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Beyond the Checklist: What Else Health Care Can Learn from Aviation Teamwork and Safety

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Beyond the Checklist: What Else Health Care Can Learn from Aviation Teamwork and Safety

Abstract

[Excerpt] Health care needs to become a high-reliability industry in more than name. It needs a radical cultural transformation, like the one that has taken place in aviation over the past thirty years.

To help promote that transformation, we decided to write this book: a description and analysis of a major cultural shift that has made one complex and safety-critical industry—never previously known for concern for interpersonal or inter-professional relations—into an exemplary teamwork culture that is arguably now one of the safest in the world.

If aviation could do it, health care can too.

The lessons of aviation and other safety-critical, high-reliability industries are receiving more attention in health care than ever before. In spite of great resistance, some of these initiatives are producing positive models that offer great promise, as described in subsequent chapters. Nevertheless, we write this book out of concern that that there is much more lip service than real systemic change when it comes to making health care a truly high-reliability industry—one in which genuine interprofessional and occupational practice is the norm. This is why it is so important for health care to recognize how much it can learn and adapt from the aviation model of safety and teamwork. Moving beyond the checklist will help advance the efforts of all of those who are working so hard to make health care safer for both patients and those who work in health care settings.

Keywords

health care, aviation, safety, teamwork, interpersonal relations

Comments

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"The deeper I progressed into this terrific book, the more embarrassed I became for my profession of medicine. Behind our casual assumption as airline customers that we will arrive safely lies an enormously complex process that addresses all human and system issues that could possibly affect safety in air travel. With a few notable exceptions, we in medicine do not come anywhere remotely close to where we need to be to assure our patients of this same kind of safety commitment. There can be no excuse for medicine not pursuing this same all-engaging, relentless process. Our patients deserve nothing less. This is a must-read book for anyone with any connection at all to the delivery of health care services."
—TERRY R. ROGERS, MD, The Foundation for Health Care Quality

"Beyond the Checklist takes us behind an apparently simple tool to lay out the complex social and organizational transformation that makes the checklist effective in aviation and to argue for a similar top-to-bottom transformation of health care. By shifting our attention to the detailed, sustained, and careful work that will be required to make health care safer, the book moves us forward on a long, difficult, but ultimately rewarding journey."
—ROBERT L. WEARS, MD, University of Florida and Imperial College London

"Beyond the Checklist provides a timely and insightful assessment of crew resource management (CRM), a key tool for averting disaster in the airline industry. The authors make a compelling case for its application to health care delivery. This book should become an essential text for health care professionals, educators, and policymakers seeking to improve interprofessional training and practice."
—SCOTT REEVES, University of California, San Francisco

"The ideas presented in this book are so clearly developed and the writing so engaging that its audience will not be limited to patient safety experts. Patients, their families, and health care providers of all kinds will also benefit from the authors' insight into hospital safety improvement. The case studies are rich in detail and full of critical reflections on the connection between quality care and optimally functioning teams. The tone of Beyond the Checklist is hopeful but, for good reason, very urgent as well."
—SEAN P. CLARKE, RN, PhD, FAAN, McGill University School of Nursing
“Some experts downplay the parallels between health care and aviation, but there is much we can learn from the system-wide change that greatly improved passenger safety on commercial airlines. This excellent book highlights the innovative programs of pioneering hospitals where better teamwork and effective communication guide every interaction—from the bedside to the boardroom.”
—JULIA HALLISY, DDS, The Empowered Patient Coalition

“This important book brings both a sense of urgency and the hope of clarity in addressing a fundamental and widespread problem in health care. It is a must-read for clinicians and students who deliver care and a call for leadership from every member of the interprofessional team. Leadership is required to change the culture and systems of care delivery. Beyond the Checklist provides the inspiration and a path for that change.”
—HEATHER M. YOUNG, RN, FAAN, Betty Irene Moore School of Nursing, University of California, Davis

“Beyond the Checklist shows us that Crew Resource Management principles help us deal with our human inability to always perform ‘perfectly’ while operating in a complex work environment. Little mistakes in aviation compound into huge problems. In commercial airlines, virtual strangers routinely solve complex problems without making critical mistakes. The culture of CRM provides for this as a normal way of operation. If embraced by the field of medicine, it will totally transform the way the industry operates.”
—CAPTAIN GREGORY S. NOVOTNY
Beyond the Checklist
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The moment a flock of Canada geese hit the aircraft and we were forced to land US Airways Flight 1549 in the Hudson River, on January 15, 2009, I knew that my life would change forever and I would gain public attention that I had never sought or imagined.

What I could not know, but only hope, is that this challenge, successfully handled, would serve as a catalyst for my becoming a consultant on the problems of patient safety.

