

- **Physician Work Hours and Patient Safety**
  Long and unpredictable work hours have been a staple of medical training for centuries. However, little attention was paid to the patient safety effects of fatigue among residents until March 1984, when Libby Zion died due to a medication-prescribing error while under the care of residents in the midst of a 36-hour shift.
- **Rapid Response Systems**
  Rapid response teams represent an intuitively simple concept: when a patient demonstrates signs of imminent clinical deterioration, a team of providers is summoned to the bedside to immediately assess and treat the patient with the goal of preventing adverse clinical outcomes.
- **The Role of the Patient in Safety**
  Efforts to engage patients in safety efforts have focused on three areas: enlisting patients in detecting adverse events, empowering patients to ensure safe care, and emphasizing patient involvement as a means of improving the culture of safety.
- **Root Cause Analysis**
  Initially developed to analyze industrial accidents, root cause analysis is now widely deployed as an error analysis tool in health care. A central tenet of RCA is to identify underlying problems that increase the likelihood of errors while avoiding the trap of focusing on mistakes by individuals.
- **Safety Culture**
  High-reliability organizations consistently minimize adverse events despite carrying out intrinsically hazardous work. Such organizations establish a culture of safety by maintaining a commitment to safety at all levels, from frontline providers to managers and executives.
- **Systems Approach**
  Medicine has traditionally treated errors as failings on the part of individual providers, reflecting inadequate knowledge or skill. The systems approach, by contrast, takes the view that most errors reflect predictable human failings in the context of poorly designed systems.
- **Teamwork Training**
  Providing safe health care depends on highly trained individuals with disparate roles and responsibilities acting together in the best interests of the patient. The need for improved teamwork has led to the application of teamwork training principles, originally developed in aviation, to a variety of health care settings.
- **Voluntary Patient Safety Event Reporting (Incident Reporting)**
  Patient safety event reporting systems are ubiquitous in hospitals and are a mainstay of efforts to detect safety and quality problems. However, while event reports may highlight specific safety concerns, they do not provide insights into the epidemiology of safety problems.
- **Wrong-Site, Wrong-Procedure, and Wrong-Patient Surgery**
  Few medical errors are as terrifying as those that involve patients who have undergone surgery on the wrong body part, undergone the incorrect procedure, or had a procedure intended for another patient. These "wrong-site, wrong-procedure, wrong-patient errors" (WSPEs) are rightly termed never events.

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Patient engagement in patient safety: barriers and facilitators.

Scobie AC, Persaud DD. Patient Saf Qual Healthc. March/April 2010;7:42-47.

This article reviews the literature and describes a framework for patient engagement in safety activities to enable greater patient awareness and participation in error prevention.

Free full text

Related Resources

COMMENTARY

Health literacy and quality: focus on chronic illness care and patient safety.

Rothman RL, Yin HS, Mulvaney S, Co JPT, Homer C, Lannon C. Pediatrics. 2009;124(suppl 3):S315-S326.

STUDY CLASSIC

Communication discrepancies between physicians and hospitalized patients.

Olson DP, Windish DM. Arch Intern Med. 2010;170:1302-1307.

BOOK/REPORT

Advancing Effective Communication, Cultural Competence, and Patient- and Family-Centered Care: A Roadmap for Hospitals.

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STUDY

Am I (un)safe here? Chemotherapy patients' perspectives towards engaging in their safety.

Schwappach DLB, Wernli M. Qual Saf Health Care. 2010;19:e9.

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- United States of America

Human Error. CLASSIC

Reason JT. New York, NY: Cambridge University Press; 1990.

Despite writing almost nothing specifically on health care, clinical psychologist James Reason has influenced modern thinking about medical errors more than any other individual. This book shows why. Although some of the information on error analysis and theory may be too technical for the average reader, Reason's lucid explanations of complex concepts, his easily accessible examples, and his wry sense of humor make this a must-read for those interested in learning safety theory. His book *Managing the Risks of Organizational Accidents* is less theoretical and may be more appropriate for the reader interested in an introduction to Reason's thinking.

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BOOK/REPORT CLASSIC

Set Phasers on Stun: And Other True Tales of Design, Technology, and Human Error.

Casey SM. Santa Barbara, CA: Aegean Publishing Company; 1993.

BOOK/REPORT CLASSIC

Normal Accidents: Living with High-Risk Technologies.

Perrow C. Princeton, NJ: Princeton University Press; 1999. ISBN: 0691004129.

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Cohen T, Ellis WS, Morrissey JJ, Bakuzonis C, David Y, Paperman WD. J Healthc Inf Manag. Fall 2005;19:38-48.

MULTI-USE WEBSITE

The Patient Safety Group.

Boston, MA.

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Produced for the Agency for Healthcare Research and Quality by a team of editors at the University of California, San Francisco with guidance from a prominent Editorial Board and Advisory Panel. The AHRQ PSNet site was designed and implemented by Silverchair.

Background

A checklist is an algorithmic listing of actions to be performed in a given clinical setting, the goal being to ensure that no step will be forgotten. Although a seemingly simple intervention, checklists have a sound theoretical basis in principles of human factors engineering and have played a major role in some of the most significant successes achieved in the patient safety movement.

The field of cognitive psychology classifies most tasks as involving either schematic behavior, tasks performed reflexively or "on autopilot," or attentional behavior, which requires active planning and problem-solving. The types of error associated with each behavior are also different: failures of schematic behavior are called *slips* and occur due to lapses in concentration, distractions, or fatigue, whereas failures of attentional behavior are termed *mistakes* and often are caused by lack of experience or insufficient training. In health care, as in other industries, most errors are caused by slips rather than mistakes, and checklists represent a simple, elegant method to reduce the risk of slips. Flight preparation in aviation is a well-known example, as pilots and air-traffic controllers follow pre-takeoff checklists regardless of how many times they have carried out the tasks involved. By standardizing the list of steps to be followed, and formalizing the expectation that every step will be followed for every patient, checklists have the potential to greatly reduce errors due to slips.

Current Use of Checklists

Checklists garnered well-deserved publicity as a result of their use in the Keystone ICU project, a multicenter study in which a checklist of evidence-based infection control interventions was implemented to reduce the risk of central line–associated bloodstream infections in intensive care unit patients. This intervention achieved a stunning reduction in line infections, with many ICUs completely eliminating line infections for months at a time. An AHRQ-funded initiative subsequently disseminated the use of the Keystone ICU interventions nationwide, and initial results indicate further sustained success. A similar level of success was achieved through implementation of a surgical safety checklist, which included specific steps during induction of anesthesia, surgical timeout, and transfer of the patient out of the operating room. Remarkable reductions in surgical mortality and morbidity were achieved across a wide range of clinical settings. Further research has investigated the use of checklists to improve safety at the time of hospital discharge, improve transfer of information during in-hospital handoffs, and improve the care of intensive care unit and trauma patients.

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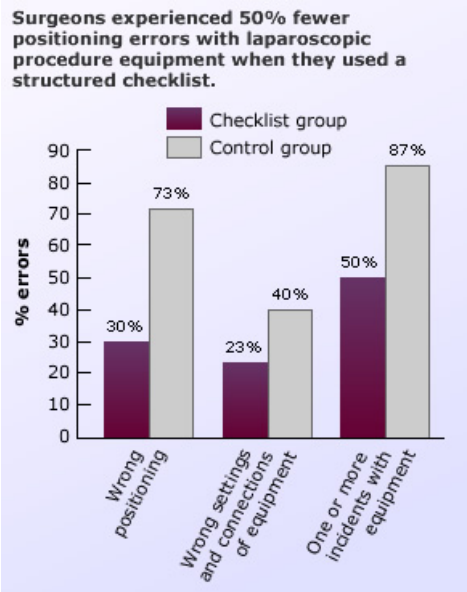

Source: Verdaasdonk EG, Stassen LP, Hoffman WF, van der Elst M, Dankelman J. Can a structured checklist prevent problems with laparoscopic equipment? Surg Endosc. 2008. Available at: http://dx.doi.org/10.1007/s00464-008-0029-3

Controversies

Checklists are a remarkably useful tool in improving safety, but care must be taken not to overemphasize their importance: they cannot solve every patient safety problem, and even when checklists are appropriate, certain co-interventions may be necessary to maximize their impact. The success of checklists in preventing central line infections and improving surgical safety resulted from the strong evidence base supporting each of the individual items in the checklist, and therefore checklists may not be successful in areas where the "gold standard" safety practices have yet to be determined. Successful implementation of a checklist requires extensive preparatory work to maximize safety culture in the unit where checklists are to be used, engage leadership in rolling out and emphasizing the importance of the checklist, and rigorously analyze data to assess use of the checklist and associated clinical outcomes. An emerging issue is whether adherence to evidence-based checklists should be elective: a New England Journal of Medicine editorial by two safety leaders recommended that providers be held accountable for failing to use such checklists. Finally, only certain types of errors can be prevented by checklists: errors in clinical tasks that involve primarily attentional behavior (such as diagnostic errors) require solutions focused on training, supervision, and decision support rather than standardizing behavior. These issues were discussed in detail in a recent commentary by some of the authors of the Keystone ICU study.

What's New in Checklists on AHRQ PSNet

STUDY
Surgical checklists: the human factor.
O'Connor P, Reddin C, O'Sullivan M, O'Duffy F, Keogh I. Patient Saf Surg. 2013;7:14.

BOOK/REPORT
Checklists to Improve Patient Safety.
Chicago, IL: Health Research & Educational Trust; June 2013.

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Impact of the World Health Organization's Surgical Safety Checklist on safety culture in the operating theatre: a controlled intervention study.
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Compliance with the WHO Surgical Safety Checklist: deviations and possible improvements.
Rydenfält C, Johansson G, Odenrick P, Åkerman K, Larsson PA. Int J Qual Health Care. 2013;25:182-187.

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Handoff checklists improve the reliability of patient handoffs in the operating room and postanesthesia care unit.
Boat AC, Spaeth JP. Paediatr Anaesth. 2013;23:647-654.

STUDY

Finding and fixing mistakes: do checklists work for clinicians with different levels of experience?
Sibbald M, De Bruin ABH, van Merrienboer JJG. Adv Health Sci Educ Theory Pract. 2013 Apr 27; [Epub ahead of print].

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Surgical safety checklist: implementation in an ambulatory surgical facility.
Morgan PJ, Cunningham L, Mitra S, et al. Can J Anaesth. 2013;60:528-538.

View all AHRQ PSNet resources on Checklists

Editor's Picks for Checklists

From AHRQ webM&M

Human Factors Engineering Can Teach You How to Be *Surprised* Again.
John Gosbee, MD, MS. AHRQ WebM&M [serial online]. November 2006

What Makes a Good Checklist.
Anne Collins McLaughlin, PhD. AHRQ WebM&M [serial online]. October 2010

From AHRQ PSNet

JOURNAL ARTICLE

A surgical safety checklist to reduce morbidity and mortality in a global population. CLASSIC
Haynes AB, Weiser TG, Berry WR, et al; for the Safe Surgery Saves Lives Study Group. N Engl J Med. 2009;360:491-499.

An intervention to decrease catheter-related bloodstream infections in the ICU. CLASSIC
Pronovost P, Needham D, Berenholtz S, et al. N Engl J Med. 2006;355:2725-2732.

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Transition of care for hospitalized elderly patients—development of a discharge checklist for hospitalists.
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NEWSPAPER/MAGAZINE ARTICLE

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Gawande A. The New Yorker. December 10, 2007;83:86-95.

BOOK/REPORT

The Checklist Manifesto: How to Get Things Right. CLASSIC
Gawande A. New York, NY: Metropolitan Books; 2009. ISBN: 9780805091748.

Safe Patients, Smart Hospitals: How One Doctor's Checklist Can Help Us Change Health Care from the Inside Out. CLASSIC

Pronovost P, Vohr E. New York, NY: Hudson Street Press; 2010. ISBN: 9781594630644.

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Background

An obstetric nurse connects a bag of pain medication intended for an epidural catheter to the mother's intravenous (IV) line, resulting in a fatal cardiac arrest. Newborns in a neonatal intensive care unit are given full-dose heparin instead of low-dose flushes, leading to three deaths from intracranial bleeding. An elderly man experiences cardiac arrest while hospitalized, but when the code blue team arrives, they are unable to administer a potentially life-saving shock because the defibrillator pads and the defibrillator itself cannot be physically connected.

Busy health care workers rely on equipment to carry out life-saving interventions, with the underlying assumption that technology will improve outcomes. But as these examples illustrate, the interaction between workers, the equipment, and their environment can actually increase the risk of disastrous errors. Each of these safety hazards ultimately was attributed to a relatively simple, yet overlooked problem with equipment design. The bag of epidural anesthetic was similar in size and shape to IV medication bags, and, crucially, the same catheter could access both types of bags. Full-dose and prophylactic-dose heparin vials appear virtually identical, and both concentrations are routinely stocked in automated dispensers at the point of care. Multiple brands of defibrillators exist that differ in physical appearance as well as functionality; a typical hospital may have many different models scattered around the building, sometimes even on the same unit.

Human factors engineering is the discipline that attempts to identify and address these issues. It is the discipline that takes into account human strengths and limitations in the design of interactive systems that involve people, tools and technology, and work environments to ensure safety, effectiveness, and ease of use. A human factors engineer examines a particular activity in terms of its component tasks, and then assesses the physical demands, skill demands, mental workload, team dynamics, aspects of the work environment (e.g., adequate lighting, limited noise, or other distractions), and device design required to complete the task optimally. In essence, human factors engineering focuses on how systems work in actual practice, with real—and fallible—human beings at the controls, and attempts to design systems that optimize safety and minimize the risk of error in complex environments.

Human factors engineering has long been used to improve safety in many industries outside of health care—it has been employed to analyze errors in aviation, automobiles, and the Three Mile Island nuclear power plant accident. Its application to health care is relatively recent; pioneering studies of human factors in anesthesia were integral to the redesign of anesthesia equipment, significantly reducing the risk of injury or death in the operating room.

Applications of Human Factors Engineering to Improving Safety

The very nature of human factors engineering precludes "one size fits all" solutions, but several tools and techniques are commonly used as human factors approaches to addressing safety issues.

Usability testing—Human factors engineers test new systems and equipment under real-world conditions as much as possible, in order to identify unintended consequences of new technology. One prominent example of the clinical applicability of usability testing involves electronic medical records and computerized provider order entry (CPOE). A seminal study found increased mortality in a pediatric intensive care unit after implementation of a commercial CPOE system, attributable in part to an unnecessarily cumbersome order entry process that reduced clinicians' availability at the bedside. Usability testing might have identified this issue and prompted earlier implementation of solutions—such as standardized order sets and the ability to obtain emergency medications outside of the CPOE system—that subsequently allowed for successful implementation of the system elsewhere. Simulated clinical scenarios may be used to conduct usability testing, as was performed in another study that identified significant limitations of existing CPOE systems. Simulated resuscitation scenarios

have also helped identify usability problems with defibrillators.

