

Applying Aviation Safety Initiatives to Medicine

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The aviation industry has had considerable success in managing threats to safety and minimizing the consequences of human error. A number of physicians have sought to apply this experience to medical practice, particularly in operating rooms, emergency rooms, and intensive care units where teamwork is essential and crises frequent.

A research group from the University of Texas at Austin has studied human factors of aviation for more than two decades and recently has extended the research into medicine. Working in both domains has convinced the researchers that there are many common issues between aviation and medicine, yet significant differences. The researchers believe that aviation's approach to threat and error management can be applied, albeit cautiously, to medicine. Here is a brief description of critical common issues and a strategy for implementing programs.

Human error is implicated in more than 70% of air crashes. Psychological research shows that error is ubiquitous and inevitable in socio-technical endeavors. People make mistakes because they are human, and hence physically and psychologically limited in memory capacity and the ability to deal simultaneously with multiple cognitive demands. Cognitive function, including decision-making, is impaired by stressors—both psychological factors such as fear and physiological ones such as fatigue. Social factors including group dynamics and culture also can lead to error.

The professional cultures of aviation and medicine share a strong commitment to doing well. However, factors inherent in organizations and the operating environment can lead the best-qualified and motivated to err. System factors pose latent threats of failures as diverse as inadequate equipment, flawed procedures, fatigue-inducing schedules, and risk-prone organizational and professional cultures. Analyses of accidents and incidents show the importance of system factors in both catastrophes and near-misses.

The researchers define error operationally as action or inaction that leads to deviation from individual or

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organizational intentions or expectations. To better understand the nature of error, the research group placed expert observers in the cockpits of airlines for more than 4,000 flights (with absolute guarantees of no jeopardy for crews observed). The researchers focused on the nature of errors and the strategies used to detect and mitigate them.

All of the errors observed can be classified into five types:

1. **Procedural errors** such as mistakes, slips, and lapses—as when a pilot inadvertently makes an incorrect navigational setting;
2. **Proficiency errors** from lack of skill or knowledge;
3. **Communication errors** between pilots or between pilots and other groups;
4. **Decision errors** where a chosen course of action unnecessarily increases risk; and
5. **Intentional non-compliance errors** (violations of procedures where pilots purposefully choose to ignore rules).

Classifying errors this way is not an academic exercise; the various error types suggest very different types of remediation including training, changing procedures and modifying organizational culture. As a side note, it seems that aviation is over-proceduralized, with new requirements coming from

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almost every accident (tombstone regulation) while medicine is rather under-proceduralized.

Aviation has responded to human error by investigating and addressing systemic factors in accidents and incidents, including developing confidential error reporting systems, and initiating formal training in teamwork and decision making (known as Crew Resource Management or CRM) that provides specific behaviors as error countermeasures.

It is sometimes argued that, because of latent system failures, individuals should not be held responsible for errors. While a blame-and-punish culture is counterproductive, individuals remain accountable for errors under two conditions:

- When formal rules and procedures are violated; and
- When available countermeasures against error (for example, inputs from colleagues, checklists, etc.) are not employed.

An error-tolerant culture accepts errors but does not tolerate violation of formal rules, especially those validated as error-avoidance or mitigation strategies.

Aviation can provide medicine a six-step template for threat and error management:

1. Understand the organization's history and issues;
2. Diagnose the error-inducing conditions by obtaining accurate data on current practices (including confidential reporting systems, surveys of personnel and observations of normal practices);
3. Change the organizational culture to a safety culture

that recognizes the inevitability of error and actively seeks to identify and reduce latent threats;

4. Train staff in effective teamwork, decision-making and error management as well as technical aspects of the job;
5. Provide feedback and reinforcement for effective teamwork and error management; and
6. Recognize the continuing need for accurate data on threat and error management and ongoing training in threat management and error countermeasures.