Aviation safety is a field I know well. But what connection could it have to patient safety? Why would workplace protocols and training practices designed to save lives in the airline industry have any relevance to health care?

As this book makes clear, the teamwork required to deliver hundreds of passengers to their destination safely is the same kind of teamwork needed to avoid life-threatening mistakes in hospitals. In the aviation industry, I was part of the effort to implement the safety methodology known as crew resource management (CRM) at US Airways. It was our CRM training that enabled my crew—which included my first officer, Jeff Skiles, and three flight attendants—to land on the Hudson River that frigid January day and then safely evacuate 150 passengers without a life-threatening injury or fatality. As the authors of Beyond the Checklist point out, there was a method behind this “miracle.” Our unscheduled landing was greatly assisted by the much-changed practices in our industry related to communication and cooperation among all members of the crew, regardless of their rank or job responsibility.

As I have spoken with and observed those who work in the health care field, I have been struck by the many similarities between the early days of CRM formation and developments happening today in the patient safety movement.

Not long ago, there were captains in our cockpits who acted like gods with a little “g” and cowboys with a capital “C.” You questioned the captain’s authority at
your own peril, even if you were a fellow pilot. When I was a young first officer, I witnessed many of my colleagues carrying around little notebooks so they could keep track of the quirks and preferences of particular captains they flew with, just as some nurses today record and share such information about the surgeons they assist in the operating room.

When CRM first emerged—in the wake of aircraft crashes that were due to failures in crew communication, teamwork, and workload management—some captains worried they would be deprived of their decision-making authority. Others, like some doctors today, felt they didn’t need to learn the “soft skills” of better communication and respectful interaction with coworkers. Over time, we have learned that our cockpit management decisions are far better when we have regular input and information from all members of our aviation team, in the air and on the ground.

Because of CRM’s sea change in our workplace culture, flying—which is inherently dangerous—has become remarkably safe. Travel through the world of high-tech medicine, which can be hazardous for individual patients, is now being made safer wherever hospitals truly embrace similar methods of interprofessional teamwork and training.

Beyond the Checklist correctly argues that aviation safety was improved through more than just checklists, as important as those are. Checklists alone cannot cure the current fragmentation of patient care or avert tragedies like the loss of twelve-year-old Rory Staunton, who died from undetected septic shock after being discharged by New York University Medical Center in summer 2012. As I noted in the New York Times after Rory’s death, some in the medical field regard such fatalities as an unavoidable consequence of delivering care in any complex, high-stress, high patient volume environment. In aviation, such rationalizations for avoidable human error were rejected long ago and replaced with the creation of a robust safety system that has now become the culture of the field. I hope that readers of this book can learn from our experiences in aviation and join our common effort to apply its best practices to the challenge of providing quality patient care in the safest possible manner.

CAPTAIN CHESLEY “SULLY” SULLENBERGER
This is a book about teamwork, and it took a team to write it. As coauthors newly relating to each other, we had to employ the methods of any successful safety-related endeavor: communication, team building, workload balancing, and threat and error management. None of that was easy. In book writing and editing, egos are always involved—in our case, the usual authorial ego quotient was multiplied by three. Marshaling the “team intelligence” necessary to produce what we hope is a useful and credible book became our overriding, collective goal.

We were assisted by many far-flung helpers who advanced our thinking, connected us to the right resources, guided and advised us, and grabbed us by the collar when we sometimes strayed down the wrong path. We all benefited from the different personal and professional support networks that each of us brought to this work. The respective individual and joint acknowledgments of Suzanne, Bonnie, and Patrick are as follows:

Along with Patrick and Bonnie—who were a joy to work with—Suzanne thanks several special people. Susan Bianchi Sands was her initial link to Robert Francis, whose explanation of the changes wrought by Crew Resource Management (CRM) led to the enlistment of Bonnie and Patrick as coauthors. Robert Francis, in turn, put us in touch with airline industry experts long involved with CRM. Jim Pitisci was an invaluable guide to the Airbus Training Center and provided much insight into understanding how pilots think. Jan Von Flatern also facilitated Suzanne's very educational visit to Airbus in Miami. Steve Predmore provided important explanations of how CRM is implemented in a major airline like JetBlue. Suzanne's contribution to the book owes much to three University of Maryland friends and colleagues: Jeff Johnson, Kate McPhaul, and Jane Lipscomb.

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Finally, Suzanne thanks her husband, Steve Early, who has cheerfully endured more impromptu lectures about health care and the airline industry than he ever expected to hear when he married Suzanne thirty-three years ago. Their daughters, Alexandra Early and Jessica Early, have been equally good listeners. Jessica has even opted to become a nurse notwithstanding her youthful overexposure to many kitchen-table discussions about the problems facing RNs and health care today.