Usability testing is also essential for identifying workarounds—the consistent bypassing of policies or safety procedures by frontline workers. Workarounds frequently arise because of flawed or poorly designed systems that actually increase the time necessary for workers to complete a task. As a result, frontline personnel work around the system in order to get work done efficiently. In the obstetric example above, the hospital had implemented a bar-code system designed to prevent medication administration errors. However, the system did not reliably scan IV bags. Nurses therefore developed a workaround for urgent situations, whereby they would administer the IV medication without scanning the bar code, and only later manually document its administration. This workaround was deemed to be a substantial contributor to the ultimately fatal error.

Forcing functions—An aspect of a design that prevents an unintended or undesirable action from being performed or allows its performance only if another specific action is performed first. For example, automobiles are now designed so that the driver cannot shift into reverse without first putting his or her foot on the brake pedal. Forcing functions need not involve device design. One of the first forcing functions identified in health care was the removal of concentrated potassium from general hospital wards. This action helps prevent the inadvertent addition of concentrated potassium to intravenous solutions prepared by nurses on the wards, an error that has produced small but consistent numbers of deaths for many years.

Standardization—An axiom of human factors engineering is that equipment and processes should be standardized whenever possible, in order to increase reliability, improve information flow, and minimize cross-training needs. Standardizing equipment across clinical settings (as in the defibrillator example above) is one basic example, but standardized processes are increasingly being implemented as safety measures. The widening use of checklists as a means of ensuring that safety steps are performed in the correct order has its roots in human factors engineering principles.

Resiliency efforts—Given that unexpected events are likely to occur, attention needs to be given to their detection and mitigation before they worsen. Rather than focus on error and design efforts to preclude it, resiliency approaches tap into the dynamic aspects of risk management, exploring how organizations anticipate and adapt to changing conditions and recover from system anomalies. Building on insights from high-reliability organizations, complex adaptive systems, and resourceful providers at the point of care, resilience is viewed as a critical system property, reflecting the organization's capacity to bounce back in the face of continuing pressures and challenges when the margins of safety have become thin.

Despite the above examples, it is generally agreed that human factors principles are underutilized in examination of safety problems and in designing potential solutions. The ever-lengthening list of unintended consequences of CPOE can, in part, be viewed as a failure to appropriately design such systems with human factors in mind.

What's New in Human Factors Engineering on AHRQ PSNet

COMMENTARY
Strategies for improving communication in the emergency department: mediums and messages in a noisy environment.
Welch SJ, Cheung DS, Apker J, Patterson ES. Jt Comm J Qual Patient Saf. 2013;39:279-286.

CALIFORNIA MEETING/CONFERENCE
2013 International Annual Meeting of the Human Factors and Ergonomics Society.
Human Factors and Ergonomics Society. September 30–October 4, 2013; Hilton San Diego Bayfront Hotel, San Diego, CA.

STUDY
Missed medication doses in hospitalised patients: a descriptive account of quality improvement measures and time series analysis.
Coleman JJ, Hodson J, Brooks HL, Rosser D. Int J Qual Health Care. 2013 Jun 5; [Epub ahead of print].

COMMENTARY
The pursuit of better diagnostic performance: a human factors perspective.
Henriksen K, Brady J. BMJ Qual Saf. 2013 May 23; [Epub ahead of print].

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Effect of noise on auditory processing in the operating room.
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Grundgeiger T, Sanderson PM, Beltran Orihuela C, et al. Ergonomics. 2013;56:579-589.

View all AHRQ PSNet resources on Human Factors Engineering

Editor's Picks for Human Factors Engineering

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Anita L. Tucker, DBA, MS. AHRQ WebM&M [serial online]. August 2009

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Tim Vanderveen, PharmD, MS. AHRQ WebM&M [serial online]. May 2009

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Benjamin S. Abella, MD, MPhil; Dana P. Edelson, MD. AHRQ WebM&M [serial online]. July/August 2007

Human Factors Engineering Can Teach You How to Be *Surprised* Again.
John Gosbee, MD, MS. AHRQ WebM&M [serial online]. November 2006

In Conversation With...Donald A. Norman, PhD.
AHRQ WebM&M [serial online]. November 2006

Thin Air.
David M. Gaba, MD. AHRQ WebM&M [serial online]. October 2004

From AHRQ PSNet

JOURNAL ARTICLE

Preventable anesthesia mishaps: a study of human factors. CLASSIC
Cooper JB, Newbower RS, Long CD, McPeek B. Anesthesiology. 1978;49:399-406.

Ergonomic and human factors affecting anesthetic vigilance and monitoring performance in the operating room environment. CLASSIC
Weinger MB, Englund CE. Anesthesiology. 1990;73:995-1021.

An intervention to decrease catheter-related bloodstream infections in the ICU. CLASSIC
Pronovost P, Needham D, Berenholtz S, et al. N Engl J Med. 2006;355:2725-2732.

A surgical safety checklist to reduce morbidity and mortality in a global population. CLASSIC
Haynes AB, Weiser TG, Berry WR, et al; for the Safe Surgery Saves Lives Study Group. N Engl J Med. 2009;360:491-499.

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Pronovost PJ, Bo-Linn GW. JAMA. 2012;308:769-770.

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Patient Safety Primers > What are Patient Safety Primers?

Root Cause Analysis

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Background

Root cause analysis (RCA) is a structured method used to analyze serious adverse events. Initially developed to analyze industrial accidents, RCA is now widely deployed as an error analysis tool in health care. A central tenet of RCA is to identify underlying problems that increase the likelihood of errors while avoiding the trap of focusing on mistakes by individuals. The goal of RCA is thus to identify both active errors (errors occurring at the point of interface between humans and a complex system) and latent errors (the hidden problems within health care systems that contribute to adverse events).

RCAs should generally follow a prespecified protocol that begins with data collection and reconstruction of the event in question through record review and participant interviews. A multidisciplinary team should then analyze the sequence of events leading to the error, with the goals of identifying how the event occurred (through identification of active errors) and why the event occurred (through systematic identification and analysis of latent errors) (Table). The ultimate goal of RCA, of course, is to prevent future harm by eliminating the latent errors that so often underlie adverse events.

Table. Factors That May Lead to Latent Errors

Type of Factor	Example
Institutional/regulatory	A patient on anticoagulants received an intramuscular pneumococcal vaccination, resulting in a hematoma and prolonged hospitalization. The hospital was under regulatory pressure to improve its pneumococcal vaccination rates.
Organizational/management	A nurse detected a medication error, but the physician discouraged her from reporting it.
Work environment	Lacking the appropriate equipment to perform hysteroscopy, operating room staff improvised using equipment from other sets. During the procedure, the patient suffered an air embolism.
Team environment	A surgeon completed an operation despite being informed by a nurse and the anesthesiologist that the suction catheter tip was missing. The tip was subsequently found inside the patient, requiring reoperation.
Staffing	An overworked nurse mistakenly administered insulin instead of an antinausea medication, resulting in hypoglycemic coma.
Task-related	An intern incorrectly calculated the equivalent dose of long-acting MS Contin for a patient who had been receiving Vicodin. The patient experienced an opiate overdose and aspiration pneumonia, resulting in a prolonged ICU course.
Patient characteristics	The parents of a young boy misread the instructions on a bottle of acetaminophen, causing their child to experience liver damage.

As an example, a classic paper described a patient who underwent a cardiac procedure intended for another, similarly named patient. A traditional analysis might have focused on assigning individual blame, perhaps to the nurse who sent the patient for the procedure despite the lack of a consent form. However, the subsequent RCA revealed 17 distinct errors ranging from organizational factors (the cardiology department used a homegrown, error-prone scheduling system that identified patients by name rather than by medical record number) to work environment factors (a neurosurgery resident who suspected the mistake did not challenge the cardiologists because the procedure was at a technically delicate juncture). This led the hospital to implement a series of systematic changes to reduce the likelihood of a similar error in the future.

RCA is a widely used term, but many find it misleading. As illustrated by the Swiss cheese model, multiple errors and system flaws often must intersect for a critical incident to reach the patient. Labeling one or even several of these factors as "causes" may place undue emphasis on specific "holes in the cheese" and obscure the overall relationships between different layers and other aspects of system design. Accordingly, some have

suggested replacing the term "root cause analysis" with "systems analysis."

Effectiveness of Root Cause Analysis

RCA is one of the most widely used approaches to improving patient safety, but perhaps surprisingly, few data exist to support its effectiveness. As noted in a recent commentary, much of the problem lies in how RCAs are interpreted rather than in how they are performed, since there is no consensus on how hospitals should follow up or analyze RCA data. This limits the utility of RCA as a quality improvement tool. Another issue is that few formal mechanisms exist for analysis of multiple RCAs across institutions. As an individual RCA is essentially a case study of a specific error, analysis of multiple RCAs performed at different institutions may help identify patterns of error and point the way toward solutions. Some states mandate performance of an RCA for certain types of errors (including never events) and report the findings of these RCAs in aggregate. Ultimately, Patient Safety Organizations listed by AHRQ will also serve this function.

Current Context

The Joint Commission has mandated use of RCA to analyze sentinel events (such as wrong-site surgery) since 1997. As of April 2007, 26 states have mandated reporting of serious adverse events (increasingly using the National Quality Forum's list of "Never Events"), and many states also require that RCA be performed and reported after any serious event. Although no data are yet available on this subject, RCA use has likely increased with the growth in mandatory reporting systems.

What's New in Root Cause Analysis on AHRQ PSNet

BOOK/REPORT
Report on the ISPE Drug Shortages Survey.
Tampa, FL: International Society for Pharmaceutical Engineering; June 2013.

COMMENTARY
Nursing student medication errors: a case study using root cause analysis.
Dolansky MA, Druschel K, Helba M, Courtney K. J Prof Nurs. 2013;29:102-108.

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Editor's Picks for Root Cause Analysis

From AHRQ web M&M

In Conversation with...Albert Wu, MD, MPH.
AHRQ WebM&M [serial online]. July 2008

The Soil, Not the Seed: The Real Problem with Root Cause Analysis.
Patrice Spath, BA, RHIT, and William Minogue, MD. AHRQ WebM&M [serial online]. July 2008

Advancing Patient Safety through State Reporting Systems.
Jill Rosenthal, MPH. AHRQ WebM&M [serial online]. June 2007

Getting to the Root of the Matter.
Scott A. Flanders, MD; Sanjay Saint, MD, MPH. AHRQ WebM&M [serial online]. June 2005

From AHRQ PSNet

JOURNAL ARTICLE

Effectiveness and efficiency of root cause analysis in medicine. CLASSIC
Wu AW, Lipshutz AKM, Pronovost PJ. JAMA. 2008;299:685-687.

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Woloshynowych M, Rogers S, Taylor-Adams S, Vincent C. Health Technol Assess. May 2005;9:1-158.

The Veterans Affairs root cause analysis system in action. CLASSIC
Bagian JP, Gosbee J, Lee CZ, Williams L, McKnight SD, Mannos DM. Jt Comm J Qual Improv. 2002;28:531-545.

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Chassin MR, Becher EC. Ann Intern Med. 2002;136:826-833.

Shaping systems for better behavioral choices: lessons learned from a fatal medication error.

CLASSIC

Smetzer J, Baker C, Byrne FD, Cohen MR. Jt Comm J Qual Patient Saf. 2010;36:152-163, 1AP-2AP.

BOOK/REPORT

Serious Reportable Events in Healthcare—2011 Update. CLASSIC
Washington, DC: National Quality Forum; 2011. ISBN: 9780982842188.

WEB RESOURCE

National Center for Patient Safety (NCPS).
Department of Veterans Affairs (VA), PO Box 486, Ann Arbor, MI 48106-0486.

Sentinel Event. CLASSIC
The Joint Commission.

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Understanding and responding to adverse events. CLASSIC

Vincent C. N Engl J Med. 2003;348:1051-1056.

In this article, Vincent describes the investigation of adverse events and how to provide support to patients' families and care providers in the wake of such events. Adapting Reason's organizational-accident model, Vincent develops a framework of contributory factors that can be applied to a specific incident. He emphasizes the importance of identifying specific care management problems and analyzing them individually. Vincent outlines steps in the investigation process, highlighting specific sources of information an investigator might use. He also outlines steps for ensuring proper care of patients who have been harmed and providing adequate support for staff involved in the error.

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COMMENTARY

Patient safety in cataract surgery.

Kelly SP, Astbury NJ. Eye. 2006;20:275-282.

BOOK/REPORT

Learning how to learn: compliance with patient safety alerts in the NHS.

In: On the State of the Public Health: Annual Report of the Chief Medical Officer 2004. London, England: Department of Health; 2005.

MULTI-USE WEBSITE

Patient Safety.

National Patient Safety Agency, BMJ Publishing Group, Institute for Healthcare Improvement.

COMMENTARY

Applying hierarchical task analysis to medication administration errors.

Lane R, Stanton NA, Harrison D. Appl Ergon. 2006;37:669-679.

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Glossary

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Definitions abound in the medical error and patient safety literature, with subtle and not-so-subtle variations in the meanings of important terms. We have tried to adopt the most straightforward terminology, with definitions that enjoy the widest use.

Production Pressure:
Represents the pressure to put quantity of output—for a product or a service—ahead of safety. This pressure is seen in its starkest form in the line speed of factory assembly lines, famously demonstrated by Charlie Chaplin in *Modern Times*, as he is carried away on a conveyor belt and into the giant gears of the factory by the rapidly moving assembly line.

In health care, production pressure refers to delivery of services—the pressure to run hospitals at 100% capacity, with each bed filled with the sickest possible patients who are discharged at the first sign that they are stable, or the pressure to leave no operating room unused and to keep moving through the schedule for each room as fast as possible. In a survey of anesthesiologists, half of respondents stated that they had witnessed at least one case in which production pressure resulted in what they regarded as unsafe care. Examples included elective surgery in patients without adequate preoperative evaluation and proceeding with surgery despite significant contraindications.

Production pressure produces an organizational culture in which frontline personnel (and often managers) are reluctant to suggest any course of action that compromises productivity, even temporarily. For instance, in the survey of anesthesiologists, respondents reported pressure by surgeons to avoid delaying cases through additional patient evaluation or canceling cases, even when patients had clear contraindications to surgery.

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The Collection >

Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery. CLASSIC

The Joint Commission.

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According to an AHRQ-supported study, wrong-site surgery occurred at a rate of approximately 1 per 113,000 operations between 1985 and 2004. In July 2004, The Joint Commission enacted a Universal Protocol that was developed through expert consensus on principles and steps for preventing wrong-site, wrong-procedure, and wrong-person surgery. The Universal Protocol applies to all accredited hospitals, ambulatory care, and office-based surgery facilities. The protocol requires performing a time out prior to beginning surgery, a practice that has been shown to improve teamwork and decrease the overall risk of wrong-site surgery. This Web site includes a number of resources and facts related to the Universal Protocol. Wrong-site, wrong-procedure, and wrong-patient errors are all now considered never events by the National Quality Forum and sentinel events by The Joint Commission. The Centers for Medicare and Medicaid Services have not reimbursed for any costs associated with these surgical errors since 2009.

