Landing on the Hudson River: Lessons for Health Care

By Barry Silbaugh, MD, MS, FACPE and Jeff Skiles

In this article...

ACPE CEO Barry Silbaugh, MD, recently got to know US Airways pilot Jeff Skiles. Together, they compared and contrasted the safety issues affecting health care and aviation.

What can be more stressful than having two jet engines on a commercial airliner fail simultaneously just after takeoff from a major metropolitan airport with a full load of passengers?

Jeff Skiles was at the controls of US Airways Flight 1549 over New York City on January 15, 2009, when the crisis now known as the Miracle on the Hudson began. The teamwork and cool professionalism of the pilots and crew who saved the plane and its passengers from tragedy didn't happen by chance.

The foundations were laid years earlier when commercial aviation recognized that fatal accidents were happening because of communication problems among the team members who were vital to getting an airplane loaded, fueled, repaired, and flying.

For years, comparisons have been made between aviation safety and patient safety. And for years, physicians have complained that aviation is too different from health care to use as a comparison.

Yes, there are indeed significant differences. But there are also powerful lessons to be learned from the experience of commercial aviation over the past 30 years regarding the relationship of autonomy to reliability, and the impact of professional communication among humans in preventing mistakes that can lead to catastrophe.

Here's a look at how a physician (ACPE CEO Barry Silbaugh, MD) and an airline pilot (Skiles) view the safety efforts in each industry, and some recommendations from both for those working in medicine to consider.

Similarities and differences

Silbaugh: It seems reasonable to compare commercial aviation as a whole to health care as a whole, rather than simply making the comparison of pilots to physicians.

From a customer's decision to fly from one city to another, to the experience of flying, to collecting one's baggage at the end of the flight, many separate and distinct work processes have occurred. Many different people with different backgrounds and levels of training are involved.

Some work processes are highly reliable, and others notoriously unreliable (lost luggage, for example). Many physicians claim that health care as a system is far more complex than aviation. Getting an airplane off the ground, into the air, and landed again is simpler than dealing with the inherent differences among patients, which include physical, emotional, psychological, and diagnostic/treatment variation.

Skiles: I would disagree with your contention that health care is far more complex than aviation. While medical complexity is confined within the patient, ours is in dealing with the complicated machines we fly and the unlimited possibilities of the uncertain environment we work in.

I recently found myself having to make an instrument approach, at night, and in weather, into a Caribbean island I had never been to before, dealing with an air traffic controller I could barely understand.

I was concerned about mountains I could not see, and what the braking action might be on the non-crowned, non-grooved runway which is offset from the approach course requiring me to do some maneuvering down low when I got it in sight.

My observation would be that aviation has been forced due to the extreme complexity of aircraft, operation, and

environment to develop layers of professionals, institutional and personnel procedural solutions, checklists, flows, and the teamwork, systems and procedures to integrate them all into a functional whole.

Atul Gawande's book *The Checklist Manifesto* details the tremendous positive results of using something that we in aviation were using as long ago as WW II, a simple checklist. Yet, getting that into hospitals is apparently difficult.

Comparing the simple checklist to modern aviation's layered "barriers to error" management techniques is like comparing a Model T to a Lamborgini.

Silbaugh: Aviation work processes are highly linear: each process is linked to another with the simple goal of getting an airplane airborne quickly and safely, and landed safely.

Health care work processes are very non-linear. Patients enter the physician's office or hospital from any of several circumstances: a traumatic accident, an illness, a search for an

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accurate diagnosis, or for treatment.

Both commercial aviation and health care are high-consequence industries. If human, equipment, or organizational failures occur, the consequences are often fatal. Because most health care accidents involve only one patient at a time, and aviation accidents involve multiple fatalities, the awareness of aviation as a high consequence industry is much higher than health care.

The 44,000 to 98,000 avoidable deaths annually cited by the 1999 Institute of Medicine report To Err is Human have been compared to the number of fatalities resulting from two or more jumbo jet crashes each week.