Bonnie would like to express her heartfelt thanks to her coauthors for their insights, wisdom, energy, and teamwork; to all of the clinicians and staff members of the Osher Clinical Center at Brigham and Women's Hospital for the best days of every workweek for the past nine years and for the compassion, warmth, and clinical skill from which she benefited. She also expresses her thanks to Mai O'Connor for unending love, support, and encouragement.

Patrick wishes to express his deepest gratitude to his wife, Martha, for her unwavering support and encouragement for this project. Throughout twenty-five years of marriage and the raising of three wonderful children, she epitomizes the ideologies of teamwork in action that are addressed in this book.

To his partners in this effort, Suzanne and Bonnie, without whom this would never have happened: This project is living proof of what can be achieved when very different individuals come together to form an authentic team with a well-defined, shared, and common vision. Suzanne has been a true inspiration to us all: Through remarkable drive, energy, and leadership, she has led (not pushed) us across the finish line. Thank you for your patience and especially for your friendship.
To Captains Gary Allen, Don Keating, and Tom Perillo, Patrick’s partners in Crew Resource Management LLC (CriticalCRM.com), thank you for your CRM wisdom and the opportunity to contribute to this effort. You have each blazed a trail in this industry and leave an enduring mark through your contributions to CRM training.

And to the thousands of pilots and flight attendants with whom Patrick has had the pleasure of working for over forty years of flying airplanes, “my education continues” each and every time we meet: thank you not only for the flying lessons but for the life lessons as well.

We all thank Sean Clarke and Bob Wears for their careful and thorough reviews of this book and for all the comments that have helped to strengthen it. Finally, we thank the team at Cornell University Press that has brought this book safely to publication. Fran Benson maintained the situational awareness that brought the project through years of development. Ange Romeo-Hall did her usual exquisite cross-monitoring and course correction. Nathan Gemignani, Mahinder Kingra, and Jonathan Hall have been on the ground—and sometimes in the air traffic control center—managing our flight plan. And Kitty Liu patiently put up with too many delays, altitude deviations, and almost-end-of-the-runway landings.
Beyond the Checklist
Introduction

PROOF OF LIFE

There is practically no member of the flying public who does not recall the amazing news of a flight that made a safe emergency landing in the middle of the Hudson River without harm to passengers or crew. At 3:25 p.m. on January 15, 2009, US Airways Flight 1549 took off on what was supposed to be a routine flight from New York's LaGuardia Airport en route to Charlotte, North Carolina, with five crew members and 150 passengers on board. One hundred seconds later, the aircraft, commanded by Captain Chesley “Sully” Sullenberger, crossed paths with a flock of migrating Canada geese. And then—BOOM!—the aircraft collided with several of the large birds, which pelted both engines. As the giant turbines, spinning at over ten thousand revolutions per minute, began to disintegrate, the engines were irreparably damaged and shut down. Captain Sullenberger and his first officer, Jeffrey B. Skiles, experienced a feeling, Sullenberger wrote later, that was “unlike anything I'd ever experienced in a cockpit before. . . . Without the normal engine noises it became eerily quiet," a quiet that turned the aircraft's cabin, as the flight attendants would later describe, "as silent as a library," only one that weighed 150,000 pounds and was 2,900 feet above New York City.1

In the next three minutes and twenty-eight seconds, Sullenberger and Skiles, neither of whom had ever experienced the simultaneous loss of both jet engines, had to function in the most catastrophic conditions to save their passengers, flight attendants, and themselves. With only seconds to react, they landed the jetliner in the middle of the frigid river, and then they and the crew proceeded to get every person safely out of the aircraft and onto rafts or the wings of the crippled plane. From there, NY Waterway ferries, Coast Guard and New York fire and police department vessels, well-trained in emergency rescues, along with passing sightseeing cruise boats, quickly retrieved them all.
In the initial reporting of what could have been a major disaster, the emphasis was on the miraculous. Later, the reality of what happened on that cold January day began to emerge, and it had nothing to do with miracles or solo heroic action. The successful landing, evacuation, and rescue of Flight 1549 was the direct result of a concerted effort to make flying safer by refining communication and teamwork, as well as workload and threat and error management—a program commonly known in the aviation industry as Crew Resource Management (CRM).

The story of US Airways Flight 1549 is perhaps the ultimate proof of life of the success of decades’ worth of safety efforts in the aviation industry. The Airbus 320 landed safely and its passengers managed to get to shore without a single serious injury not simply because of Sullenberger’s and Skiles’s knowledge, judgment, and skill but because, in the commercial aviation industry, thirty years of research, training, and commitment has taught groups of individuals how to function as teams. As Sullenberger recently said, “creating a team out of a collection of individuals was incredibly important that day.” As an industry, aviation is now indisputably safer than it was thirty years ago, in large part because the industry has systematically moved beyond individual intelligence to embrace and foster what we call “team intelligence” (TI). CRM has resocialized and reeducated everyone who works in aviation (not only flight deck, cabin, and ground crew but also management and many others) to stop thinking, deciding, acting, and learning alone and to think, decide, act, and learn together.