Information

Related Resources

COMMENTARY

Surgical site verification: A through Z.

Dunn D. J Perianesth Nurs. 2006;21:317-328.

NEWSPAPER/MAGAZINE ARTICLE

'Wrong site' surgeries on the rise.

Davis R. USA Today. April 17, 2006.

MEASUREMENT TOOL/INDICATOR

AORN Evaluation of the Universal Protocol.

Association of PeriOperative Registered Nurses.

STUDY CLASSIC

Operating room briefings and wrong-site surgery.

Makary MA, Mukherjee A, Sexton BJ, et al. J Am Coll Surg. 2007;204:236-243.

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Find Related Resources by...

Resource Type
- Organizational Policy/Guidelines

Setting of Care
- Operating Room

Target Audience
- Physicians
- Nurses
- Health Care Executives and Administrators
- Patients

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- Surgery

Safety Target
- Wrong Patient
- Wrong-Site Surgery
- Wrong-Site Surgery

Approach to Improving Safety
- Critical Pathways
- Read Back Protocols
- Provider-Patient Communication

Origin/Sponsor
- United States of America

Produced for the Agency for Healthcare Research and Quality by a team of editors at the University of California, San Francisco with guidance from a prominent Editorial Board and Advisory Panel. The AHRQ PSNet site was designed and implemented by Silverchair.

Is failure mode and effect analysis reliable?

Shebl NA, Franklin BD, Barber N. J Patient Saf. 2009;5:86-94.

Failure mode and effect analysis (FMEA) is a widely used tool for hazard analysis. However, in this study, independent FMEA of the same process conducted by separate groups failed to reach similar conclusions regarding potential failures and their severity.

PubMed citation
Available at

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Setting of Care
- General Hospitals

Target Audience
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Clinical Area
- General Internal Medicine
- Hospital Medicine
- Infectious Diseases

Safety Target
- Medication Errors/Preventable Adverse Drug Events

Approach to Improving Safety
- Failure Mode Effects Analysis

Origin/Sponsor
- United Kingdom

Related Resources

STUDY

Medication errors: how reliable are the severity ratings reported to the National Reporting and Learning System?

Williams SD, Ashcroft DM. Int J Qual Health Care. 2009;21:316-320.

NEWSPAPER/MAGAZINE ARTICLE

Following the patient journey to improve medicines management and reduce errors.

Crocker C. Nurs Times. 2009 Nov 24;105:12-15.

STUDY CLASSIC

The effect of hospital-acquired *Clostridium difficile* infection on in-hospital mortality.

Oake N, Taljaard M, van Walraven C, Wilson K, Roth V, Forster AJ. Arch Intern Med. 2010;170:1804-1810.

STUDY

Medication details documented on hospital discharge: cross-sectional observational study of factors associated with medication non-reconciliation.

Grimes TC, Duggan CA, Delaney TP, et al. Br J Clin Pharmacol. 2011;71:449-457.

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Effectiveness and efficiency of root cause analysis in medicine. CLASSIC

Wu AW, Lipshutz AKM, Pronovost PJ. JAMA. 2008;299:685-687.

Application of root cause analysis (RCA) continues to serve an important role in improving patient safety and quality, with past studies describing RCA use in Veterans Affairs facilities and tertiary referral hospitals. This commentary discusses the history and experience of RCA and points out the lack of evidence supporting its use to reduce risk or improve safety. Also absent are best practices for establishing recommendations for action, follow-up, and analyzing results. The authors suggest that many recommendations stemming from RCAs should focus at the level of the health care system to prevent the inefficiencies of having individual institutions recycle the same discussions locally. This would require greater collaboration among relevant national stakeholders to develop and share mechanisms for deploying scarce implementation resources. A past AHRQ WebM&M commentary discusses the steps in conducting an RCA.

PubMed citation
Available at

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- Risk Managers
- Quality and Safety Professionals

Approach to Improving Safety
- Root Cause Analysis

Origin/Sponsor
- United States of America

Related Resources

STUDY
Responding to patient safety incidents: the "seven pillars."
McDonald TB, Helmchen LA, Smith KM, et al. Qual Saf Health Care. 2010;19:e11.

COMMENTARY
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Cohen MR, Smetzer JL. Hosp Pharm. 2010:45;352-355.

STUDY
Wrong-site craniotomy: analysis of 35 cases and systems for prevention.
Cohen FL, Mendelsohn D, Bernstein M. J Neurosurg. 2010;113:461-473.

STUDY
What's past is prologue: organizational learning from a serious patient injury.
Tamuz M, Franchois KE, Thomas EJ. Safety Sci. 2011;49:75-82.

View all related resources...

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AHRQ PSNet patient safety network

Glossary

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Definitions abound in the medical error and patient safety literature, with subtle and not-so-subtle variations in the meanings of important terms. We have tried to adopt the most straightforward terminology, with definitions that enjoy the widest use.

Forcing Function:
An aspect of a design that prevents a target action from being performed or allows its performance only if another specific action is performed first. For example, automobiles are now designed so that the driver cannot shift into reverse without first putting her foot on the brake pedal. Forcing functions need not involve device design. For instance, one of the first forcing functions identified in health care is the removal of concentrated potassium from general hospital wards. This action is intended to prevent the inadvertent preparation of intravenous solutions with concentrated potassium, an error that has produced small but consistent numbers of deaths for many years.

Close Window

Glossary

Close Window

Definitions abound in the medical error and patient safety literature, with subtle and not-so-subtle variations in the meanings of important terms. We have tried to adopt the most straightforward terminology, with definitions that enjoy the widest use.

Workaround:
From the perspective of frontline personnel trying to accomplish their work, the design of equipment or the policies governing work tasks can seem counterproductive. When frontline personnel adopt consistent patterns of work or ways of bypassing safety features of medical equipment, these patterns and actions are referred to as *workarounds*. Although workarounds "fix the problem," the system remains unaltered and thus continues to present potential safety hazards for future patients.

From a definitional point of view, it does not matter if frontline users are justified in working around a given policy or equipment design feature. What does matter is that the motivation for a workaround lies in getting work done, not laziness or whim. Thus, the appropriate response by managers to the existence of a workaround should not consist of reflexively reminding staff about the policy and restating the importance of following it. Rather, workarounds should trigger assessment of workflow and the various competing demands for the time of frontline personnel. In busy clinical areas where efficiency is paramount, managers can expect workarounds to arise whenever policies create added tasks for frontline personnel, especially when the extra work is out of proportion to the perceived importance of the safety goal.

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Patient Safety Primers > What are Patient Safety Primers?

Disruptive and Unprofessional Behavior

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• Safety Culture
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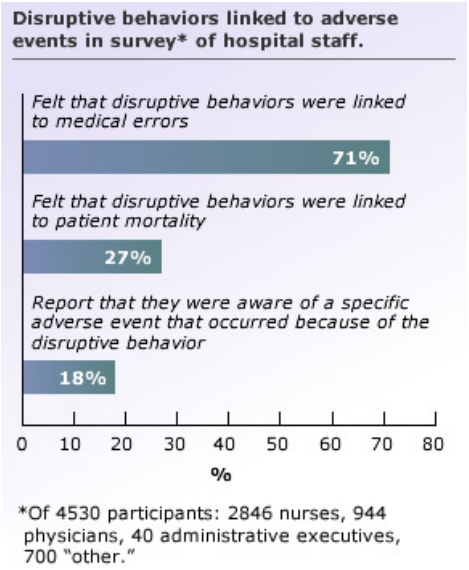
Background

Although the television physician of old was sometimes depicted as grandfatherly (Marcus Welby), today's iconic TV physician is Dr. Gregory House: brilliant, irascible, and virtually impossible to work with. This stereotype, though undoubtedly dramatic and even amusing, obscures the fact that disruptive and unprofessional behavior by clinicians poses a definite threat to patient safety. Such behavior is common: in a 2008 survey of nurses and physicians at more than 100 hospitals, 77% of respondents reported witnessing physicians engage in disruptive behavior (most commonly verbal abuse of another staff member), and 65% reported witnessing disruptive behavior by nurses. Most respondents also believed that unprofessional actions increased the potential for medical errors and preventable deaths. Disruptive and disrespectful behavior by physicians has also been tied to nursing dissatisfaction and likelihood of leaving the nursing profession, and has been linked to adverse events in the operating room. Physicians in high-stress specialties such as surgery, obstetrics, and cardiology are considered to be most prone to disruptive behavior. These concerns should not obscure the fact that no more than 2%-4% of health care professionals at any level regularly engage in disruptive behavior.



Source: Rosenstein AH, O'Daniel M. A survey of the impact of disruptive behaviors and communication defects on patient safety. Jt Comm J Qual Patient Saf. 2008:34;464-471. [go to PubMed]

Although there is no standard definition of disruptive behavior, most authorities include any behavior that shows disrespect for others, or any interpersonal interaction that impedes the delivery of patient care. Fundamentally, disruptive behavior by individuals subverts the organization's ability to develop a culture of safety. Two of the central tenets of a safe culture—teamwork across disciplines and a blame-free environment for discussing safety issues—are directly threatened by disruptive behavior. An environment in which frontline caregivers are frequently demeaned or harassed reinforces a steep authority gradient and contributes to poor communication, in turn reducing the likelihood of errors being reported or addressed. Indeed, a workplace culture that tolerates demeaning or insulting behavior is likely to be one in which workers are "named, blamed and shamed" for making an error. The seriousness of this issue was underscored by a 2008 Joint Commission sentinel event alert, which called attention to this problem.

Preventing and Addressing Disruptive Behavior

As the sentinel event alert noted, "There is a history of tolerance and indifference to intimidating and disruptive behaviors in health care." This attitude is so widespread that, in some settings, disruptive behavior is considered the norm. Several studies have demonstrated that unprofessional behavior during medical school is linked to subsequent disciplinary action by licensing boards, suggesting that an early emphasis on teaching professionalism and addressing disruptive behavior during training may prevent subsequent incidents.

Unfortunately, there are few data to guide efforts to prevent and address disruptive behaviors. It is clear that eliminating such behaviors, and developing a strong culture of safety, requires a strong organizational emphasis. Role modeling desired behaviors, maintaining a confidential incident reporting system, and training managers in conflict resolution and collaborative practice are likely to be beneficial. Although not formally studied, other interventions designed to improve a culture of safety, such as teamwork training and structured communication protocols, may have the potential to reduce disruptive behaviors, or at least promote early identification of them. An editorial by Dr. Lucian Leape, one of the founders of the patient safety movement, proposed a systems-level approach to identifying, monitoring, and remediating poorly performing physicians, including those who regularly engage in unprofessional behavior. This approach would require collaboration between hospital accreditation organizations, federal and state medical licensing boards, and individual hospitals to establish formal standards for professional conduct, monitor adherence to those standards through confidential evaluations, and provide punishment and/or remediation in response to violations.

Although most patient safety problems are attributable to underlying systems issues, disruptive behaviors are fundamentally due to individual actions. The concept of just culture provides an appropriate foundation for dealing with disruptive behavior, as it calls for disciplinary action for individuals who willfully engage in unsafe behaviors. The Joint Commission requires that organizations have an explicit code of conduct policy for all staff and recommends including a "zero tolerance" approach to intimidating and disruptive behaviors. One example of a successful approach is the "disruptive behaviors pyramid" approach developed at Vanderbilt University Medical Center. A stepwise process for identifying and managing problem behaviors is outlined in this AHRQ WebM&M perspective.

Current Context

The Joint Commission's Leadership Standard went into effect in 2009, including mandates for organizations to maintain a code of conduct that defines disruptive behaviors and a process for managing such behaviors. A subsequent sentinel event alert issued in August 2009 reinforced the importance of leadership in ensuring a culture of safety, with prevention of disruptive behavior among the key leadership attributes delineated. Adherence to the leadership standard is evaluated as part of Joint Commission accreditation surveys.

What's New in Disruptive and Unprofessional Behavior on AHRQ PSNet

TOOLKIT
Guide to Patient and Family Engagement in Hospital Quality and Safety.
Rockville, MD: Agency for Healthcare Research and Quality; June 2013.

NEWSPAPER/MAGAZINE ARTICLE
Disrespectful behavior in healthcare...have we made any progress in the last decade?
ISMP Medication Safety Alert! Acute Care Edition. June 27, 2013.

STUDY
Inpatient suicide on mental health units in Veterans Affairs (VA) hospitals: avoiding environmental hazards.
Mills PD, King LA, Watts BV, Hemphill RR. Gen Hosp Psychiatry. 2013 May 20; [Epub ahead of print].

STUDY
Identification of doctors at risk of recurrent complaints: a national study of healthcare complaints in Australia.
Bismark MM, Spittal MJ, Gurrin LC, Ward M, Studdert DM. BMJ Qual Saf. 2013;22:532-540.

View all AHRQ PSNet resources on Disruptive and Unprofessional Behavior

Editor's Picks for Disruptive and Unprofessional Behavior

From AHRQ webM&M

How to Identify and Manage Problem Behaviors.
Alan H. Rosenstein, MD, MBA; Michelle O'Daniel, MSG, MHA. AHRQ WebM&M [serial online]. December 2009

In Conversation with...Gerald B. Hickson, MD.
AHRQ WebM&M [serial online]. December 2009

Danger in Disruption.
Dorrie K. Fontaine, RN, PhD. AHRQ WebM&M [serial online]. October 2009

Difficult Encounters: A CMO and CNO Respond.
Ernest J. Ring, MD; Jane E. Hirsch, RN, MS. AHRQ WebM&M [serial online]. October 2009

Do Not Disturb!.
F. Daniel Duffy, MD; Christine K. Cassel, MD. AHRQ WebM&M [serial online]. October 2007

Is the "Surgical Personality" a Threat to Patient Safety?
Charles L. Bosk, PhD. AHRQ WebM&M [serial online]. April 2006

From AHRQ PSNet

JOURNAL ARTICLE

A survey of the impact of disruptive behaviors and communication defects on patient safety. CLASSIC
Rosenstein AH, O'Daniel M. Jt Comm J Qual Patient Saf. 2008;34:464-471.

A complementary approach to promoting professionalism: identifying, measuring, and addressing unprofessional behaviors. CLASSIC
Hickson GB, Pichert JW, Webb LE, Gabbe SG. Acad Med. 2007;82:1040-1048.

Problem doctors: is there a system-level solution? CLASSIC
Leape LL, Fromson JA. Ann Intern Med. 2006;144:107-115.

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Papadakis MA, Teherani A, Banach MA, et al. N Engl J Med. 2005;353:2673-2682.

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Perspective: a culture of respect—part 1 and part 2.
Leape LL, Shore MF, Dienstag JL, et al. Acad Med. 2012;87:845-858.