The public, however, has a much different perspective on the safety of health care. According to the Kaiser Health Poll Report of 2003, 60 percent of Americans

estimate that medical errors cause fewer than 5,000 deaths annually.[1]

Skiles: Yes, I agree with your view of linear and non-linear problem solving. I believe that it is even more important for physicians to control what they can with strict procedure, clearly defined roles, responsibilities and teamwork, so that they can concentrate on the true differences in patient care.

The difficulty with truly linear thinking is that the team can only accomplish as much as the mental abilities of the person in charge. For that reason, in aviation we have moved away from linear thinking in emergency situations.

The importance of "flying" the aircraft requires one pilot to be entirely concentrated on the common flying

duties while the other pilot accomplishes whatever emergency procedure is necessary. Most emergency procedures require some level of involvement of both pilots, but the flying pilot will move in and out of the procedure, as necessary, cued by certain words.

And the flying pilot's contribution to the emergency procedure is intentionally kept to a role of verifying important and non-reversible actions. This split in focus in high-workload situations is not done by agreement or command at the height of the crisis, but rather is instantly accomplished by both pilots in compliance with strict protocols established by the overall organization.

The value of this is the understanding that I came to from my experience in the Miracle on the Hudson. When you find yourself in the midst of an unfamiliar and stressful situation, you fall back on rote procedure and trained interaction with your team. This structure allows you to accomplish, almost without thought, the obvious tasks, while you concentrate on what is unique in your immediate environment.

High reliability principles

Karl Weick and Kathleen Sutcliffe of the University of Michigan Business School have described five principles that are at the core of highly reliable industries and companies in their book, *Managing the Unexpected: Assuring High Performance in an Age of Complexity.*

Highly reliable firms tend to be mindful at all times of these key principles. These firms train and encourage all employees to be aware of these principles, and to speak up when safety-critical issues arise. Let's look at these five principles from the perspectives of commercial aviation and health care.

1.   Preoccupation with failure

Silbaugh: Experienced clinicians are aware of how even small or seemingly inconsequential errors or events may be an indicator that something is wrong with a care process.

Their experience has shown them how these apparent minor variations from the expected can be the first indication that a catastrophic event may be coming unless actions are taken to prevent it. The best clinicians from all health care professions take pride in recognizing and acting on the sometimes subtle events that may not raise an alarm in less experienced professionals.

Though the engineering term "preoccupation with failure" may sound negative and uninspiring to many, it is meant to describe how highly skilled professionals are continually vigilant for opportunities to prevent catastrophic failure. In fact, they love their work and enjoy their role in preventing big problems by being preoccupied with small failures.

In health care, the intensivist or surgeon may interpret small changes in blood pressure, urine output, or mental status as early warning signs of sepsis, when less experienced or less mindful professionals are unconcerned. Other members of the health care team may have a feeling that "something's not right," but aren't sure how to communicate their concerns.

Skiles: In aviation, it has long been understood that accidents don't just happen. An accident is almost always the culmination of chain of smaller errors or oversights.

Break the chain, and the accident doesn't happen. This is accomplished by developing "barriers to error," definitive procedures, checklists and flows which the pilot uses to accomplish the everyday mundane tasks without thought and provide structure for accomplishing of time critical emergency procedures..

The most necessary components of "barriers to error" management are the crewmembers themselves. These "barriers" begin with an engaged crew who are respectful of each other but are not afraid to challenge one another.

Procedures have been developed to mandate that pilots cross check each other for critical tasks. While something might escape the attention of one individual, it rarely escapes the attention of the team.

It is important to understand however that five people in a room do not constitute a team. Look at a football team, for instance, it takes practice, study and structure for 11 separate specialists to act on the field as one team.

While individually, every player has a specific role and associated responsibilities within their specialty, they must also coordinate and work from the same playbook. They must execute as a unit, with every component critical to the outcome. And their combined achievement as a team is the key to measurable success.