During the airline industry transition to the jet age in the 1960s and 1970s, a series of disastrous crashes took place: among them, two planes colliding in Tenerife, Canary Islands; a “controlled flight into terrain,” or CFIT—straight into the Florida Everglades; and a perfectly airworthy craft simply running out of fuel and crashing near Portland, Oregon. In response, CRM began in the early 1980s. Its goal was to transform a culture in which error was defined as “weakness”—which, in turn, led to shame, blame, and punishment—into a culture of learning and teamwork. Now human errors are immediately dealt with and then evaluated for what they can teach about preventing, managing, or containing their effects. Critical to this endeavor was redefining the roles of the team leader and team members. In aviation, the captain is still the captain of the ship, but his or her focus as the team leader is on the efficient and effective management and functioning of the entire team and not simply on accomplishing the tasks of the captain and copilot. Similarly, the job of the team members is not to blindly obey orders but to inquire, contribute, advocate, and assert; in the most extreme conditions, it is also to intervene if necessary to assure the safety of the aircraft and its passengers.

Rather than exhorting people to work in teams or simply declaring that the cockpit, cabin, ground, and other personnel are a team by virtue of their presence together at the same time and in the same place, the airline industry recognized early on that true teams are deliberately created and that an institutional infrastructure
that supports teamwork must also be created and continually maintained. The in-
dustry has devoted extensive resources to team socialization and education, fol-
lowed up by frequent retraining to keep teamwork skills current. As we shall
describe, in the aviation industry, protocols are established so that team leaders
create functional teams rapidly, sometimes expanding them in crisis situations. Like
the crew on flight 1549, more often than not, these teams are made up of people who
have never worked together as a group but nonetheless routinely find themselves
responsible for the safety of hundreds of passengers, as well as one another, on any
given flight. Like Captain Sullenberger did when he started the journey that ended
in the Hudson, the job of the team leader may be to turn a group of strangers into a
high-functioning team in just minutes or hours.

As is suggested by the program's name—Crew Resource Management—the
team's job is to utilize all resources and information available. Decisions and infor-
mation are shared and consistently updated. Crews are taught how to construc-
tively frame, negotiate, and resolve disagreements so that conflicts or problems
fuel further collective and individual learning experiences. Team members are re-
defined not as obstacles to the captain's authority but as crucial human resources
who make flight safer and the captain's job easier.

Under this new paradigm people are still given orders to carry out, but every
team member is empowered to monitor all others, and all are given a voice in
decision making. All members of the team, regardless of rank, status, or position, are
authorized and even encouraged to point out to any other team member—with suf-
ficient clarity and urgency—if he or she is making a mistake. The team works to en-
sure that errors are resolved and do not develop into catastrophes. Captain
Sullenberger was the first to state that it was this kind of training—training that he
frequently conducted as one of the people who designed and implemented CRM at
his own airline and later as founder of his own consulting company—that was re-
 sponsible for the successful landing and passenger evacuation in January 2009.

As Robert Francis, who worked in the Federal Aviation Administration (FAA)
for years before becoming vice chairman of the National Transportation Safety
Board (NTSB), has explained,

The transformation that has made aviation safer is the result of a fundamental
shift in perceptions and definitions of authority and deference that has taken
place in aviation over the past three decades. Thirty years ago the captain would
come in to the cockpit and either directly or indirectly convey the following to the
first officer and flight engineer, "I'm the captain. I'm king. Don't do anything, don't
say anything. Don't touch anything. Shut up!" Now, it's "I'm the captain, I'm king.
Please tell me if you see me making a mistake."

The result: There are fewer airplane crashes and far less tension in workplace
relationships.
THE STATE OF PLAY IN HEALTH CARE

Let's contrast commercial aviation with another industry in which millions of people depend on the skill, judgment, and action of a group of highly trained professionals whose historical socialization and education has taught them to think, act, and learn as individuals. In this industry, the long-standing norms regarding socialization and education have yet to be reversed or—in most settings—even minimally challenged. That industry is health care.

Since 1999, when the prestigious Institute of Medicine (IOM) issued its report on patient safety in the United States, *To Err Is Human*, the startling facts of a deeply dysfunctional health care system have become the subject of intense debate. Sadly, there has been little substantive change. According to the IOM, as many as ninety-eight thousand Americans die of medical errors and injuries every year in the United States. Preventable complications are the order of the day in U.S. hospitals, with each patient experiencing on average at least one medication error every single day. Hospital-acquired infections like methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile* (C-diff) are increasingly common, as are patient falls, bedsores, urinary tract and central venous catheter line infections, and a host of other ills.