Professionalism: a necessary ingredient in a culture of safety.
DuPree E, Anderson R, McEvoy MD, Brodman M. Jt Comm J Qual Patient Saf. 2011;37:447-455.

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Leadership committed to safety.
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Behaviors that undermine a culture of safety.
Sentinel Event Alert. July 9, 2008;(40):1-3.

ACOG Committee Opinion #366: disruptive behavior.
ACOG Committee on Patient Safety and Quality Improvement of American College of Obstetricians and Gynecologists. Obstet Gynecol. 2007;109:1261-1262.

BOOK/REPORT

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Oakbrook, IL: Joint Commission Resources; 2007. ISBN: 9781599400846.

Silence Kills: The Seven Crucial Conversations for Healthcare.
Maxfield D, Grenny J, McMillan R, Patterson K, Switzler A. VitalSmarts; 2005.E45

NEWSPAPER/MAGAZINE ARTICLE

Arrogant, abusive and disruptive — and a doctor.
Tarkan L. New York Times. December 1, 2008;Science Desk:1.

Hospitals try to calm doctors' outbursts: medical road rage affecting patient safety, group says.
Kowalczyk L. The Boston Globe. August 10, 2008;Metro section:1A.

Last Updated: October 2012

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Patient Safety Primers > What are Patient Safety Primers?

Safety Culture

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Background

The concept of safety culture originated outside health care, in studies of high reliability organizations, organizations that consistently minimize adverse events despite carrying out intrinsically complex and hazardous work. High reliability organizations maintain a commitment to safety at all levels, from frontline providers to managers and executives. This commitment establishes a "culture of safety" that encompasses these key features:

- acknowledgment of the high-risk nature of an organization's activities and the determination to achieve consistently safe operations
- a blame-free environment where individuals are able to report errors or near misses without fear of reprimand or punishment
- encouragement of collaboration across ranks and disciplines to seek solutions to patient safety problems
- organizational commitment of resources to address safety concerns

Improving the culture of safety within health care is an essential component of preventing or reducing errors and improving overall health care quality. Studies have documented considerable variation in perceptions of safety culture across organizations and job descriptions. In prior surveys, nurses have consistently complained of the lack of a blame-free environment, and providers at all levels have noted problems with organizational commitment to establishing a culture of safety. The underlying reasons for the underdeveloped health care safety culture are complex, with poor teamwork and communication, a "culture of low expectations," and authority gradients all playing a role.

Measuring and Achieving a Culture of Safety

Safety culture is generally measured by surveys of providers at all levels. Available validated surveys include AHRQ's Patient Safety Culture Surveys and the Safety Attitudes Questionnaire. These surveys ask providers to rate the safety culture in their unit and in the organization as a whole, specifically with regard to the key features listed above. Versions of the AHRQ Patient Safety Culture survey are available for hospitals and nursing homes, and AHRQ provides yearly updated benchmarking data from the hospital survey.

Safety culture has been defined and can be measured, and poor perceived safety culture has been linked to increased error rates. However, achieving sustained improvements in safety culture can be difficult. Specific measures, such as teamwork training, executive walk rounds, and establishing unit-based safety teams, have been associated with improvements in safety culture measurements but have not yet been convincingly linked to lower error rates. Other methods, such as rapid response teams and structured communication methods such as SBAR, are being widely implemented to help address cultural issues such as rigid hierarchies and communication problems, but their effect on overall safety culture and error rates remains unproven.

The culture of individual blame still dominant and traditional in health care undoubtedly impairs the advancement of a safety culture. One issue is that, while "no blame" is the appropriate stance for many errors, certain errors do seem blameworthy and demand accountability. In an effort to reconcile the twin needs for no-blame and appropriate accountability, the concept of "just culture" is being introduced. A just culture focuses on identifying and addressing systems issues that lead individuals to engage in unsafe behaviors, while maintaining individual accountability by establishing zero tolerance for reckless behavior. It distinguishes between human error (eg, slips), at-risk behavior (eg, taking shortcuts), and reckless behavior (eg, ignoring required safety steps), in contrast to an overarching "no-blame" approach still favored by some. In a just culture, the response to an error or near miss is predicated on the type of behavior associated with the error, and not the severity of the event. For example, reckless behavior such as refusing to perform a "time-out"

prior to surgery would merit punitive action, even if patients were not harmed.

Fundamentally, in order to improve safety culture, the underlying problem areas must be identified and solutions constructed to target each specific problem. Although many organizations measure safety culture at the institutional level, significant variations in safety culture may exist within an organization. For example, the perception of safety culture may be high in one unit within a hospital and low in another unit, or high among management and low among frontline workers. These variations likely contribute to the mixed record of interventions intended to improve safety climate and reduce errors. Many of the determinants of safety culture are dependent on interprofessional relationships and other local circumstances, and thus changing safety culture occurs at a micro-system level. Some organizational behavior experts therefore believe that safety culture improvement needs to emphasize incremental changes to providers' everyday behaviors, "growing new [safety] culture that can be layered onto the old."

Current Context

The National Quality Forum's Safe Practices for Healthcare and the Leapfrog Group both mandate safety culture assessment. The Agency for Healthcare Research and Quality also recommends yearly measurement of safety culture as one of its "10 patient safety tips for hospitals." Baseline data on safety culture in a variety of hospital settings, derived from the Hospital Survey on Patient Safety Culture, are available from AHRQ.

What's New in Safety Culture on AHRQ PSNet

STUDY
The relationship between safety culture and patient outcomes: results from pilot meta-analyses.
Groves PS. West J Nurs Res. 2013 Jun 5; [Epub ahead of print].

STUDY
Culture change in infection control: applying psychological principles to improve hand hygiene.
Cumbler E, Castillo L, Satorie L, et al. J Nurs Care Qual. 2013 May 10; [Epub ahead of print].

STUDY
Impact of the World Health Organization's Surgical Safety Checklist on safety culture in the operating theatre: a controlled intervention study.
Haugen AS, Søfteland E, Eide GE, et al. Br J Anaestesia. 2013;110:807-815.

STUDY
Involvement of patients with cancer in patient safety: a qualitative study of current practices, potentials and barriers.
Martin HM, Navne LE, Lipczak H. BMJ Qual Saf. 2013 Jun 10; [Epub ahead of print].

COMMENTARY
'Bad apples': time to redefine as a type of systems problem?
Shojania KG, Dixon-Woods M. BMJ Qual Saf. 2013;22:528-531.

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Changes to supervision in community pharmacy: pharmacist and pharmacy support staff views.
Bradley F, Schafheutle EI, Willis SC, Noyce PR. Health Soc Care Community. 2013 May 29; [Epub ahead of print].

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Ethical issues in patient safety: implications for nursing management.
Kangasniemi M, Vaismoradi M, Jasper M, Turunen H. Nurs Ethics. 2013 May 23; [Epub ahead of print].

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Editor's Picks for Safety Culture

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AHRQ WebM&M [serial online]. October 2007

Making Just Culture a Reality: One Organization's Approach.
Alison H. Page, MS, MHA. AHRQ WebM&M [serial online]. October 2007

Establishing a Safety Culture: Thinking Small.
Timothy J. Hoff, PhD. AHRQ WebM&M [serial online]. December 2006

In Conversation with...J. Bryan Sexton, PhD, MA.
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From AHRQ PSNet

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Huang DT, Clermont G, Sexton JB, et al. Crit Care Med. 2007;35:165-176.

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Strategies for improving patient safety culture in hospitals: a systematic review.
Morello RT, Lowthian JA, Barker AL, McGinnes R, Dunt D, Brand C. BMJ Qual Saf. 2013;22:11-18.

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Committee on the Work Environment for Nurses and Patient Safety, Board on Health Care Services, Page A, ed. Washington, DC: National Academies Press; 2004.

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Marx D. New York, NY: Columbia University; 2001.

Hospital Survey on Patient Safety Culture: 2011 User Comparative Database Report. CLASSIC
Sorra J, Famolaro T, Dyer N, Khanna K, Nelson D. Rockville, MD: Agency for Healthcare Research and Quality; April 2011. AHRQ Publication No. 11-0030.

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Patient Safety Culture Surveys. CLASSIC
Rockville, MD: Agency for Healthcare Research and Quality; September 2012.

Last Updated: October 2012

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Building bridges: future directions for medical error disclosure research.

Hannawa AF, Beckman H, Mazor KM, Paul N, Ramsey JV. Patient Educ Couns. 2013 Jun 21; [Epub ahead of print].

According to this report of an expert panel discussion, error disclosure research should emphasize translating findings into practice and interdisciplinary collaboration between medicine, ethics, and the law.

PubMed citation
Available at

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Resource Type
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Clinical Area
- Medicine

Approach to Improving Safety
- Error Reporting
- Patient Disclosure

Origin/Sponsor
- Europe

Related Resources

COMMENTARY webM&M

Misread Label.

Franklin BD. AHRQ WebM&M [serial online]. November 2003.

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Medical errors: mandatory reporting, voluntary reporting, or both?

Grepperud S. Eur J Law Econ. 2005;20:99-112.

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Insufficient communication about medication use at the interface between hospital and primary care.

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Continuous monitoring of adverse events: influence on the quality of care and the incidence of errors in general surgery.

Rebasa P, Mora L, Luna A, Montmany S, Vallverdú H, Navarro S. World J Surg. 2009;33:191-198.

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Conversations with...Lucian Leape, MD.

Lundberg G. MedPage Today. July 5, 2013.

This interview with Dr. Lucian Leape highlights progress in patient safety and areas that still need improvement.

Available at

Related Resources

STUDY

A comparison of hospital adverse events identified by three widely used detection methods.

Naessens JM, Campbell CR, Huddleston JM, et al. Int J Qual Health Care. 2009;21:301-307.

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COMMENTARY

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Denham CR. J Patient Saf. 2011;7:113-121.

STUDY

Effect of the 2011 vs 2003 duty hour regulation-compliant models on sleep duration, trainee education, and continuity of patient care among internal medicine house staff: a randomized trial.

Desai SV, Feldman L, Brown L, et al. JAMA Intern Med. 2013;173:649-655.

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National Healthcare Safety Network.

Centers for Disease Control and Prevention.

This Web site provides resources to help identify, track, and prevent health care–associated infections in the United States.

Available at
Patient safety module

Related Resources

BOOK/REPORT

Patient Safety Authority Annual Reports.

Harrisburg, PA: Patient Safety Authority; April 2013.

BOOK/REPORT

Eliminating CLABSI: A National Patient Safety Imperative.

Rockville, MD: Agency for Healthcare Research and Quality; September 2011. AHRQ Publication No. 11-0037-1-EF.

BOOK/REPORT

Tennessee Center for Patient Safety Annual Report 2010.

Nashville, TN: Tennessee Center for Patient Safety; August 2011.

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Health care–associated invasive MRSA infections, 2005–2008.

Kallen AJ, Mu Y, Bulens S, et al; Active Bacterial Core surveillance (ABCs) MRSA Investigators of the Emerging Infections Program. JAMA. 2010;304:641-648.

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Close calls in patient safety: should we be paying closer attention?

Wu AW, Marks CM. CMAJ. 2013 Apr 16; [Epub ahead of print].

This commentary highlights the value of analyzing near misses in preventing errors and includes several examples of close-call reporting systems.

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- Canada

Related Resources

COMMENTARY

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Vincent C. CMAJ. 2013;185:110-111.

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Double checking the administration of medicines: what is the evidence? A systematic review.

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What is preventable harm in healthcare? A systematic review of definitions.

Nabhan M, Elraiyah T, Brown DR, et al. BMC Health Serv Res. 2012;12:128.

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McVeigh TP, Waters PS, Murphy R, O'Donoghue GT, McLaughlin R, Kerin MJ. J Am Coll Surg. 2013;216:50-56.

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Quantifying and characterizing adverse events in dermatologic surgery.

O'Neill JL, Lee YS, Solomon JA, et al. Dermatol Surg. 2013;39:872-878.

This prospective study found that the rate of adverse events in outpatient dermatologic surgery was very low, occurring in approximately 1 in 50 cases.

PubMed citation
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Related Resources

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Cambridge, MA: CRICO/RMF Strategies; 2010.

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Weiser TG, Haynes AB, Dziekan G, et al; Safe Surgery Saves Lives Investigators and Study Group. Ann Surg. 2010;251:976-980.

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- Surgical Complications

Error Types
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- United States of America

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Teaching medical error disclosure to physicians-in-training: a scoping review.

Stroud L, Wong BM, Hollenberg E, Levinson W. Acad Med. 2013;88:884-892.

When an error has occurred, many physicians choose their words carefully—failing to explicitly describe the error, acknowledge responsibility, or express sympathy to patients. This in part occurs because training in error disclosure is not a standard component of medical school or residency curricula. This review found that when implemented, error disclosure training generally resulted in improved knowledge and self-reported comfort with the disclosure process. However, few studies assessed whether training led to real-world behavior change. A difficult case of error disclosure is discussed in an AHRQ WebM&M commentary.

PubMed citation
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Graduate medical education and patient safety: a busy--and occasionally hazardous--intersection.

Shojania KG, Fletcher KE, Saint S. Ann Intern Med. 2006;145:592-598.

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Duffy FD, Cassel CK. AHRQ WebM&M [serial online]. October 2007.

COMMENTARY webM&M

Physical Diagnosis: A Lost Art?

Thompson GR, Verghese A. AHRQ WebM&M [serial online]. August 2006.

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Patient safety in orthopedic surgery: prioritizing key areas of iatrogenic harm through an analysis of 48,095 incidents reported to a national database of errors.

Panesar SS, Carson-Stevens A, Salvilla SA, Patel B, Mirza SB, Mann B. Drug Healthc Patient Saf. 2013;5:57-65.

The largest proportion of surgical patient safety events reported to the National Reporting and Learning System came from trauma and orthopedic surgery patients. Many of the events involved failure to rescue.

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Approach to Improving Safety
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- United Kingdom

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STUDY

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Effect of a "Lean" intervention to improve safety processes and outcomes on a surgical emergency unit.

McCulloch P, Kreckler S, New S, Sheena Y, Handa A, Catchpole K. BMJ. 2010;341:c5469.

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Error Types

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COMMENTARY
Systems approach to reduce errors in surgery.
Dankelman J, Grimbergen CA. Surg Endosc. 2005;19:1017-1021.

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- Epidemiology of Errors and Adverse Events (437)
- Active Errors (236)
- Latent Errors (154)
- Near Miss (44)

Approach to Improving Safety
- Quality Improvement Strategies (410)
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- Ambulatory Care (168)
- Outpatient Surgery (16)
- Patient Transport (9)

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July 2008 | Interview

In Conversation with...Albert Wu, MD, MPH

Editor's note: *Albert Wu, MD, MPH, is Professor of Health Policy and Management at the Johns Hopkins School of Public Health and is presently working with the World Health Organization's World Alliance for Patient Safety, based in Geneva. He is a leading expert on several aspects of patient safety, including disclosure and evaluation. He recently wrote a commentary on the use of root cause analysis in patient safety in the* Journal of the American Medical Association (JAMA).