Sometimes the greatest strides in an industry come from borrowing concepts from a seemingly unrelated industry. By applying aviation's six-step plan, health care organizations can make major progress in identifying error-inducing conditions and training individuals in how to minimize the risk of health care errors. [NPSF](#)

Related University of Texas Research Publications

1. Helmreich, R.L., & Merritt, A.C. (1998). Culture at work in aviation and medicine: National, organizational, and professional influences. Aldershot, U.K.: Ashgate.
2. Helmreich, R.L. (2000). On error management: Lessons from aviation. *British Medical Journal*, 320, 781-785.
3. Helmreich, R.L., & Schaefer, H.G. (1994). Team performance in the operating room. In M.S. Bogner (Ed.), *Human error in medicine* (pp. 225-253). Hillside, NJ: Lawrence Erlbaum and Associates.
4. Helmreich, R.L., & Musson, D.M. (2000). Surgery as a team endeavor [Editorial]. *Canadian Journal of Anesthesia*, 47:5, 391-392.
5. Helmreich, R.L., & Musson, D.M. (2000). Threat and error management model: Components and examples. *British Medical Journal* [On-line], *bmj.com*. Available: <http://www.bmj.com/misc/bmj.320.7237.781/sld001.htm>.
6. Sexton, J.B., Thomas, E.J., & Helmreich, R.L. (2000). Error, stress, and teamwork in medicine and aviation: Cross sectional surveys. *British Medical Journal*, 320, 745-749.
7. University of Texas Human Factors Project Website (aviation and medical research): <http://www.psy.utexas.edu/psy/helmreich/nasaut.htm>.

NPSF Statement of Principle

Talk to Patients About Health Care Injury

The NPSF recently developed a Statement of Principle in response to requests from patients and their families. The Board of Directors and staff endorse and support the

following statement regarding talking to patients about health care injuries, and encourage all health care organizations to adopt these practices:

When a health care injury occurs, the patient and the family or representative are entitled to a prompt explanation of how the injury occurred and its short- and long-term effects.

When an error contributed to the injury, the patient and the family or representative should receive a truthful and compassionate explanation about the error and the remedies available to the patient. They should be informed that the factors involved in the injury will be investigated so that steps can be taken to reduce the likelihood of similar injury to other patients.

Health care professionals and institutions that accept this responsibility are acknowledging their ethical obligation to be forthcoming about health care injuries and errors.

The National Patient Safety Foundation urges all health care professionals and institutions to embrace the principle of dealing honestly with patients.

Patient Safety Awards Recognize 3 Successful Error-reduction Practices

On October 6, 2000, NPSF announced the winners of the first-ever Patient Safety Awards recognizing practical solutions that reduce medical errors and improve patient safety.

Award recipients presented their winning solutions during the "Patient Safety Initiative 2000: Spotlighting Strategies, Sharing Solutions" conference held in Chicago.

Each of the three Patient Safety Award winners received \$10,000 for demonstrating superior foresight and innovation in patient safety. "These three outstanding award winners exemplify the five criteria we were looking for in our call," said NPSF Executive Director Joanne E. Turnbull, PhD.

The chosen solutions:

1. Have been tested, implemented and proven to reduce errors;
2. Are scientifically based;
3. Are practical to implement and administer;
4. Are creative and innovative; and
5. Are transferable across organizations and settings.

"The National Patient Safety Foundation is honored and proud to recognize these three leaders in health care organizations whose pioneering programs have put safety first," said NPSF Board Chair Henri R. Manasse, Jr., PhD, ScD. "They've demonstrated solutions that prevent injuries and save lives, and have set new standards for safety and excellence in our health care institutions. That makes us all winners."

Innovative Clinical Solutions Award: Fairview Southdale Hospital, Edina, Minnesota

The Innovative Clinical Solutions Award, sponsored by 3M, was given to Fairview Southdale Hospital in Edina, Minn., for developing an interdisciplinary model shown to significantly reduce heparin-related medication errors. Heparin is a drug used to treat a variety of thromboembolic (blood clot-related) conditions.