Since the IOM report in 1999, billions of dollars have been spent trying to make health care safer. In some instances, these efforts have resulted in improvements for both patients and staff—and we will discuss some of these examples at length. In general, however, too many of the problems highlighted in the IOM report remain. We know, for example, that simple hand washing is the most effective infection-prevention mechanism known to humankind. Yet in health care institutions in industrialized countries, 50 percent of health care workers still do not wash their hands. We now recognize that failures of teamwork and communication are responsible for more than 75 percent of medical errors and injuries, yet health care professionals and workers still do not communicate with one another routinely and effectively. In one major eastern teaching hospital, an unpublished survey revealed that 40 percent of hospital employees said they were too afraid of reprisals to speak up about a safety issue even if a patient was in imminent danger. Numerous studies show that although health care institutions have spent literally billions of dollars on safety initiatives, our institutions are still not safe. In 2010, several reports from the Agency for Healthcare Research and Quality (AHRQ) showed that rates of bloodstream infections could be reduced dramatically by a series of simple steps, known as the Checklist. At the same time, AHRQ reported, such infections increased by 8 percent in one year for most of the nation.

In the same year two professors from Case Western Reserve published an article in the *Berkeley Technology Law Journal* warning doctors about the false promises of health care information technology. Software bugs, inadequate training in
complex technology, incessant warnings of drug interactions when no real threats exist, and data-entry errors that generate incorrect outputs can, even in the electronic environment, create significant patient safety hazards for which physicians may be held liable.

Finally, just as we finished writing this book, the U.S. Department of Health and Human Services released results of a study on hospital-error reporting practices. When the investigators looked at hospital records for Medicare patients, they discovered that in spite of requirements, most hospital errors were not reported. When errors were reported, hospitals did not initiate efforts to solve the problems that caused them. What was most disturbing about the study was its discussion of why such reports were not made. Unlike in years past, the failure to report was not because employees were afraid to admit mistakes but because they did not recognize what kinds of events actually harmed patients or were confused about what actually constituted harm. In some cases employees thought common events were isolated ones or that someone else would report the problem. In other words, hospital staff members do not share a common mental model, assumptions, or information about what is and is not harmful to patients. Serious events that either were not reported or were "not captured by incident reporting systems" in hospitals "included hospital-acquired infections, such as a case of septic shock leading to death; and medication-related events, such as four cases of excessive bleeding because of the administration of blood-thinning medication that also led to death."

The injuries and harm that an individual hospital patient experiences may seem far less dramatic than an airplane with 155 people landing in the Hudson River or a crash in the Everglades that killed 101. Still, it is worth contrasting the failures in communication and teamwork that threaten patients with the communication successes that now save passengers and crews every day. Here is an example with which we are quite familiar, but which has not been published in the medical literature:

In March 2010, a sixty-four-year-old woman who had survived several cancers, whom we will call Mrs. Smith, was admitted to a major northeastern teaching hospital with a life-threatening bowel obstruction. She had low blood pressure, was in shock, and had a systemic infection and kidney failure. The hospital was world-renowned for its patient safety; Mrs. Smith's family was confident she would get high-quality care. An emergency colostomy was performed to bypass the affected area of her colon. When the surgeon sewed her up, however, he made an error and left behind some necrotic bowel. Over the next two weeks, the woman ate almost nothing, even after her kidneys started to rebound and she seemed better. Although Mrs. Smith's colostomy output was high—a sign of bowel dysfunction—the many specialists working on her case (internal medicine physicians, kidney doctors, and surgeons) seemed unable to agree about her nutritional status or the significance of the high output. As is common in teaching hospitals, the rotating
specialists and hospitalists communicated through notes in the patient’s chart but rarely face-to-face.

After three weeks, Mrs. Smith left the hospital for home (her insurance did not cover admission to a rehabilitation facility). There she developed a fungal infection in her mouth and throat, to which doctors quickly attributed her eating problems. After the infection was treated, however, Mrs. Smith still could not eat. One of her closest friends—who happened to be an internist (let’s call her Dr. A)—stayed with her when her home care nurse had to be away. Dr. A, who measured her friend’s caloric intake, observed that she consumed fewer than three hundred calories over twenty-four hours. She became convinced that Mrs. Smith had a significant bowel problem and was slowly starving to death. When Dr. A discussed the issue with the home care nurse, the nurse said she was frantic because she could not convince the patient’s doctors to recognize how serious the eating problem was.