This interview can be heard by subscribing to the AHRQ WebM&M Podcast

Interview

Dr. Robert Wachter, Editor, AHRQ WebM&M: What got you interested in the topic of root cause analysis?

Dr. Albert Wu: Traveling around the country, I have been struck by the number of people who spontaneously volunteer comments about root cause analysis, comments that implied that they had, at best, mixed feelings about the effectiveness and efficiency of root cause analysis as a tool for helping them improve their institutions. They began their comments by sighing or complaining, griping that they were in the midst of conducting a root cause analysis and it was consuming all of their time, and they were not sure in the end what the result was going to be—whether it was going to actually help their institution to improve quality or safety.

RW: So as you then began to research the literature, what were your main findings?

AW: Although we are living in an era of evidence-based medicine, root cause analysis was widely adopted by the medical community in the 1990s without the benefit of much evidence. Every institution now conducts root cause analysis. Thousands of health care workers devote many hours to conducting these analyses, yet root cause analysis has never really been evaluated.

RW: Is there any evidence that it's effective in other industries outside of health care?

AW: Root cause analysis has been quite effective in nonmedical industry, including some heavy industries and aviation. It was more or less adopted because it had good face validity. Jim Bagian, who has a background in aviation, was one of the first to suggest that the VA [Department of Veterans Affairs] try out this approach to investigating their problems. One of the reasons that it was taken up so readily was that it made sense: you look systematically at an incident, try to figure out what the root causes are, and then try to find solutions. It's relatively easy to find problems or the causes of problems, but good corrective actions are much harder to find.

RW: Speak philosophically about the role of evidence, because some people would look at your argument in the *JAMA* paper and say that arguing for evidence for root cause analysis is unrealistic. As we've come to understand that many medical errors do relate to systems problems, isn't face validity for a method whose goal is to unearth all those systems problems and then create a plan to fix them so high that it is reasonable to ask why you should need evidence for this? It's not like a new drug.

AW: Well, I think that evidence-based medicine can be overdone. It's common knowledge that we have evidence for a relatively small fraction of what we do in practice. But I think that the face validity of root cause analysis is restricted to finding out what the problem is. It's clear that individual investigators and institutions have discovered things that cause problems, and some of those things were surprising. And they have learned from this. Doing a root cause analysis can help you realize that medicine is a system and that the system is flawed—the system causes errors to occur and problems with safety. However, I think the face validity doesn't extend much further than the initial analysis. When it comes to finding

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PERSPECTIVE: The Soil, Not the Seed: The Real Problem with Root Cause Analysis

solutions and then following up on whether those solutions were adopted and whether or not they were effective, that's where things fall down. Any institution you speak to will admit that they're much better at finding causes than finding solutions. In general, there tends to be little follow-up to see if improvements can be demonstrated.

RW: So is that an argument to study various follow-up methods or to scrap the process until there's better evidence?

AW: I think it's too late to scrap the whole process. But you can make an argument for at least starting to follow up and to systematically collect information on what actions are recommended and what actions are taken. And if possible, particularly for problems and outcomes that are pretty common, to follow up to see if there's any evidence that outcomes are improved.

RW: So let me push you to disentangle some of the arguments you made in the paper. One is that individual organizations don't seem to follow up on their root cause analyses very well. Another thread says that everybody is rediscovering the wheel in a very inefficient way. And we don't have a method to roll up the solutions into something that will become more robust because it must be done at a higher level, national level, for example. How do you think about those issues?

AW: I would say that they're three issues that are largely separate. The first is that in many cases the people who do root cause analysis are not trained well enough. Consequently, the results that come out of many root cause analyses are not that useful. The second problem is that there tends not to be much follow-up. So there's no way of knowing what has happened. When people try to make changes, like most other attempted fixes, the fix works for a few days or a few weeks and then you lapse back to your previous behavior. The third problem is reinventing the wheel. For example, virtually every institution has problems with, for example, medications being incorrectly administered, and almost every organization tends to come up with its own local solution. The problem really needs a higher level fix.

Here's an example that we gave in our paper. The patient was receiving patient-controlled analgesia (PCA), which includes a local anesthetic and a narcotic. This is supposed to be given into the epidural space. Unfortunately, the nurse connected the tubing to an IV [intravenous] catheter. The patient did not succumb to this, but it could have been a lethal episode. The root cause analysis identified a number of problems, but what the team really wanted to do was to prevent tubing for an epidural infusion from being connected to an intravenous catheter. However, they felt that they couldn't do that, so instead they reeducated their staff. They took some actions, but if you ask anyone in the institution if this was likely to be effective, they were not very secure that they had done anything worthwhile. In fact, a year later there was almost an identical incident at the same institution. And this happened after a lengthy root cause analysis, which took perhaps 100 hours to perform. A number of policies and changes were made, but things were not safer. What ideally would have been done was that someone at a higher level than the individual hospital would realize that this was a problem and perhaps make a recommendation to all the manufacturers of tubing for PCA and identify this as a problem that should be eradicated. This kind of solution has been achieved in aviation. But it has been achieved perhaps only a few times in medicine.

The Department of Veterans Affairs is capable of doing this and, in some cases, does it. All of the root cause analyses from their hospitals are reported to their National Patient Safety Center. Several people monitor what comes in. If they notice a particularly prevalent problem, they collect the cases, try to see if there are common elements, and then design and post a solution. When things work at the VA, I think they could be a model for the way things should go for general hospitals in the United States.

RW: What are we learning from systems like the VA or the state of Pennsylvania in terms of whether these roll up clearinghouses for the results of root cause analyses are able to do what it sounds like you hope they could?

AW: Well, I think we're learning a few things. First of all, if you talk to people off the record, they will tell you that a large percentage of the root cause analyses presented to any big organization are not very useful. When you examine them closely, most really haven't been done as well as they ought, and the findings are difficult to interpret. They're difficult to combine with one another, so that you could find a common solution. This is a problem that even the VA frequently confronts. Another thing that the country of England and large states like Pennsylvania have discovered is that it is difficult to analyze millions of cases reported. It's a little bit like drinking from a fire hose—it's difficult to figure out the patterns of the individual drops when you're drowning in thousands and thousands of reports.

RW: Is there a solution to that? It seems to me that is to some extent the crux of the problem. At some level you would like as much data as possible from these local analyses to be rolled up to something larger. At another level you very quickly get overwhelmed with noise-to-signal problems.

AW: The problem with general incident reporting has more to do with pattern recognition. Most hospitals in the United States do several root cause analyses a year, and there is not an indigestible number of root cause analyses. It would be possible to look at these very detailed analyses, if done in a standardized way, and to classify them, even using some form of automation. The VA is now using some artificial intelligence tools to search reports. The reports bear more resemblance to one another than the myriad of incidents

reported all over the country, and they are able to extract themes automatically. They then use experts in patient safety to look at what may be a signal and to help interpret what's going on. One thing that is necessary is to have patient safety experts skilled in root cause analysis and in handling this kind of information who are constantly looking over the data.

RW: In your perfect world, does an organization exist today that could receive all of these root cause analyses, sift through them, analyze them, and come up with broad solutions, or would that have to be invented?

AW: That organization doesn't exist today. Such an organization would have to have a few things. One, it would need to have enough experts, enough resources to be able to actually handle the raw data. The second is that there would need to be a process to convince people who could actually change things at a high level, for example, manufacturers, professional societies, other health organizations, that redesign is necessary and to actually compel them to do it. It may be that we need legislation so that in cases that were deemed to be widespread enough or serious enough, manufacturers would be required to get together and fix the problem. But I think that this can't just be legislated. All of those groups would need to participate in some way or another. It's probably in their interest that things be safer, but at the present time it's simply easier to say well, we get nurses who are smarter or physicians who are more capable and why don't you just do things right. That unfortunately is not likely to be an effective solution.

RW: From what you've seen or read, what does the best root cause analysis process look like?

AW: First of all, the best root cause analysis employs people who know how to do them—have been properly trained and can do them efficiently—because they can be very time consuming. They can take hundreds of person hours to do. And also, that those performing root cause analyses have access to clinical experts so that the analyses can be sensible. The solutions that I've proposed can at least have a chance to solve the problems. What then needs to happen is the institutions need to track what the solutions are, and they need to be accountable to show that those solutions have been put into place. Ideally, they should try to see if there's any evidence that a particular type of incident has been reduced. Root cause analyses are usually touched off by pretty serious incidents, called sentinel events, and any hospital board would like to see these things never happen again. At every meeting of a hospital board, it would be reasonable to present the sentinel events and the root cause analyses and recommendations. And at every meeting, the board should also track what had happened to the previous quarter's or previous year's root cause analyses and recommendations, and again, if possible, what has happened to that kind of patient or that sort of incident, as much as can be known from evidence from the hospital's data systems.

RW: Of course there's a statistical problem here, where some things that are sentinel events are unusual but horrible events. In most hospitals, the difference between it never happening again and happening once is not statistically significant.

AW: Well, absolutely. Wrong site surgeries are a pretty good example of this—they happen to every big institution a few times a year but not often enough to make into statistics. Perhaps the best that can be done is to see that the solutions that were proposed were indeed put into place and perhaps are still operating. Another thing is to try to collect data from other sources. One possible source would be regular surveys of frontline health care workers who could at least tell you what their perceptions are of safety and perhaps of compliance with particular important safety measures.

RW: So you're basically saying that when the outcomes are very rare, you might think about whether the processes or structures are robust, and then the frontline workers are essentially proxies for the outcomes, because statistically those outcomes will be too unusual.

AW: I think so, and I think this is a case where the wisdom of crowds can be helpful. Frontline workers observe things happening all the time and, if surveyed in sufficient density, can tell you how safe they think things are and how well they think safety measures have been adopted. Bryan Sexton and others have shown that those impressions correlate very well with other measures of safety.

RW: Some people have read your article in *JAMA* and wondered, maybe this is not a reasonable method. We're putting a lot of time and energy and resources into root cause analyses. Would you tell them today to stop doing them or to work on making them better?

AW: I think the horse is out of the barn. There is much that is good about root cause analysis—the basic idea of not looking for one root cause, but instead looking at the factors that allow safety incidents to occur. I think that people are educated about the fact that there is a health care system, and that system causes both safety and lack of safety. So I wouldn't throw out the whole process. It does behoove us to make it better and to study it. I think that we ought to follow up systematically; organizations or individual hospitals and groups of hospitals and hospital systems, where they exist, should track what's going on. And root cause analyses ought to be kicked upstairs somewhere central, so that they can be looked at in aggregate, and so that those rare events could have a greater chance of being detected. Also, we ought to do some research on what kinds of solutions might be both effective and doable for individual institutions and groups of institutions. Some solutions are at the level of making a policy or retraining an individual

clinician. Others are at the level of redesigning the entire system or piece of equipment. And there's quite a lot in between. It would be worth studying what kinds of problems could be resolved by a relatively low-level solution and what kinds of problems really do require a higher level solution in order to make any difference.

RW: How do you balance the tensions between looking for system flaws, as root cause analysis forces you to do, and the recognition that sometimes the problem may be more individually based?

AW: I don't think there's quite that much of a conflict. Systems are built up of individuals, and individuals are a part of a big, complicated system. Sometimes the solution is improving the performance of an individual. And individual accountability, individual feelings of responsibility, and high moral fiber are crucial to the whole system working.

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July 2008 | Perspective

The Soil, Not the Seed: The Real Problem with Root Cause Analyses

Perspective

by Patrice Spath, BA, RHIT, and William Minogue, MD

Throughout most of his life, 19th century French chemist Louis Pasteur insisted that germs were the cause of disease, not the body. It wasn't until Pasteur was nearing the end of his life that he came to believe just the opposite. After reaching this conclusion, he declined treatment for potentially curable pneumonia, reportedly saying, "It is the soil, not the seed."(1) In other words, a germ (the seed) causes disease when our bodies (the soil) provide a hospitable environment.

This bacteriology lesson is relevant to our patient safety efforts. Health care organizations are implementing numerous safety improvement techniques, many borrowed from other industries. One such technique is root cause analysis (RCA), commonly used to identify and correct the factors that led to an untoward patient incident. Health care organizations were introduced to this accident investigation technique in the mid-1990s. Now, accreditation groups and some state regulatory agencies mandate RCAs after a sentinel or significantly harmful adverse event.

In a recent article in the *Journal of the American Medical Association* (*JAMA*), Wu and colleagues questioned whether RCAs have actually reduced the risk of adverse events and unintended patient harm.(2) Citing published studies going back as far as 2002, the authors reported problems with RCAs such as incomplete investigations, ineffectual corrective actions, failure to follow through on implementing actions, and lack of evaluation to assess the outcomes from actions that are implemented. Similar problems have been reported by Maryland's Office of Health Care Quality (OHCQ), a state agency that reviews the RCAs of serious adverse events conducted in Maryland hospitals.(3)

One conclusion that could be drawn from these experiences is that the RCA tool, apparently only marginally successful, needs to be significantly modified. In fact, the authors of the JAMA article suggest that a new incident investigation model is needed: one that has been adequately tested for its effectiveness. This recommendation caused us to reflect on Pasteur's dying words. For all of our patient safety efforts, which has a greater influence on outcomes, the seed (a safety intervention) or the soil (the host organization)? It is our contention that hospitable organizational factors are the most important predictor of safety intervention effectiveness. If we are correct, then the RCA tool is not the problem. Rather, the "soil" must be well prepared and fertile for discovery to take root.

Organizations are often unprepared to respond to medical tragedies. In health care, errors are seen as character flaws. The focus is on individuals, rules, and sanctions; therefore, lessons learned are not shared. There is fear of embarrassment, peer and patient reaction, and litigation. In this environment, it's not surprising that an RCA fails to uncover and correct system failures.

However, due in part to growing experience using the RCA tool, the environment is shifting. There are published reports of the culture-changing benefits of multidisciplinary patient incident investigations.(4,5) While RCA is just one piece of the culture changing puzzle, it has been an important tool for preparing the more hospitable soil that we have today. Imagine the push-back if we'd tried to implement teamwork training among caregivers in 1990, before we'd begun to use the RCA tool to investigate events.

Although caregiver collaboration is improving and organizations are focusing less on individual blame, RCAs do not always result in sustainable safety gains. Here too, the fault lies with the soil, not the seed. OHCQ's review of RCAs reveals that many of the hospitals that fail to find and fix serious systematic problems lack leadership involvement in the investigation process.(3) Administrative and medical staff leaders must do

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more than endorse the formation of an RCA team and approve the final report. They must ensure that relevant physicians and staff members attend and fully participate in RCA discussions. Even better, they themselves should also attend.