Combining the individual talent into a winning team is the responsibility of the coach, the leader of the organization. The coach does this by insisting on strict protocols and discipline in following defined procedures within the organization.

2.   Sensitivity to operations

Silbaugh: What happens on the front lines, far from the executive suite, determines whether organizational strategies, goals, and financial performance are successful.

In health care, highly reliable organizations continually monitor conditions where patient care happens, and make decisions with input from clinicians working at the patient care interface. Executives at these organizations understand that good decisions depend on knowing the truth of what's occurring with patient care. They develop policies, procedures, and protocols that reflect interdisciplinary collaboration, and anticipated conditions.

You'll often see leaders of these organizations making rounds in the ED, ICU, or surgical suite to understand the issues at the front lines of care.

Skiles: In aviation, periodic recurrent training allows pilots to practice and test not only their skills at common emergency procedures, but also to develop an understanding for emerging threats.

Sophisticated training departments take data from many sources and create training scenarios preparing pilots for new technological advancements, procedures or operating theaters. The most important source for input from the line pilots into this process is aviation safety assurance programs that allow a pilot, within strict parameters, to self-report errors or problems far from the corporate eye to aid management in recognizing difficulties and developing solutions.

As in health care, pilots make decisions almost entirely without management input. Management must develop procedures and protocols to provide guidance and structure for that autonomous decision making and integration of specialties.

3. Reluctance to simplify

Silbaugh: When a medical mistake occurs, it's been common practice to blame a nurse, pharmacist, or physician for the error. It's never that simple.

It's important to seek perspective and opinion from individuals with diverse backgrounds, and experience before coming to a conclusion about what went wrong. Just as there are human failings involved, organizational policies, procedures, or culture, often contribute to those errors.

It's important to look at both human and organizational failure modes. We have a hard time in medicine acknowledging that we're not perfect. We sometimes believe that we're immune to poor performance from sleep deprivation, stress, and sensory overload.

Skiles: Aviation has tried to come to grips with—and has attempted to move past—the culture of blame.

Human beings are capable of great things. But, human beings are also fallible creatures subject to many influences. No pilot has ever made a perfect flight. Likewise, I'm sure no surgeon has ever conducted an absolutely perfect procedure.

When a mistake occurs, merely finding someone to blame does not go far enough in addressing our professional responsibilities. We, as professionals, must look beyond blame to prevention and find the root cause of the problem and develop a solution.

Only when we accept that human beings are fallible can we move forward and develop compensatory procedural resolutions to solve critical recurring problems. It is important to understand that blame-free is not accountability free, however.

The permission to accept mistakes and be personally fallible carries a price. That price is the responsibility to develop a team around you that uses consistent procedures to trap mistakes before they lead to an undesirable outcome.

4. Commitment to resilience

Silbaugh: Highly reliable organizations understand that adverse events will occur despite efforts to prevent them. When they do occur, these organizations evaluate the causes and develop mechanisms to keep other events like it from happening.

They may apologize and admit accountability for the adverse event, but then get on with the business and take steps to assure the same type of incident doesn't occur in the future.

Skiles: To successfully solve the problems that threaten safety, we must first find out what the causal errors are. The goal is to find those errors and develop and implement solutions before they ever lead to an accident.

We must at the very least attempt to learn from accidents that have occurred and develop a means of

prevention for the future. For the analysis of actual accidents, we have the National Transportation Safety Board, which seeks, by exhaustive study, to determine causal factors and safety recommendations for prevention.

The FAA can then take these recommendations and refine them into regulatory safety requirements applicable to the airlines and employees.

Within airline cultures, innovative structures have been created to not only track errors that are occurring, but devise solutions to combat them before they can lead to an accident. Airlines have several programs to accomplish this. Airlines allow their pilots to self-report errors without threat of disciplinary action. They also monitor pilot performance for deviation from established protocols, not with an eye to disciplining the individual but to track trends within the group.

And finally, the aircraft themselves are sophisticated enough to self-report errors if certain parameters are exceeded. The goal is always to find the human errors the pilot group is making and develop compensating mechanisms before an error can become part of a chain leading to a devastating accident.