Not surprisingly, several days later Mrs. Smith was readmitted to the hospital. Her care was now transferred to a new group of providers who did not know her at all. After reading her chart, they assumed she was chronically sick and was “on her last legs.” Dr. A and Mrs. Smith’s daughter tried to convince the new team that Mrs. Smith was actually not “like this,” and that there was something seriously wrong. A nutritionist who consulted on the case wrote a strongly worded note recommending that if she did not improve, the patient should receive total parenteral nutrition (TPN)—which delivers complete nutrition intravenously. The physicians’ belief that this was “just the way the patient was” contradicted yet another strongly worded note: the patient’s oncologist had visited from another hospital and clearly informed the treating physicians that Mrs. Smith had survived her previous cancers and should make a full recovery.

Mrs. Smith did not improve. She was discharged to a long-term acute care facility (LTAC), where her condition deteriorated even further. She was readmitted to the original hospital, where the treating physicians finally met with Dr. A and Mrs. Smith’s family. The medical team attributed Mrs. Smith’s difficulties to psychological problems, insisting she was simply “not trying hard enough” to eat. Only when Dr. A and her daughter became her health care proxies a week later were they able to arrange for another meeting, where finally a hospitalist (was it the third, fourth, or fifth involved in her care?) listened to the distraught daughter and physician friend, examined the condition of her colon more carefully, discovered the dead bowel, and finally prescribed TPN. Within a day of getting the nutrition, Mrs. Smith was better. Within a week, she could stand. It took two months of TPN before the surgeon could operate to remove her necrotic bowel. She lost considerable bone density and deteriorated from a vigorous woman who could easily walk two miles without effort to one who found it difficult to walk a mile without getting winded.
Dr. A summed it up:

This took place at one of the best hospitals in the world. Her primary care doctor is a noted patient safety advocate. Yet she was dying of malnutrition in front of everyone’s eyes. No one ever talked to anyone else. The teams never met with one another. Things were communicated in the electronic medical record, but there was never a [face-to-face discussion about the patient]. No one would listen to the family, or friends, or even me—and although it shouldn’t matter, I am, after all, a physician. My friend went into the hospital on March 11. . . . [I]t wasn’t until May 22nd that she was put on TPN. For over two months, she ate no more than 400 calories a day. It’s a miracle—and not a medical miracle—that she is alive.

This is not good enough. Health care needs to become a high-reliability industry in more than name. It needs a radical cultural transformation, like the one that has taken place in aviation over the past thirty years.

To help promote that transformation, we decided to write this book: a description and analysis of a major cultural shift that has made one complex and safety-critical industry—never previously known for concern for interpersonal or interprofessional relations—into an exemplary teamwork culture that is arguably now one of the safest in the world.

If aviation could do it, health care can too.

The superficial evidence appears to suggest that more health care administrators and professionals concerned with safety now recognize the parallels between health care and aviation. Yes, there are many differences between these professions, yet people who work in health care seem increasingly to recognize that the similarities with aviation are significant and cannot be ignored. Both are hierarchical settings: one group dominates all other groups; the ones that are dominated have been tutored in deference and their contributions have been traditionally downplayed. In both settings, people’s lives depend on the knowledge, skill, and judgment of a host of players who ostensibly work well together. A heroic medical narrative that has obscured the roles of the lower-status professionals whose participation is essential to service provision permeates health care. In both fields this narrative has contributed to a lack of oversight and effective communication that have put its end users at risk.

Finally, there is a huge reliance on advanced technology in both sectors and a deep reluctance to engage in the teamwork and communication that have been demonstrated to save lives. Ironically, failure to embrace and master communication and team-building skills can actually cause enhanced technologies to work against success and safety.

As if recognizing all of this, best-selling books and scientific journal articles now promote aviation-inspired checklists and time-outs in ORs and ICUs. We hear about the use of huddles—a series of daily briefings—in labor and delivery.
Simulation centers are popping up in hospitals and medical and nursing schools as effective teaching tools for adult learners, as efforts to introduce interprofessional education in health care. In hospitals, CNOs, CEOs, and medical leaders are finally recognizing the need to create more respectful relationships in their workplaces and are launching so-called civility initiatives. Pilots are often invited to consult or lecture in hospitals to share the aviation perspective on the safety that comes with teamwork and to describe their successful experiences.