Leaders must encourage RCA teams to delve deeper to find the system problems that contributed to the occurrence of errors or that allowed the errors to cause harm to patients. System problems, often called latent conditions, cause an unhealthy environment that sets up failures at the front lines of patient care. To discover latent conditions, participants in the RCA training sessions offered by the Maryland Patient Safety Center are taught to ask a simple, yet powerful question, "Why is this situation allowed to exist?" For instance, suppose the RCA team finds that staff members were not adequately trained on a new piece of equipment. Rather than pronounce the root cause to be "lack of training" and stop at that point, the team is encouraged to ask, "Why are staff members not adequately trained before using new equipment?" The answer to this question points to the latent conditions that also must be resolved to reduce the risk of future untoward events.

Finding root causes and latent conditions is just the start. Next, the problems need to be fixed. Frontline caregivers—people with little training in mistake-proofing techniques and systems redesign—are asked to create effective interventions. Is it any wonder that we end up with so many weak actions? This shortcoming is evident in OHCQ's review of RCAs done in Maryland hospitals. Of the 168 RCAs reviewed in 2007, the most common action plan was to educate staff (65% contained this recommendation).(3) More personal involvement by leadership is needed during the action-planning phase to redesign processes and create system changes that will result in safer patient care over the long term.

The final role for administrative and medical staff leaders is to hold people accountable for timely completion of process improvements and compliance with safe practices. For example, at one hospital, a patient known to be allergic to latex had an anaphylactic reaction to a Penrose (latex) drain inserted during surgery. Following an RCA of this event, the operating room (OR) manager was instructed to evaluate all OR supplies and convert to non-latex where such products were available. Six months after the RCA, the manager had not yet started the evaluation. Anesthesiologists at another hospital complained that it wasn't convenient to always label medication containers on the sterile field and they often didn't follow this safe practice. Medical staff leaders were unwilling to speak up and say, "For the sake of patient safety, we will no longer accept this behavior."

To achieve a highly reliable and safer health care system, we need a hospitable soil where the seeds of improvement can thrive. Instead of replacing the RCA tool with yet another improvement technique, it's time we heeded the lesson discovered by Pasteur so many years ago.

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The Editors

Robert M. Wachter, MD, Editor, AHRQ WebM&M/PSNet

Robert M. Wachter, MD is Professor and Associate Chair of the Department of Medicine at the University of California, San Francisco, where he directs the 60-physician Division of Hospital Medicine. Author of 250 articles and 6 books, he coined the term "hospitalist" in 1996 and is generally considered the "father" of the hospitalist field, the fastest growing specialty in the history of modern medicine. He is past president of the Society of Hospital Medicine, and is currently the chair of the American Board of Internal Medicine.

In the safety and quality arenas, he edits the US government's two leading websites on safety (they receive about one million yearly visits) and has written two bestselling books on the subject, including *Understanding Patient Safety*, whose 2nd edition was published in 2012. In 2004, he received the John M. Eisenberg Award, the nation's top honor in patient safety. For the past five years, *Modern Healthcare* magazine has named him one of the 50 most influential physician-executives in the U.S. (#14 in 2012). He has served on the healthcare advisory boards of several companies, including Google. His blog, www.wachtersworld.org, is one of the nation's most popular healthcare blogs.

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Dr. Ranji received his medical degree from the University of Illinois at Chicago. He completed his Internal Medicine residency training at the University of Chicago and subsequently served as Chief Medical Resident at Cook County Hospital. He joined the UCSF Hospitalist Group in 2004 after completing a 2-year fellowship in Hospital Medicine and Clinical Research at UCSF.

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Kaveh G. Shojania, MD, Deputy Editor, AHRQ PSNet; Consulting Editor, AHRQ WebM&M

Kaveh Shojania is Editor-in-Chief of BMJ Quality and Safety and Director of the Centre for Patient Safety at the University of Toronto, where he also sees patients as a hospital-based general internist. Kaveh's research focuses on identifying evidence-based patient safety interventions and effective strategies for translating evidence into practice. He has published over 100 peer review articles, including in leading journals such as the *New England Journal of Medicine, the Lancet, Journal of the American Medical Association (JAMA)*, and the *Annals of Internal Medicine*. He has lectured widely on issues related to the scholarly advancement of patient safety and quality improvement, including twice delivering invited lectures to the US Institute of Medicine.

Before moving back to Canada in 2004, Kaveh was on the faculty at the University of California, San Francisco (UCSF), where he was one of the founding editors of AHRQ WebM&M. He was also lead editor (and authored six chapters) of Making Healthcare Safer, the evidence report produced for AHRQ following the publication of the Institute of Medicine report, To Err Is Human. While at UCSF, Kaveh co-authored a book (with Dr. Wachter) on patient safety for a general audience that received excellent reviews in the New York Times and many other media and has sold approximately 50,000 copies. In 2004, Kaveh and Bob Wachter received one of the John M. Eisenberg Patient Safety Awards from the US Joint Commission for the Accreditation of Healthcare Organizations and the National Quality Forum for work in patient safety that has had an impact at a national level.

Kaveh received his medical degree from the University of Manitoba and completed his residency training at Harvard's Brigham and Women's Hospital. After a hospital medicine fellowship at UCSF, he joined the faculty there for several years before returning to Canada. He holds a Canada Research Chair in Patient Safety and Quality Improvement at the University of Toronto.

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Russ Cucina is Associate Professor of Medicine at the University of California, San Francisco. His research is in clinical human-computer interaction science with an emphasis on human factors and patient safety, decision support systems and automated clinical inference, sociotechnical aspects of clinical information systems, information storage and retrieval methods, and knowledge representation and management.

Prior to his work with AHRQ Patient Safety Network, Russ participated in knowledge management projects with the U.S. Centers for Disease Control and Prevention and the Defense Advanced Research Projects Agency, as well as on information storage and retrieval projects at Stanford Medical Informatics and with a number of medical publishing houses. He attends regularly on the inpatient Medicine Service, on the Medical Consultation Service, and in the Screening and Acute Care Clinic, all at UCSF Medical Center. Operationally, Russ works with UCSF Medical Center's information services department on the enterprise clinical information systems and was previously the physician lead for Stanford Hospital & Clinic's computerized provider order entry and multidisciplinary electronic documentation projects. He consults for a number of clinical software and technology vendors, community hospitals, and academic centers regionally and nationally.

Russ received his medical degree from the University of California, Davis. He was resident and chief resident in Internal Medicine at Stanford University. Russ also holds a master's degree in biomedical informatics from Stanford University.

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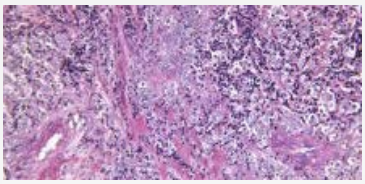

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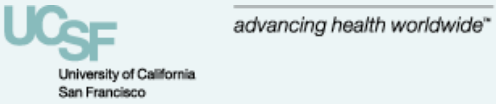

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Vineet Arora, MD, MAPP

Dr. Arora is Associate Director for Internal Medicine Residency and Assistant Dean for Scholarship and Discovery at University of Chicago Pritzker School of Medicine. Her work on quality and safety of care in teaching hospitals, including resident fatigue and patient handoffs, has resulted in over 50 peer reviewed publications and media coverage by the *New York Times*, CNN, ABC News, and *US News and World Report*. Dr. Arora has received Society of Hospital Medicine's Excellence in Hospital Medicine Research Award, American Geriatrics Society's New Investigator Award, Society of General Internal Medicine's Milton Hamolsky Award, and the American College of Physicians' Walter J. McDonald Young Physician Award. She has received grants from Agency for Healthcare Research and Quality, National Institute on Aging, John A. Hartford Foundation, ABIM Foundation, ACP Foundation, and the ACGME.

In her educational role, Dr. Arora launched a new Quality and Safety Track, a 4-year curriculum to cultivate student leaders in these areas. She is also a faculty advisor for the Institute for Healthcare Improvement Open School and improvehealth.org. She served on the AMA Designing Patient Safety Experiences in Medical Education Task Force and wrote patient safety questions for ABIM's certification examination. She testified to the Institute of Medicine on resident duty hours and to Congress on physician payment reform to revitalize primary care. She has lectured on quality and safety topics in more than 30 institutions in 15 cities over 3 continents. As an academic hospitalist, Dr. Arora supervises medical trainees caring for hospitalized patients.

Pascale Carayon, PhD

Dr. Carayon is Procter & Gamble Bascom Professor in Total Quality in the Department of Industrial and Systems Engineering and Director of the Center for Quality and Productivity Improvement (CQPI) at the University of Wisconsin-Madison. She leads the Systems Engineering Initiative for Patient Safety (SEIPS) at the University of Wisconsin–Madison. She received her degree in Engineering from the École Centrale de Paris, France, in 1984 and her PhD in Industrial Engineering from the University of Wisconsin–Madison in 1988.

Her research examines systems engineering, human factors and ergonomics, sociotechnical engineering, and occupational health and safety, and has been funded by the Agency for Healthcare Research and Quality, the National Science Foundation, the National Institutes of Health (NIH), the National Institute for Occupational Safety and Health, and the Department of Defense, as well as various foundations and private industry. She is the North American editor for *Applied Ergonomics* and a member of the editorial boards of the *Journal of Patient Safety*, *Behaviour and Information Technology*, and *Work and Stress*. She is a Fellow of the Human Factors and Ergonomics Society and the International Ergonomics Association. Between 2006 and 2009, she was the Secretary General of the International Ergonomics Association. Dr. Carayon was a member of the Institute of Medicine Committee on Resident Hours. She is the editor of the *Handbook of Human Factors and Ergonomics in Health Care and Patient Safety*.

Michael Cohen, RPh, MS, ScD

Dr. Cohen is president of the Institute for Safe Medication Practices (ISMP), a non-profit health care organization that operates the voluntary and confidential ISMP Medication Error Reporting Program (MERP). Through ISMP, MERP medical professionals and consumers learn about the causes of medication errors and error-reduction strategies are shared with the health care community, policy makers, and the public. He is a pharmacy graduate of Temple University School of Pharmacy, holds a master's degree from Temple, and has received honorary doctor of science degrees from the University of Sciences and Long Island University as well as a doctor of public service degree from the University of Maryland.

Dr. Cohen serves as vice chair of the Patient Safety Advisory Group for The Joint Commission and is a member of the National Quality Forum Committee on Safe Practices for Better Healthcare. He served recently as a member of the Committee on Identifying and Preventing Medication Errors for the Institute of Medicine and is a consultant for FDA for its Drug Safety and Risk Management Advisory Panel. In 2005, he was awarded a MacArthur Fellowship by the John D. and Catherine T. MacArthur Foundation. He was also the 2008 recipient of the John Eisenberg Award for Patient Safety given jointly by The Joint Commission and the National Quality Forum.

Pat Croskerry, MD, PhD

Dr. Croskerry is Professor of Emergency Medicine and in the Division of Medical Education at Dalhousie University in Halifax, Nova Scotia, Canada. He also holds a PhD in Experimental Psychology and fellowship training in Clinical Psychology. His main interest lies in patient safety and clinical decision making, especially the impact of various cognitive and affective biases on the diagnostic process. He was a member of the organizing committee of the first conference on Diagnostic Error in Phoenix, AZ, in 2008, and of the Los Angeles conference in 2009. He has published widely in the area of patient safety and medical education reform and is senior editor on a major text, *Patient Safety in Emergency Medicine,* published in 2008. Over the last 15 years, he has given over 400 invited presentations on health care safety at provincial, national, and international levels.

Nancy Elder, MD, MSPH

Dr. Elder is Associate Professor and Director of Research at the University of Cincinnati Department of Family and Community Medicine. Dr. Elder received her medical degree from the University of Minnesota and finished a family medicine residency at Good Samaritan Medical Center in Phoenix, AZ. She was in practice in Arizona and Africa for 4 years, before completing an Academic Family Medicine Fellowship and receiving a master's degree in public health at the University of Missouri–Columbia. Dr. Elder then joined the faculty at Oregon Health and Sciences University in 1992, and in 2000 she moved to her present position at the University of Cincinnati.

Dr. Elder's personal research has focused on quality and safety in the outpatient, primary care setting. With funding from the National Patient Safety Foundation and the Agency for Healthcare Research and Quality, she has studied the testing process in primary care, systems for quality and safety in the office setting, and patient empowerment for safety and quality in primary care. Dr. Elder has served on task forces and advisory boards on ambulatory patient safety and laboratory safety for the National Patient Safety Foundation, the Centers for Disease Control and Prevention, the National Quality Forum, and the American Medical Association. Dr. Elder maintains an active clinical practice caring for homeless patients through the Cincinnati Health Care for the Homeless Program.

Thomas H. Gallagher, MD

Dr. Gallagher is a general internist who is an Associate Professor in the Department of Medicine and the Department of Bioethics and Humanities at the University of Washington. He received his medical degree from Harvard University, Cambridge, MA; completed his residency in Internal Medicine at Barnes Hospital, Washington University, St. Louis; and completed a fellowship in the Robert Wood Johnson Clinical Scholars Program, University of California, San Francisco.

Dr. Gallagher has a long-standing research interest in the ethical and communication dimensions of conflicts of interest, research ethics, and disclosure of medical errors and adverse events. His work in error disclosure received the 2004 Best Published Research Paper of the Year award from the Society of General Internal Medicine. He also received a Robert Wood Johnson Foundation Investigator Award in Health Policy Research. Dr. Gallagher has published over 30 articles on patient safety and error disclosure, which have appeared in journals including *New England Journal of Medicine* (2), *Health Affairs, Surgery, Journal of Clinical Oncology, Archives of Internal Medicine, Archives of Pediatric and Adolescent Medicine,* and *The Joint Commission Journal.* He is the principal investigator on RO1 grants from the Agency for Healthcare Research and Quality and the National Cancer Institute, as well as on a grant from the Greenwall Foundation.

Dr. Gallagher is an active member of many professional organizations, including the American College of Physicians (Fellow) and the American Society of Bioethics and Humanities. He was recently elected to the Council (Board of Directors) for the Society of General Internal Medicine.

Paul A. Gluck, MD

Dr. Gluck is an Associate Clinical Professor in the Department of Obstetrics and Gynecology at the University of Miami Miller School of Medicine in Miami, FL. Dr. Gluck received his Doctor of Medicine degree from the New York University School of Medicine after earning a bachelor's of science degree in Life Sciences from the Massachusetts Institute of Technology. He completed his postgraduate training in obstetrics and gynecology at the University of Miami School of Medicine, where he remains on the voluntary faculty as Associate Clinical Professor. After 32 years, he retired from private practice to pursue his passion as a Patient Safety Fellow at the University of Miami Center for Patient Safety.

Dr. Gluck has served on numerous community and state boards. He was President or Chair of the William A. Little OB/GYN Society, Miami OB/GYN Society, Florida OB/GYN Society, Baptist Health System Foundation, Health Council of South Florida, Florida Section American College of Obstetricians and Gynecologists (ACOG), and Dade County Medical Association. Currently, he is Immediate Past Chair of the Board of the National Patient Safety Foundation.