5. Deference to expertise

Silbaugh: When safety of a patient is at stake, the hierarchy may need to break down. Although the physician or nurse may be the individual in the hierarchy who normally would be the decision-maker, at certain moments they need to acknowledge that someone else on the health care team may be better qualified from experience and training to deal with a specific problem.

For example, a physician may defer to the clinical pharmacist for decisions about a patient's drug regimen because of her deeper knowledge of drug-drug interaction, or dosing requirements in renal compromise. This kind of teamwork is just beginning in health care.

Skiles: As the complexity of aircraft and their operations have matured, it has become far too difficult for any one individual to conduct operations. Teams have developed.

For instance, the flight planning is generally done by a dispatcher who is jointly responsible, along with the captain, for the operation of the flight. The dispatcher has far greater access to weather information and trends and is in a better position to plan for required alternate airports and fuel loads.

Airframe, power plant, and avionics mechanics must inspect and certify the aircraft for flight. Baggage loaders must put your luggage in the precise locations specified to ensure the aircraft is not nose or tail heavy. There are experts who do nothing more than calculate the weight and balance of an aircraft.

Aircraft fuelers, gate agents and flight attendants all have roles in the safe accomplishment of every flight. These are all members of the team that gets every airliner off the ground. Each has an area of expertise and responsibility and the boundaries of those responsibilities must be respected.

The ultimate responsibility, however, lies with the captain. Where there are others with greater knowledge in an area, the captain will defer to their expertise and perhaps delegate responsibility to achieve the common goal.

But coordinating all of these disparate specialties into a cohesive whole is also necessary to provide a safe flying experience. Definitive systems and structure are necessary to optimize interaction between all these disparate specialists. Procedures must be developed to synchronize all their efforts.

Autonomy vs. teamwork

Several decades ago, pilots were often found to be unprofessional in their communication with other pilots, flight crews and ground crews. Aviators from WWII and the Korean Conflict developed their own personal standards for how they operated an aircraft, and how they communicated with others on the crew. The dynamics typically centered on the autonomy and authority of the pilot-in-command to act independently of other pilots.

Other members of the crew were not expected to provide critical safety information to the captain, but were expected to respect the hierarchy and status of the pilot. Several well-known aircraft accidents occurred because of communication failures, which sometimes involved challenging the autonomy or position of the captain.

For example, on December 28th, 1978, United 173 was approaching Portland, Oregon, at the end of a long flight. Upon lowering the landing gear the flight crew did not get a down and locked indication on the main gear.

The crew displayed good division of duties. The first officer flew the aircraft in a holding pattern while the captain contacted the company dispatcher, company maintenance personnel, briefed the flight attendants for a possible emergency landing, and had the flight engineer visually check the gear for proper position.

While they continually delayed the approach and landing, the flight engineer on several occasions remarked on their extremely low fuel levels. His words went unheeded by the captain. The engines flamed out short of the airport and the airplane crashed unpowered into a field with the landing gear down and locked.

The cause of the accident was inadequate crew coordination. This accident, along with Eastern 401 in the Everglades and Air Florida 90 that struck a bridge in Washington, DC, became the basis for modern Cockpit Resource Management (CRM) programs.

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Much has been written over the past few years about autonomy in health care, particularly the use of time outs and checklists in surgery and invasive procedures. Resistance continues to surface, even in some of the best hospitals and academic centers in the country.

Rene Amalberti, MD, PhD, has written about autonomy and its relationship to safety.[2] He describes five key points for the professional who typically is granted autonomy because of training, skills, and responsibility involved in their jobs. Pilots, physicians, military officers, and law enforcement officers are excellent examples of professionals who can act autonomously in their respective roles.

Amalberti suggests that for maximum safety, the autonomous actor might want to:

1. Accept limits on discretionary actions. (Listening to air traffic control advising when to take off or land, performing a legitimate time out before beginning a surgical procedure.)