Steven Meisel, PharmD, Fairview Southdale's Assistant Director of Pharmacy, received the award for his team's work, "An Interdisciplinary Model for Reducing Intravenous Heparin Errors." "We found that by applying principles of simplification and standardization, we were able to make dramatic improvements in patient safety," said Meisel. "Our interdisciplinary team applied these principles to a very

complicated drug—heparin. They simplified the process dramatically, and in doing so, reduced errors by as much as 66%."

"The program at Fairview Southdale Hospital is having a very direct effect on the lives of patients," said Paul Rosso, PhD, of corporate sponsor 3M. "And equally exciting is the prospect of the Fairview heparin system being rolled out to other hospitals within their network as well as other hospitals in the United States."

Patient-Provider Communication Solutions Award: Children's Hospitals and Clinics, Minneapolis-St. Paul, Minnesota

The Patient Safety Award for Patient-Provider Communication Solutions, sponsored by The St. Paul Companies, was presented to the Children's Hospitals and Clinics in Minneapolis-St. Paul, Minn. The hospital developed a comprehensive disclosure policy involving families and caregivers to improve young patients' care and safety.

"Unless people feel safe to talk about failures, to talk about risk, to talk about mistakes, we will never learn all the vulnerabilities that exist in these complex systems of care," said Julie Morath, RN, MS, Chief Operating Officer and Vice President of Health Care Delivery. "So we're moving from blame and secrecy into reporting and learning, which gives us the ability to predict and prevent."

The winning solution, "Partnering with Families: Disclosure and Trust," set forth a patient safety agenda:

- Encourage families to participate in patient care and to ask questions;
- Offer complete, prompt and truthful disclosure of information and counseling to families when a medical accident occurs;
- Fully analyze each accident to prevent such an event from happening again. Protect staff who promptly and appropriately report accidents to a patient's immediate caregiver, manager or safety officer; and
- Offer continuing patient safety education by developing targeted learning packets for leadership and clinical staff as well as information packets for patients and families.

"We think that Children's Hospital has created an innovative culture around patient safety," said Tim Morse of corporate sponsor, The St. Paul. "They've taken a step in disclosure which is being hotly debated and contested in the health care community now, and they've set a standard for hospitals across the country to follow."

Janssen Patient Safety Award for Elder Care: Health Care Financing Administration (HCFA), Baltimore, Maryland

The winner of the Janssen Patient Safety Award for Elder Care was a solution presented by Christopher P. Koepke, PhD, a social science research analyst for the Health Care Financing Administration (HCFA), which administers Medicare. His team's research project was entitled, "Which Messages on Patient Safety Should the Federal Government Promote? HCFA Research with Medicare Beneficiaries."

The study looked at whether widespread popular interest in medical errors can be transformed into an active public role in preventing these errors by Medicare beneficiaries. Koepke's team found that consumer messages on reducing medical error work best if the messages:

- Advocate a collaborative doctor-patient relationship in which patients work with, rather than challenge, health professionals;
- Specify actions to be taken in messages that are easily understood by patients; and
- Clearly give patients directions on how they should act on these safety messages.

"Our research suggests that senior citizens prefer messages that suggest a collaborative relationship with their health care providers," said Koepke. "They also preferred messages that suggest a specific action to be taken, rather than more general patient safety messages."

"This award is going to help minimize some problems that a lot of people face in everyday life: that there are multiple products and potential drug interactions," said Anwar Feroz of corporate sponsor Janssen Pharmaceutica. "Research like this helps involve more people in improving the quality of care for the frail and elderly."

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**Julie Morath, RN, MS
Children's Hospitals and Clinics
Minneapolis-St. Paul, Minn.**

30 Safety Solutions Presented at October Conference

The three award-winning safety solutions were only part of the solutions presented during the Patient Safety Initiative 2000 conference in Chicago.

In May, NPSF and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) issued a nationwide call for abstracts outlining real-world health-care strategies shown to reduce medical errors and improve patient safety. Thirty of these solutions were chosen to be presented at the October Patient Safety Initiative 2000 conference, co-sponsored by NPSF and JCAHO. A compendium of these successful practices will be available in the coming months.