Dr. Gluck is frequently called upon as a speaker on quality improvement, patient safety, and professional liability. Specifically on the topic of patient safety, he has given over 200 presentations, authored 8 articles and 5 book chapters, edited a Clinics of North America monograph, moderated an ACOG Audio Update, given postgraduate courses, and developed web-based learning modules. He served on two National Quality Forum Technical Advisory Committees to standardize error reporting and two AHRQ committees to award research grants for safety implementation and simulation initiatives and was a consultant to RAND for evaluating team function in high-risk environments.

Caprice Christian Greenberg, MD, MPH

Dr. Greenberg is the director of the Center for Surgery and Public Health at Brigham and Women's Hospital, a faculty member of the Center for Outcomes and Policy Research at the Dana-Farber Cancer Institute, and an Assistant Professor of Surgery at Harvard Medical School. Dr. Greenberg, a graduate of the University of Chicago Pritzker School of Medicine, completed her general surgery residency at the Brigham and Women's Hospital and her surgical oncology fellowship in the Dana-Farber/Partners program. During her training, she also completed a master's of public health through the Clinical Effectiveness program at the Harvard School of Public Health and a research fellowship in surgical health services research.

Dr. Greenberg's research interests include provider communication, and intraoperative safety and system performance. She is also working to understand variation in practice and how to measure and improve the quality of surgical oncology care, particularly related to breast cancer. Dr. Greenberg serves on the Executive Committee of the Surgical Outcomes Club, a national organization that she co-founded, as well as the Editorial Advisory Board of the Pennsylvania Patient Safety Advisory.

John L. Haughom, MD

Dr. Haughom is corporate Senior Vice President of Clinical Quality and Patient Safety for PeaceHealth. In this role, he is responsible for clinical improvement, patient safety initiatives, health services research, outcomes measurement, and all information systems initiatives including the Community Health Record, a computer-based medical record system providing support across the continuum of care to physician groups and regional health care facilities in three states (Oregon, Washington, and Alaska). In addition to an electronic medical record, features of the Community Health Record include physician order entry, real-time decision support, chronic disease registries, a robust analytical environment supported by an advanced data warehouse, and advanced secure access to clinical information for patients

online. Dr. Haughom previously served as Chairman of the Board for the Health Technology Center (HealthTech), a research organization focused on improving health care through technology-enabled innovation. He is also a Clinical Assistant Professor in the Department of Medical Informatics at the Oregon Health Sciences University in Portland, OR.

Prior to this, Dr. Haughom served as the corporation's Chief Medical Officer and the Director of Health Services Research and Development. He also has 15 years of clinical practice experience.

Dr. Haughom received a bachelor's degree in economics from the University of Colorado and his medical degree from University of California, San Francisco. He completed a year of study in medical informatics at the University of Utah in 1996. Dr. Haughom has dual board certification in internal medicine and gastroenterology. Under Dr. Haughom's leadership, PeaceHealth was selected as a finalist among 226 applicants for the Robert Wood Johnson Pursuing Perfection grant to work with Don Berwick's Institute for Healthcare Improvement to systematically improve health care quality. Dr. Haughom has also been selected by 60 national experts as one of the nation's Top Ten Health Care IT Innovators.

David R. Hunt, MD, FACs

Dr. Hunt joined the Office of the National Coordinator (ONC) for Health Information Technology in October 2007. He currently serves as Medical Director in the Office of Provider Adoption and Support (OPAS).

Prior to joining ONC, he served at the Centers for Medicare & Medicaid Services (CMS) in Baltimore from 2002 through 2007. There, he led the measure development, design, testing, and implementation of the Surgical Care Improvement Project (SCIP) as well as the Medicare Patient Safety Monitoring System (MPSMS), a nationwide surveillance project aimed at identifying the rates of specific adverse events within the Medicare population.

Dr. Hunt, a native of Baltimore, MD, attended public schools and graduated high school from the Baltimore Polytechnic Institute. After receiving an undergraduate degree from the University of Rochester in New York, he attended Howard University College of Medicine, and graduated with a medical degree in 1984. A diplomate of the American Board of Surgery, Dr. Hunt completed his residency in surgery at Howard University and is licensed to practice medicine in the District of Columbia. Practicing in both private and academic settings, Dr. Hunt served as a Clinical Assistant Professor of Surgery at Howard University and as chair of surgical peer review at various hospitals in the Washington metropolitan area, and has been a fellow of the American College of Surgeons since 1993. He has served on the Safe Practices Consensus Committee of the National Quality Forum since 2005, and in March 2009 he was appointed to the Federal Coordinating Council for Comparative Effective Research.

Susy Jeng, MD

Dr. Jeng currently serves as a Chief Resident in child neurology at the University of California, San Francisco. She received a bachelor's degree from Harvard College and her medical degree from the University of California, San Diego. She completed her pediatrics residency training at University of California, San Francisco and is board certified in pediatrics. After practicing pediatrics for 2 years, she returned to UCSF for further specialty training and will be completing her 3-year training in child neurology in June of 2011. She currently serves on the Long-Range Planning Committee of the Child Neurology Society, the UCSF Ethics Committee, and UCSF Neurology Education Committee.

Ashish Jha, MD, MPH

Dr. Jha is associate professor of Health Policy and Management in the Department of Health Policy and Management at the Harvard School of Public Health. He is also an Associate Professor of Medicine at Harvard Medical School and Associate Physician at Boston's Brigham and Women's Hospital and VA Boston Healthcare System. Over the past 3 years, he has served as Special Advisor for Quality and Safety to the Department of Veterans Affairs.

Dr. Jha received his medical degree from Harvard Medical School in 1997 and trained in Internal Medicine at the University of California, San Francisco, where he also served as Chief Medical Resident. He completed his General Medicine fellowship from Brigham and Women's Hospital and Harvard Medical School and received his MPH in Clinical Effectiveness from Harvard School of Public Health in 2004. He joined the faculty in July of 2004.

Dr. Jha is a practicing general internist with a clinical focus on hospital care. The major themes of his research include quality of care provided by health care systems with a focus on safety, efficiency, and effectiveness; health information technology as a tool to reduce disparities and improve the quality, efficiency, and safety of care; disparities in care, with a focus on the quality of care provided by minority-serving providers; and hospital governance and its impact on quality of care.

Christopher P. Landrigan, MD, MPH

Dr. Landrigan is Assistant Professor of Pediatrics and Medicine at Harvard Medical School, Director of the Sleep and Patient Safety Program at Brigham and Women's Hospital, and a practicing pediatric hospitalist. He has 12 years of experience studying the quality and safety of hospital care. His research has evaluated efficiency and outcomes of care in pediatric hospitalist systems, as well as patient safety across pediatric and adult inpatient settings. His primary focus has been studying the effects of resident sleep deprivation on patient safety.

Dr. Landrigan has also led a series of studies evaluating the relationship between resident depression and patient safety, the effects of computerized order entry systems on rates of medication errors, and the relationship between resident handoffs and error. His current work

focuses on evaluating the effectiveness of diverse approaches to reducing fatigue-related error, improving handoffs of care, and translating safety research into policy and practice.

Peter Pronovost, MD, PhD

Dr. Pronovost is a practicing anesthesiologist and critical care physician, teacher, researcher, and international patient safety leader. Dr. Pronovost is a Professor in the Johns Hopkins University School of Medicine (Departments of Anesthesiology and Critical Care Medicine, and Surgery), in the Bloomberg School of Public Health (Department of Health Policy and Management), and in the School of Nursing. He is also Medical Director for the Center for Innovation in Quality Patient Care, which supports quality and safety efforts at the Johns Hopkins Hospitals. In 2003, he established the Quality and Safety Research Group to advance the science of safety. Dr. Pronovost and his research team are dedicated to improving health care through methods that are scientifically rigorous, yet feasible at the bedside. Dr. Pronovost holds a doctorate in clinical investigation from the Johns Hopkins Bloomberg School of Public Health.

The author of more than 340 articles and chapters in the fields of patient safety, ICU care, quality health care, evidence-based medicine, and the measurement and evaluation of safety efforts, Dr. Pronovost is also a frequent speaker on the topics of quality and safety leadership and implementation of large-scale change. He chairs the JCAHO ICU Advisory Panel for Quality Measures and the ICU Physician Staffing Committee for the Leapfrog Group, and serves on the Quality Measures Work Group of the National Quality Forum. He also serves in an advisory capacity to the World Health Organization's World Alliance for Patient Safety and is leading WHO efforts to improve patient safety measurement, evaluation, and leadership capacity globally.

Dr. Pronovost has won several national awards for his research, including the 2004 John Eisenberg Patient Safety Research Award. He was also one of 25 individuals awarded a coveted MacArthur Fellowship in 2008, known popularly as the "genius grant."

Time magazine named Dr. Pronovost one of the world's 100 "most influential people" in 2008 for his work in patient safety—specifically the checklist for ICU procedures inspired by the airline industry's routine safety checklist. Dr. Pronovost's work in patient safety and care improvement innovations is changing the way in which not just the United States, but the world thinks about medical care. The magazine's annual list recognizes people "whose power, talent or moral example is transforming our world."

The U.S. House of Representatives' Committee on Oversight and Government Reform, chaired by Henry A. Waxman (D-CA), released a report strongly endorsing Dr. Pronovost's ICU infection prevention program, noting that its use has the potential of saving thousands of lives and millions of dollars throughout the United States. And Maryland Senator Barbara Mikulski recently drafted a health care bill based almost entirely on Dr. Pronovost's work.

Dr. Pronovost is currently leading several large national and international safety projects.

Stephen Raab, MD

Dr. Raab is Professor of Pathology, Vice Chair of Quality, and Director of Anatomic Pathology at the University of Colorado, Denver. Dr. Raab practices anatomic pathology and performs health services research in laboratory medicine patient safety, culture, and implementation and dissemination science. Dr. Raab and his team have received funding from AHRQ, Centers for Disease Control and Prevention, Jewish Healthcare Foundation, and College of American Pathologists (CAP). Dr. Raab has received the international Papanicolaou Award and the CAP Lansky and Humanitarian Awards for his national and international focus on laboratory medicine quality outcomes and commitment to patient care.

Dr. Raab received his undergraduate degree in philosophy at the University of Pennsylvania and his medical degree at the Sate University of New York at Syracuse. His postgraduate training was completed at Washington University, East Carolina University, and Stanford University. Dr. Raab has published over 190 articles on quality and safety in diagnostic testing and is the Editor-in-Chief of *Pathology and Laboratory Medicine*. His current research involves the implementation of Lean practices, transformational leadership, and the development of simulation training in diagnostic testing services.

William M. Sage, MD, JD

Dr. Sage, an authority on health law and policy, is Vice Provost for Health Affairs and James R. Dougherty Chair for Faculty Excellence at the University of Texas at Austin. He is a member of the Institute of Medicine of the National Academies and serves on the Fellows Council of the Hastings Center on bioethics and the editorial board of *Health Affairs*. He holds degrees from Harvard and Stanford and has practice experience in both medicine and law. In 1993, he headed four working groups of the Clinton Administration's Task Force on Health Care Reform.

Before joining the UT faculty in 2006, he was professor of law at Columbia University, and has had visiting appointments at Harvard and Duke. Dr. Sage's edited books include *Medical Malpractice and the U.S. Health Care System* and *Uncertain Times: Kenneth Arrow and the Changing Economics of Health Care*. He has written over 100 articles in publications such as *JAMA*, *Health Affairs*, the *Journal of Health Politics, Policy and Law*, and the law reviews of Columbia, Duke, Georgetown, Texas, and Vanderbilt.

Eduardo Salas, PhD

Dr. Salas is University Trustee Chair and Pegasus Professor of Psychology at the University of Central Florida (UCF). He is also Program Director for Human Systems Integration Research Department at UCF's Institute for Simulation & Training. Previously, he was a Senior Research Psychologist and Head of the Training Technology Development Branch of NAVAIR Orlando for 15 years.

Dr. Salas has co-authored over 350 journal articles and book chapters and has co-edited over 20 books. He has been on 20 editorial boards, was Editor of *Human Factors*, and is currently Associate Editor for the *Journal of Applied Psychology*. In addition, he has edited three Special Issues (on training, patient safety, and decision making in complex environments) for the *Human Factors* journal. He has edited other Special

Issues on team training and performance and training evaluation (*Military Psychology*), shared cognition (*Journal of Organizational Behavior*), and simulation and training (*International Journal of Aviation Psychology*). He is also very active with Society for Industrial and Organizational Psychology (SIOP). He is currently the President of the Society and Series Editor of the Organizational Frontier book series. Dr. Salas is a Fellow of the American Psychological Association (SIOP and Divisions 19, 21 & 49), the Human Factors and Ergonomics Society, and the Association for Psychological Science. In 1984, he received his PhD in industrial and organizational psychology from Old Dominion University.

His expertise includes helping organizations foster teamwork, design and implement team training strategies, facilitate training effectiveness, manage decision making under stress, develop performance measurement tools, and design learning- and simulation-based environments. He is currently working on designing tools, instructional strategies, and techniques to minimize human errors in aviation, law enforcement, and medical environments.

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- Linux
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- Internet Explorer 5
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Frequently Asked Questions

Check to find the answers to your questions about the Agency for Healthcare Research and Quality (AHRQ) programs and activities. You can search by category or key words. You can also send us your questions or Web site feedback here. We will respond to your requests based on the best available scientific evidence and research from our Agency.

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AHRQ was originally created as the Agency for Health Care Policy and Research (AHCPR) on December 19, 1989, under the Omnibus Budget Reconciliation Act of 1989 (103 Stat. 2159), as a Public Health...

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The "10 Questions To Ask Your Doctor" are on the Agency for Healthcare Research and Quality (AHRQ) Web site at http://www.ahrq.gov/patients-consumers/patient-involvement/ask-your-doctor/index.html .
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Improving the Quality, Safety, Efficiency, and Effectiveness of Health Care For All Americans

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Improving the Quality, Safety, Efficiency, and Effectiveness of Health Care For All Americans

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Information about how AHRQ makes information and resources on the Web sites that it sponsors accessible to the widest possible audience.

The Agency for Healthcare Research and Quality (AHRQ) is committed to making the information and resources on the Web sites that it sponsors accessible to the widest possible audience, including persons with disabilities.

Overview

In keeping with its mission, AHRQ complies with accessibility requirements by implementing the regulations of Section 508 of the Rehabilitation Act and the U.S. Department of Health and Human Services (HHS) Secretary's Section 508 Implementation Policy.

AHRQ would appreciate being notified of accessibility problems so that we can remediate them and better serve you.

Federal agencies are required, upon request, to provide information and data to individuals with disabilities through an alternative means of access that can be used by the individuals.