Throughout North America, to one degree or another, the education of health professionals now includes efforts to encourage interprofessional education (IPE) in the service of creating interprofessional practice or care (IPE/IPC) in the clinical setting. These have been under way in Canada for several years. In the United States, IPE/IPC efforts began to gain momentum in 2009 with the founding of the American Interprofessional Health Collaborative (AIHC) and the Interprofessional Education Collaborative (IPEC), the latter comprising representatives from the American Association of Colleges of Nursing, the American Association of Colleges of Osteopathic Medicine, the American Association of Colleges of Pharmacy, the American Dental Education Association, the Association of Schools of Public Health, and the Association of American Medical Colleges. In 2011, IPEC issued two concurrent reports: Competencies for Interprofessional Practice, identifying four key competency areas to be mastered in addition to the existing Competencies presently guiding curricula for each individual profession, and its action-strategy companion piece, Team-Based Competencies: Building a Shared Foundation for Education and Clinical Practice.¹⁰

In medicine it seems now to be universally acknowledged that failures of teamwork and communication—not simply failures in technical proficiency—cause the majority of medical errors and injuries in hospitals and other health care facilities. Studies too numerous to cite have now documented that it is not the incompetent surgeon or a small group of bad apples in other disciplines that cause the most harm to patients. It is human factors—the failure of human beings to relate effectively and productively with one another in highly technological settings, to recognize human limitations in performance ability owing to “life factors” such as extreme fatigue and emotional distress, and to actively resist the culture of blame—that are the major cause of patient harm.

In many of the studies published in the most reputable scientific journals, CRM is repeatedly mentioned as a model for how to create safer hospitals and health care institutions. In the mid-1990s, the MedTeams Project was utilized in the emergency room setting.¹¹ The AHRQ has developed an aviation-inspired TeamSTEPPS curriculum that is used in many facilities, and The Joint Commission (TJC), formerly known as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), now recommends that teamwork and communication training be incorporated into professional education. The Affordable Care Act also allo-
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cates funding to create more interprofessional education in health care professional training programs and to encourage interprofessional practice in healthcare facilities.

Many of these initiatives have created their own small revolutions and promise to create even more. The lessons of aviation and other safety-critical, high-reliability industries are receiving more attention in health care than ever before. In spite of great resistance, some of these initiatives are producing positive models that offer great promise, as described in subsequent chapters. Nevertheless, we write this book out of concern that there is much more lip service than real systemic change when it comes to making health care a truly high-reliability industry—one in which genuine interprofessional and occupational practice is the norm. This is why it is so important for health care to recognize how much it can learn and adapt from the aviation model of safety and teamwork. Moving beyond the checklist will help advance the efforts of all of those who are working so hard to make health care safer for both patients and those who work in health care settings. For those already familiar with CRM, this book provides a detailed look at the content of CRM training programs that many safety advocates may find of interest.

We’ve called this book Beyond the Checklist because we are convinced that those working for safety in healthcare can benefit from a greater awareness of the enormous breadth and depth of the transformation that has occurred over the past three decades in commercial aviation and of what it actually took to make that happen. As our title suggests, safety in aviation is not just about the creation of checklists or briefing protocols. It is about a major cultural and behavioral shift—one that needs to occur in health care as well.

We explore not only what the CRM model offers—the nuts and bolts of CRM training—but also how aviation has managed, in a relatively short time, to create this massive cultural shift so that those in health care can review its most critical lessons for system-wide change and adapt and apply those lessons to their own settings. We will address the following questions:

- How did the airline safety movement develop?
- How were CRM trainings initially designed and implemented?
- How were they studied, refined, and changed on the basis of research findings?
- How did safety advocates overcome the resistance of pilots who felt their authority was directly challenged by this movement?
- How did they overcome resistance or skepticism from other airline workers?
- How did reformers demonstrate positive impact on work processes and organization?
- How did they demonstrate enhanced safety outcomes?
As we explore how a change of this magnitude took place in aviation, we will also be careful to describe the context in which the transformation occurred. In order to design and implement this new model and help refine and improve it, aviation reformers gathered together all involved stakeholders (including unions, researchers, company officials, government officials, and academics). The reformers understood that cultures and practices do not change after a single workshop or presentation; thus the central concepts, safety trainings, oversight, and supervision were designed to be continuous and self-reinforcing. In these trainings the emphasis is not on abstract concepts but on practical application of specific sets of teachable skills. The aviation safety curriculum is undergirded by a strong conceptual framework and supported by decades of human-factors and sociotechnical research; it is evidence-based. CRM training focuses on the kinds of skills and standard operating procedures (SOPs) that produce and reinforce new behaviors, which in turn engender new attitudes. For reinforcement, the new paradigm was also integrated into the work processes—technical, mechanical, and social—and the work organization of the airlines. Over time, CRM has been expanded beyond the crew inside the aircraft (i.e., pilots and flight attendants) to include other specialties—handlers, dispatchers, and mechanics, as well as resources outside the bounds of the company. All of this has produced a keen sense of team intelligence and recognition of “distributed cognition,” which has produced greater safety across the industry.

TEAM INTELLIGENCE AND DISTRIBUTED COGNITION

Any discussion of safety in high reliability industries will include the concept of “emotional intelligence” (EI). First articulated by psychologist Howard Gardner in his groundbreaking *Frames of Mind* and later popularized by author Daniel Goleman, EI has become such a popular concept that it now comes with its own set of constructs, promises, management tomes, scoring systems, and inventories (and, of course, critiques).