"These proven strategies for improving safety show the value of translating research into practice," said NPSF Board Chair Henri R. Manasse, Jr., PhD, ScD. "The National Patient Safety Foundation will continue its call for solutions from practitioners who directly care for patients as well as managerial leaders from our health care system. We're confident that these solutions will improve patient safety through transferability at the national, and perhaps, international level." **NPSF**

Do you have a proven safety solution? For information on submitting abstracts for the 2001 Patient Safety Awards, see page 7.

Introducing The Leapfrog Group Business Roundtable Launches Initiative to Boost Patient Safety

A leading group of Fortune 500 companies and other large health care purchasers have founded The Leapfrog Group by creating and committing to a common set of purchasing principles aimed at improving patient safety.

"Leapfrog is a national effort by purchasers of health care to achieve major improvements or 'leaps' in patient safety," says Executive Director Suzanne Delbanco, PhD.

Its founding members include the Buyer's Healthcare Action Group, GE, General Motors, Verizon (formerly GTE), and The Pacific Business Group on Health. The Health Care Financing Administration (HCFA) and the US Office of Personnel Management also participate as liaison members. Together, Leapfrog's now 60-plus private- and public-sector purchasers represent more than 20 million Americans.

Leapfrog members agree to support and implement certain purchasing principles designed to improve patient safety, including use of comparative ratings for providers, employee education, and use of substantial incentives to reward patient safety, such as patient volume, price and public recognition.

The organization is focused on three initial safety "leaps" for hospitals, developed from the Institute of Medicine's Report, "To Err is Human," as well as consultations with leading quality researchers. The three leaps are:

1. Computerized Physician Order Entry (CPOE)

CPOE systems with intercept capability have been shown to reduce serious prescribing errors by more than 50 percent—yet fewer than two percent of US hospitals have CPOE completely or partially available and require its use by physicians. CPOE systems can eliminate errors caused by misreading or misinterpreting handwritten instructions. They can also intercept orders that might result in adverse drug reactions or that deviate from standard protocols. This recommendation is supported by research from David Bates, MD, MSC, Brigham & Women's Hospital (JAMA. 1998; 280: 1311-1316, 1995; 274:29-43, 1997; 277:307-311.

2. Evidence-based Hospital Referral (EHR)

"For certain elective procedures and treatments," Delbanco explains, "patients should be guided to the hospitals and clinical teams that are more likely to produce better outcomes." One marker of how well a hospital is likely to perform is the experience of that hospital and its surgical team. In the absence of data to compare hospitals on their complications and survival rates, you can begin by evaluating experience and looking at the number of surgical procedures a hospital performs each year.

"Referrals to institutions with a lot of experience treating certain conditions offer the best survival odds," says Delbanco. This recommendation is supported by research from Adams Dudley, MD, MBA, University of California, San Francisco. (JAMA. 2000; 283:1159-66) and others (JAMA. 1996; 276:1054-9).

3. ICU Physician Staffing

Hospital intensive care unit (ICU) care should be managed by a physician certified (or eligible for certification) in critical care medicine. Evidence shows a direct correlation between the level of training of ICU personnel and the quality of patient care.

"When ICUs are staffed with physicians who have credentials in critical care medicine, the risk of patients dying in the ICU has been shown to reduce by more than 10%," says Delbanco. This is supported by research by Peter Pronovost, MD, PhD, The Johns Hopkins University School of Medicine. (JAMA. 1999; 281:1310-17).

Any health care purchaser can be part of The Leapfrog Group. "The first thing Leapfrog needs from you is your commitment to the purchasing principles and safety standards and the actions you can carry out in your organization," says Delbanco. "Leapfrog also seeks the collaboration of health plans, hospitals, health care providers and consumers. Purchasers know we can't do this alone." [NPSF](#)

Visit the Leapfrog Web site at www.leapfroggroup.org.

request for abstracts

Patient Safety Initiative 2001 Needs Your Safety Solutions

Share your successful practices! The National Patient Safety Foundation (NPSF) and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) are soliciting abstracts of patient safety and error-reduction strategies that have been proven effective in health care. Selected abstracts will be featured at a national conference on patient safety, published in a compendium, and considered for the NPSF 2001 Patient Safety Awards.