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Synopsis of Section 508 Accessibility Requirements

Section 508 requires federal agencies to ensure that individuals with disabilities who are members of the public or Federal employees have access to and use of electronic and information technology (EIT) that is comparable to that provided to individuals without disabilities, unless an undue burden would be imposed on the agency. The requirements of Section 508 apply to an agency's procurement of EIT, as well as the agency's development, maintenance, or use of EIT.

Although federal agencies have an explicit statutory obligation to make all electronic and information technology (EIT) that they develop, procure, maintain, or use compliant with Section 508, individuals may only file complaints or lawsuits to enforce Section 508's requirements with respect to EIT systems procured or deployed on or after June 21, 2001. Learn more at FAR Final Rule.

The Section 508 requirements do not apply retroactively to pre-existing EIT. However, as agencies upgrade and change their electronic and information technology, they must comply with the standards. Specifically, the Electronic and Information Technology Accessibility Standards: Economic Assessment states that:

> "The standards are to be applied prospectively and do not require federal agencies to retrofit existing electronic and information technology. As agencies upgrade and change their electronic and information technology, they must comply with the standards."

Federal agencies have additional responsibilities under Section 501 and Section 504 of the Rehabilitation Act. These Sections require that agencies provide reasonable accommodation to employees with disabilities and provide program access to members of the public with disabilities and take other actions necessary to prevent discrimination on the basis of disability in their programs.

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More Information

- The HHS Office on Disability (OD) oversees the implementation of Section 508 at HHS. Visit this site to learn more about the OD's activities and leadership.
- The U.S. Access Board's Section 508 Homepage provides information on Section 508 law, frequently asked questions, and standards.
- The Section 508 Homepage provides Section 508 tools, resources, standards, and news.

Current as of October 2007

Internet Citation: Accessibility. October 2007. Agency for Healthcare Research and Quality, Rockville, MD.
http://www.ahrq.gov/policy/electronic/accessibility/index.html

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President Obama's Economic Vision

A Better Bargain for the Middle Class

President Obama kicks off a series of speeches that will lay out his vision for rebuilding an economy that puts the middle class and those fighting to join it front and center.

Mobile users watch here

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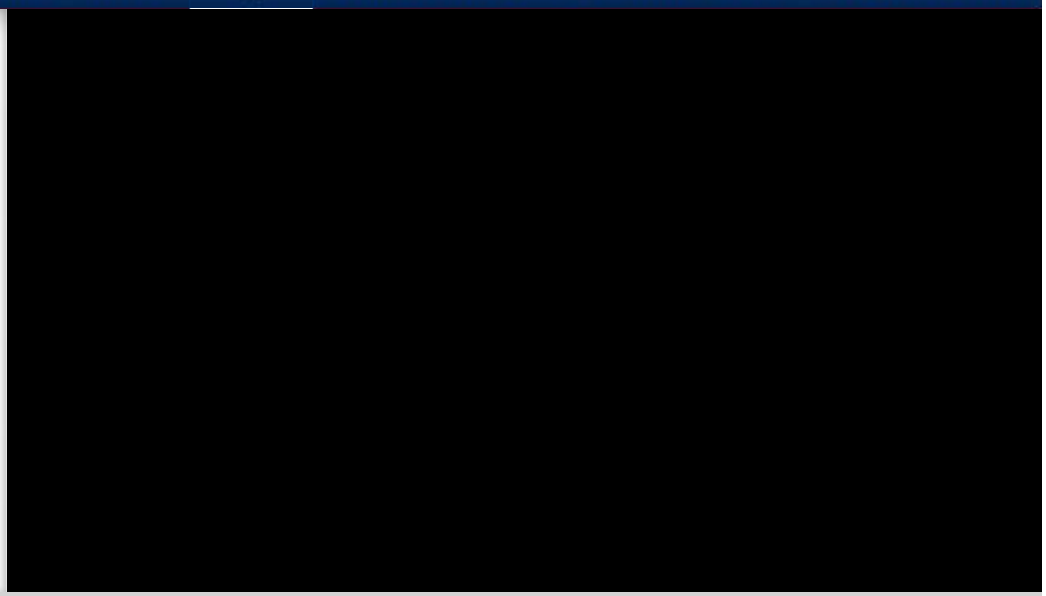

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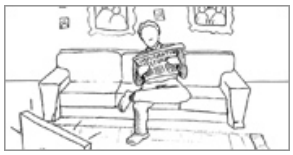

Immigration and the Economy

Here's one of the best things about immigration reform: It's going to make the economy a lot better.

A Plan to Fight Climate Change

We have a moral obligation to lead the fight against carbon pollution.

Education

Preparing students for the jobs of the future starts with a strong school system.

Weekly Address: Confirming Rich Cordray to Lead the CFPB

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Recognizing Leaders in Youth Job Creation

Vice President Biden and Indian Leaders Discuss U.S.-India Engagement

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State and Local Leaders Press Case for Commonsense Immigration Reform

Student Loan Deal Will Cut Interest

TOP NEWS

July 23, 6:09pm

The Louisville Cardinals Celebrate Their NCAA Championship Win at the White House

July 21, 8:00pm

You're Going to Want to Watch This Speech

July 20, 6:00am

Weekly Address: Confirming Rich Cordray to Lead the CFPB

@WHITEHOUSE

President Obama just landed in IL for his speech at Knox College. Watch it at 12:55pm ET: http://t.co/iiKB014sH9, http://t.co/GAdkOzDQwH

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June 2005

Getting to the Root of the Matter

SPOTLIGHT CASE

Commentary by **Scott A. Flanders, MD; Sanjay Saint, MD, MPH**

PowerPoint Slideshow (616K) of this case
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Also from June 2005

CASES & COMMENTARIES: Two Pills, Same Drug

CASES & COMMENTARIES: Blind Spot

PERSPECTIVE: Interpreting the Patient Safety Literature

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Related content on AHRQ PSNet, the world's most robust collection of patient safety information:

- Preventing vincristine administration errors.
- Not again!

The Case

A 65-year-old man with atrial fibrillation, lung cancer, and chronic renal insufficiency presented to the emergency department (ED) with shortness of breath. His vital signs were significant for a respiratory rate of 32, a temperature of 102.4°F, and an oxygen saturation of 87% on a 100% non-rebreather. A chest X-ray showed a right middle lobe infiltrate. Due to respiratory distress, the patient was intubated.

Shortly thereafter, the patient became hypotensive with a systolic blood pressure (BP) of 65 mm Hg. Fluid resuscitation was continued while BP was supported with phenylephrine and vasopressin. Phenylephrine was changed to norepinephrine. After 8 hours, arterial blood gas test revealed a pH 7.23, Pco_2 23 mm Hg, Po_2 161 mm Hg and base excess –16, lactate 6.2 mmol/L (normal 0.5 – 2.2 mmol/L). A pulmonary artery catheter was placed, and initial numbers were—surprisingly—more consistent with cardiogenic shock than septic shock, with a central venous pressure of 13-17 mm Hg, pulmonary capillary wedge pressure of 19 mm Hg, cardiac index (CI) 1.8 L/min/m^2, and systemic vascular resistance (SVR) of 1500 dynes/sec x cm^{-5}. Norepinephrine was weaned rapidly. The patient remained on vasopressin. An echocardiogram showed global decrease in contractility, with an ejection fraction 45% and mild right ventricular dilatation. Shortly thereafter, it was discovered that the patient had been receiving 0.4 units/min of vasopressin, rather than the intended dose of 0.04 units/min. Vasopressin was discontinued.

Within the next few hours, the patient's condition improved. The CI and mixed venous oxygen saturation increased to 3.8 L/min/m^2 and 75%, respectively, and the SVR decreased to 586 dynes/sec x cm^{-5}. A creatine kinase (CK) peaked to 7236 U/L, CKMB to 37 U/L. The patient was treated with fluids and antibiotics and had an uneventful recovery.

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The wrong patient. CLASSIC

Chassin MR, Becher EC. Ann Intern Med. 2002;136:826-833.

This case study describes the events of a patient who underwent an unintended invasive cardiac electrophysiology study. While reviewing the details of the case and the institution's root cause analysis, the authors identify 17 distinct errors that culminated in the procedure taking place. The authors discuss the role of the individual versus the system, the existing culture contributing to the error, and strategies to avoid similar errors in the future. This article is part of a special collection entitled "Quality Grand Rounds," a series of articles published in the *Annals of Internal Medicine* that explores a range of quality issues and medical errors.

PubMed citation
Free full text

Related Resources

STUDY

Missed lesions at abdominal oncologic CT: lessons learned from quality assurance.

Siewert B, Sosna J, McNamara A, Raptopoulos V, Kruskal JB. Radiographics. 2008;28:623-638.

STUDY

A case of mistaken identity: staff input on patient ID errors.

Ortiz J, Amatucci C. Nurs Manage. April 2009;4:37-41.

AUDIOVISUAL

Chasing Zero: Winning the War on Healthcare Harm.

Austin, TX: Texas Medical Institute for Technology and the Quaid Foundation; 2010.

NEWSPAPER/MAGAZINE ARTICLE

Building patient safety skills: common pitfalls when conducting a root cause analysis.

ISMP Medication Safety Alert! Acute Care Edition. April 22, 2010;15:1-4.

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Error in medicine. CLASSIC

Leape LL. JAMA. 1994;272:1851-1857.

Leape discusses how traditional methods of error reduction in medicine have focused on individual performance rather than on the systems in which individuals operate. With reference to Reason, he briefly reviews the cognitive psychology of human error, distinguishing between performance and error at the schematic or "skill" level, where an error is a "slip" (or "lapse"), and at the rule-based or "knowledge" level, where an error is a "mistake." Using the aviation industry as an example, Leape advances a systems-based approach to improving patient safety. Rather than relying on the absence of human error, as has been traditional in medicine, he advocates systems that assume human errors will occur and that are designed to minimize their occurrence and absorb them when they happen. He reviews several specific systems modifications to accomplish this transformation, as well as advocates national policy changes to institutionalize safety improvement.

PubMed citation
Available at

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- Cognitive Errors ("Mistakes")

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- United States of America

Related Resources

NEWSPAPER/MAGAZINE ARTICLE

RHIOs aim to transform quality of care and patient safety.

van der Grinten P. Patient Safety & Quality Healthcare. May/June 2006;3:46-48.

STUDY

Missed and delayed diagnoses in the emergency department: a study of closed malpractice claims from 4 liability insurers.

Kachalia A, Gandhi TK, Puopolo AL, et al. Ann Emerg Med. Ann Emerg Med. 2007;49:196-205.

STUDY

Medication prescribing errors involving the route of administration.

Lesar TS. Hosp Pharm. 2006;41:1053-1066.

BOOK/REPORT

How Doctors Think.

Groopman J. Boston, MA: Houghton Mifflin; 2007. ISBN: 0618610030.

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Case 34-2010: a 65-year-old woman with an incorrect operation on the left hand. CLASSIC

Ring DC, Herndon JH, Meyer GS. N Engl J Med. 2010;363:1950-1957.

The Case Records of the Massachusetts General Hospital are one of the most hallowed traditions in the medical literature, having been published weekly in the New England Journal of Medicine for more than a century. In contrast to the usual clinical focus, this article discusses a never event—a case of a patient who underwent the wrong surgical procedure. Presented by the surgeon himself, the article details the factors that led to the error, including production pressures, language barriers, and failure to perform a time out, and explores the ramifications of the error for the surgeon, the patient, and the institution.

PubMed citation
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Error Types
- Active Errors

Approach to Improving Safety
- Read Back Protocols
- Never Events

Origin/Sponsor
- United States of America

Related Resources

STUDY
Impact of preoperative briefings on operating room delays.
Nundy S, Mukherjee A, Sexton JB, et al. Arch Surg. 2008;143:1068-1072.

NEWSPAPER/MAGAZINE ARTICLE
Preventing surgical errors.
Frenzel JC, Kelly T. HHN Magazine Online. January 6, 2009.

STUDY
Improved operating room teamwork via SAFETY prep: a rural community hospital's experience.
Paige JT, Aaron DL, Yang T, Howell DS, Chauvin SW. World J Surg. 2009;33:1181-1187.

COMMENTARY
The 5th anniversary of the "Universal Protocol": pitfalls and pearls revisited.
Stahel PF, Mehler PS, Clarke TJ, Varnell J. Patient Saf Surg. 2009;3:14.

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Clinical Risk Management. Enhancing Patient Safety. CLASSIC

Vincent CA, ed. London: British Medical Journal Publications; 2001.

Vincent has updated his text on risk management, infusing it with concepts directly related to patient safety improvement. Forty-five authors contributed to the text. Its survey incorporates an essay on human error by James Reason. This section provides the baseline for subsequent discussions on risk management in safety on various clinical specialties. Principles of safe medical practice center on topics such as teamwork, culture change, communications, and human factors engineering, which are key components to seeking improvements through a safety lens. The book is anchored by tangible examples of the application of these ideas within the context of a risk management program and incident analysis.

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Resource Type
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Target Audience
- Health Care Providers

Clinical Area
- Medicine

Origin/Sponsor
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Related Resources

STUDY

Hospital staff should use more than one method to detect adverse events and potential adverse events: incident reporting, pharmacist surveillance and local real-time record review may all have a place.

Olsen S, Neale G, Schwab K, et al. Qual Saf Health Care. 2007;16:40-44.

NEWSPAPER/MAGAZINE ARTICLE

NHS drug error 'crackdown' urged.

BBC News. August 11, 2006.

NEWSPAPER/MAGAZINE ARTICLE

Simple mistakes, serious consequences: positive ID is no laughing matter.

Edozien L. Saferhealthcare. June 2, 2006.

SPECIAL OR THEME ISSUE

Interprofessional Approaches to Patient Safety.

J Interprof Care. 2006;20:455-571.

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Systems Analysis of Critical Incidents: the London Protocol.

Taylor-Adams S, Vincent C. London, England: Clinical Safety Research Unit, Imperial College London; 2004.

This report documents a process for adverse event analysis that risk managers and others may apply in a variety of health care environments.

Available at
Related information

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Resource Type
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Target Audience
- Risk Managers

Approach to Improving Safety
- Error Analysis

Origin/Sponsor
- United Kingdom

Related Resources

STUDY

Surgical skill is predicted by the ability to detect errors.

Bann S, Khan M, Datta V, Darzi A. Am J Surg. 2005;189:412-415.

STUDY CLASSIC

The investigation and analysis of critical incidents and adverse events in healthcare.

Woloshynowych M, Rogers S, Taylor-Adams S, Vincent C. Health Technol Assess. May 2005;9:1-158.

BOOK/REPORT

With Safety in Mind: Mental Health Services and Patient Safety.

Scobie S, Minghella E, Dale C, Thomson R, Lelliott P, Hill K. London, UK: National Patient Safety Agency; July 2006.

TOOLKIT

Manchester Patient Safety Framework (MaPSaF).

Manchester, UK: University of Manchester; 2006.

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