2. Abandon autonomy in certain situations. (Listening to advice and concerns of co-pilot and crew about landing, deferring to pharmacist or ICU nurse on appropriate decisions or actions.)

3. Transition from a craftsmanship attitude to the principle of equivalent actor. (Understanding that one's craft is important, but may not be any more important than any other in the larger system.)

4. Share residual risk along the vertical axis of hierarchy. (Accepting and understanding responsibility for one's important role, and how the system hierarchy deals with failure.)

5. Manage the visibility of risk when effects of change cannot be observed. (As systems become ultra safe through individual and process improvement efforts over time, it's easy to become complacent or unaware that catastrophic events can still happen. It's important to

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Thank you, ACPE.

**Glenn W. Mitchell,
MD, MPH, CPE, FACEP**

*Chief Medical Officer
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find ways for the team to remember that catastrophes can still occur despite procedures and policies that have prevented them as safety of a system has improved. It is likely that a larger number of errors by individuals are necessary to cause a catastrophic event.)

Recommendations for health care

1. Begin training physicians, nurses, pharmacists, and other clinicians together during their educational years. This allows an opportunity for the newest health care professionals to learn how to work together with respect and appreciation for different approaches to patient care.

2. Introduce systems safety engineering principles of reliability into academic training. These include recognizing: (a) how human beings make mistakes, (b) how organizational policies, procedures, structure, environment of technology, and culture are linked to the individual's accountability, and (c) how structured communication techniques designed to make it safe for anyone working with patients to bring safety critical information to the attention of superiors—without risking professional humiliation or one's job to do so. An excellent summary of the deficiencies in medical training, and specific recommendations for improvement, can be found in the recently published *Unmet Needs: Teaching Physicians to Provide Safe Patient Care* from the Lucian Leape Institute of the National Patient Safety Foundation.

3. All white coat professionals should be held accountable for their behaviors as members and leaders of the health care team. A small percentage of care givers continue to wreak havoc on the people who work with

them, and the institutions in which they work, through intimidating an unprofessional communication and behaviors. These dysfunctional behaviors are not unique to physicians.[3] Professional colleagues, particularly those in formal leadership roles, must make it a priority to deal with unprofessional behavior whenever and wherever it occurs. Pilots have plenty of stresses and disappointments in their careers, just as physicians do. Despite dealing with management's scheduling, loss of pension plans, lack of pay raises, and other career challenges, the culture of accountability and professionalism keeps those issues from damaging the respectful appreciation and communication among other members of the aviation crew.

4. For community hospitals, ACPE's recent survey on communication among the health care team revealed successful approaches to strengthening teamwork and communication.[4] Some of these approaches include developing and enforcing codes of conduct for care givers, learning effective communication techniques together and developing rules for respectful communication, and evaluating and changing organizational cultures to have patient safety as the primary focus. The importance of senior leaders' walking the talk of teamwork for patient safety was mentioned frequently by respondents, particularly the need for the chiefs of nursing and the medical staff to demonstrate professionalism and teamwork through their working relationship.

5. Licensing bodies in health care, such as state medical boards and specialty boards, can be powerful change agents to improve patient safety through teamwork and communication. Expectations of professional behavior can be explicit,

and deviation from expectations of professional standards can be dealt with by peers, much like the commercial airline pilots do when one of their own develops problematic behavior.

6. Finally, we think it may be helpful to create a central, non-punitive, professionally "neutral" organization where any member of the health care team can share safety issues or stories. The purpose of such an organization would be to begin identifying safety critical situations in our fragmented, balkanized health system—and communicating these high-risk situations and recommendations for improvement as quickly as possible. When an aviation accident occurs, the contributory human, organizational, and equipment factors are analyzed and communicated as quickly as possible to others in the industry to prevent a similar incident from occurring. In contrast, significant safety incidents (e.g., administration of look-alike meds or concentrated solutions) that occur at one health care institution are often occurring at other institutions because care givers are unaware of these incidents, and how they might prevent them from occurring elsewhere.

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