Who can submit safety solutions?

This call for abstracts is open to all areas of health care, including provider organizations, practitioners, professional societies and managed care entities, and interfaces between these and other settings. Abstracts are welcome from everyone, including purchasers, risk managers, patients and health care consumers, clinician educators, clinicians, consultants and patient advocates, as well as representatives of the legal community, health systems, manufacturers of medical products and standards-setting organizations.

What are the judging criteria?

Solutions will be judged on the extent to which they meet the following criteria:

- Strategies, techniques or processes that have already been tested in practice are strongly preferred over proposals, plans or ideas that have yet to be implemented;
- General discussions, literature reviews and undemonstrated new ideas are considered less desirable;
- Strategies whose immediate impact is to improve efficiency, quality or clinical care must also demonstrate increased patient safety and/or reduced error rates. Explicit processes of measuring error are encouraged;
- Although traditional scientific designs are certainly welcome—especially randomized clinical trials—other methods of demonstrating effectiveness are also acceptable, such as indirect measurements, observation, or staff or patient opinion;
- Solutions that are practical to implement and administer are preferred;
- Creative, innovative solutions are encouraged; and
- Solutions that are transferable across a variety of health care settings are strongly preferred.

How should the abstracts be written?

Abstracts should be no longer than three pages and must include: (1) a summary of the solution, including outcomes or results, (2) references, and (3) a 100-word biographical sketch of the primary author.

What categories are included?

Solutions for all types of error reduction will be considered, including the following examples of categories:

- Error reporting and disclosure in a non-punitive setting
- Clinical solutions
- Systems-error reduction
- Technical solutions
- Educational solutions
- Cultural solutions
- Environmental solutions
- Patient-provider communication solutions

Abstracts are due May 1, 2001

Please submit your abstracts by May 1, 2001. Brief full papers will be due August 15, 2001. The Patient Safety Initiative 2001 conference will be held November 7-9 in Chicago.

How should abstracts be submitted?

Abstracts should be submitted electronically, in either Microsoft Word or WordPerfect, to:

Mitch Dvorak
Project Manager
National Patient Safety Foundation
E-mail: mitch_dvorak@ama-assn.org

Questions? Call Mitch Dvorak at (312) 464-4848. [NPSF](#)

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The opinions expressed in this publication are not necessarily those of the National Patient Safety Foundation or of its Board of Directors.

To submit articles or publications for possible review in Focus, please direct materials to: Dawn McGinley, Managing Editor, Focus on Patient Safety, National Patient Safety Foundation, 515 N. State Street, Chicago, Illinois 60610. Materials, inquiries and subscription requests for the publication will be accepted electronically at npsf@ama-assn.org or via fax at 312-464-4154.

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'Let's Talk: Communicating Risk and Safety in Health Care' Patient Safety Conference Set for May 2001

NPSF, in conjunction with The Annenberg Center for Health Sciences, announces the third in a series of landmark conferences focused on reducing health care errors and improving patient safety.

Conference Dates: May 16-18, 2001

"Let's Talk: Communicating Risk and Safety in Health Care," will be held at the Radisson Riverfront Hotel in St. Paul, Minn., on May 16-18, 2001.

For registration information, visit www.npsf.org or call (312) 464-4848.

Topics will include:

- The nature of patient-provider communication.
- Professionals' and patients' disparate understanding of risk.
- Communications at the sharp end.
- Intrastaff communication.
- Effective communication as a core element in a culture of safety.
- Communicating technological needs and human factors.
- Health literacy and communication.
- Communications between providers and patients/families.
- Disclosing health care errors.
- Threat of litigation as a deterrent to disclosure and communication.

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