While EI is certainly an important concept, creating genuine teamwork requires moving beyond the individualized concept of emotional intelligence to that of team intelligence (TI). Emotional intelligence emphasizes self-regulation and monitoring as necessary for one-on-one relationships and what are known as “social skills.” It is perhaps a prerequisite of team intelligence, but on its own it is not enough.

As we have defined it, TI is the active capacity of individual members of a team to learn, teach, communicate, reason, and think together, irrespective of position in any hierarchy, in the service of realizing shared goals and a shared mission. TI has the following requisites:
• Team members must develop a shared team identity that allows them to articulate the shared mental model, shared language, and shared assumptions needed to realize their clear and common goals.
• Team members must be willing and able to share information, cross-monitor, and coach all members of the team, as well as to solicit and take into account their input, no matter their position in the occupational hierarchy.
• Team members must understand one another’s roles and work imperatives and how these mesh so that common goals can best be accomplished.
• Team members must help and support one another so that each individual member can perform his or her job efficiently and effectively.

Team intelligence produces not only action but also effective interaction.

In high-reliability, safety-critical industries, creation of team intelligence is grounded in the recognition that safe and effective job performance requires individuals to engage in a specific kind of group cognition—what cognitive anthropologist Edwin Hutchins calls “distributed cognition.” In his work on aircraft carriers and aviation (in Cognition in the Wild), Hutchins lays out a theory of distributed cognition that is crucial to our understanding of CRM—and by extension what it will take to create true teams in health care:

All divisions of labor, whether the labor is physical or cognitive in nature, require distributed cognition in order to coordinate the activities of the participants. Even a simple system of two men driving a spike with hammers requires some cognition on the part of each to coordinate his own activities with those of the other. When the labor that is distributed is cognitive labor, the system involves the distribution of two kinds of cognitive labor: the cognition that is the task and the cognition that governs the coordination of the elements of the task.

Put in everyday language, what Hutchins is saying is that all the participants in a real team need to know how to do—and how to think about—their individual tasks. But they also need to think about how their tasks, knowledge of their tasks, and knowledge of the changing context in which those tasks are performed affect the activities of those with whom they are working—even if those people are not working right by their side at the moment.

Distributed cognition is much too complex a phenomenon to elaborate on in this short discussion, but one of its fundamental elements is the recognition that the people on your team are in fact thinking about their work and not just doing mindless work. On the aircraft carrier that Hutchins describes, those involved in the crucial activity of navigation—the constant effort to figure out where one is and where one is going—combine different “sources of data that are reasonably independent.” One crew member plots by means of visual bearings, another by
means of radar, another by means of ocean depth. Each crew member, however, values the information gathered by the other—a fact that affords the team as a whole "the opportunity for the detection of error through the comparison of independently [calculated] representations." That is, one crew member does not dismiss the other’s data and concerns because that crew member is lower in status or acquired his information through direct observation rather than through “objective measures.”

A Danish nurse once told Suzanne about a lecture she’d attended given by a military general to a group of health care professionals: The general told the group that when an army is in battle and a private says, "Stop! There’s a mine," we don’t say, 'No, we won’t stop because the person providing this information is just a private.' We all stop. You in health care," he told the audience, “are [also] on a battlefield, but when the equivalent of a private—say a nurse—tells a surgeon to stop, you don’t ignore the directive because that person giving it is 'just a nurse.'” The point? In the army everyone implicitly if not explicitly recognizes the concept of distributed cognition and acts accordingly. Meanwhile, in health care, concerns about status often lead people to devalue the important information those of lower status actually have. Although team intelligence and distributed cognition were not popular currency in the early aviation safety movement, we believe that the creation of a culture of safety in aviation is a perfect example of both concepts at work.

**FLIGHT MAP**

The first chapter of Beyond the Checklist describes the history of the airline safety movement. Chapters 2 through 9 take you through the content of CRM courses and explain how the key concepts—communication, team building, workload management, and threat and error management—function: how they shape new behaviors and generate new norms. Interspersed among these four topics are case studies that illustrate how some health care institutions have tried to use teamwork initiatives to transform the problematic aspects of health care training and socialization that put patients at risk. One of these case studies reports on the results of a team-building initiative funded by a National Institute of Health (NIH) grant to Dr. David Eisenberg, who coauthors the case presentation. These chapters describe and analyze positive examples of change in health care that utilize some of the principles of cultural change that have made the aviation model so successful.

The book’s penultimate chapter analyzes why the aviation safety model worked. What principles of cultural change does CRM embody, and how might they be adapted and applied to the health care setting? Our conclusion argues that if aviation, with its history of toxic hierarchy and poor communication, can change, so can health care—and suggests how fundamental change can be facilitated.