Most physicians think of progress in surgery—medical progress in general—as scientific progress. The great flowering of medicine in the last half of the 20th century was one of the greatest triumphs of science of all time. We developed progressively—and impressively—better treatments, medical and surgical, because we continually expanded our understanding of diseases, and we were incredibly innovative.

Using the scientific method of hypothesis generation, experimental design, and collection and analysis of data, we developed new operations, new devices, and new drugs. And, particularly in surgery, the results were truly awesome. Millions upon millions of patients have had their pain relieved, their health restored, and their lives extended because of the brilliant advances that occurred just in the lifetimes of many of us here today. This all came from exactly the kinds of studies we have heard about during this meeting the past 2 days.

But starting in the mid 1980s, an alternative way of looking at progress began to emerge. It began with the disturbing observations of John Wennberg that the rates at which patients received treatments, surgical and nonsurgical, varied tremendously, not according to incidence of disease, but according to where they lived.1 Shortly thereafter, researchers at RAND developed measures of appropriateness and carried out studies that showed significant numbers of patients were receiving procedures that would not benefit them, which we call overuse, while other patients failed to receive procedures of known value, which we call underuse.2 The science of quality measurement and improvement was born.

A few years later, more bad news arrived: the Harvard Medical Practice Study, a large study of medical injury in patients hospitalized in New York state in 1984, showed that 4% had complications of their treatment.3 Even more shocking was the finding that two-thirds of these iatrogenic injuries were due to mistakes and therefore were preventable.4 Curiously, there was almost no public or professional outcry at this time.

That changed with the publication of the 2000 Institute of Medicine (IOM) report, To Err is Human, that revealed as many as 98,000 Americans die yearly from medical mistakes.5 (That figure, interestingly, was a contemporary national extrapolation of the results in the New York study in the ‘80s.) This time, everyone got aroused. Although quality concerns of overuse and underuse had disturbed policymakers and a few physicians for a decade or more, most doctors and the public had little interest. The revelation of the risk of injury, however, grabbed the attention of both the public and our profession. The field of patient safety was born.

A large number of studies have since shown that the extent of overuse, underuse, and misuse is even worse than these early studies suggested. We now know that half of Americans fail to get effective treatments they need,6 at least a third receive treatments of little or no benefit,2 and 10% or more are significantly harmed by preventable mishaps.7

It has increasingly become apparent that in the short term we could relieve more pain, restore more health, and extend more lives by improving quality and safety than...
to promote hand hygiene. The second challenge, Safe Surgery Saves Lives is being led by Atul Gawande.11 The goal: to get the surgeons and staff in every operating room in the world to implement a simple surgical check list. He estimates that this systems change will save tens of thousands of lives every year.

Recently, we’ve heard some impressive results: the Institute for Healthcare Improvement 100 000 Lives campaign enlisted 3100 hospitals to implement 6 new proven safe practices. Result: Within 1½ years, 122 000 fewer people died.12 Ascension Health, the largest nongovernmental hospital system made safety a systemwide priority in 2005. They have since achieved dramatic reductions in infant mortality, pressure ulcers, falls, nosocomial infections, and overall hospital mortality.13 Many others have had similar successes.

Some of us have complained about the slow pace of improvement. Far too many people still die preventable deaths. But a long-term view may be less judgmental. For example, many surgeons date the beginning of cardiac surgery with the first division of the patent ductus arteriosus by Robert E. Gross in 1939. It was another 15 years before cardiopulmonary bypass became a reality and made open-heart surgery possible. And 23 years before, Favaloro performed the first successful CABG [coronary artery bypass graft]. So from an historical perspective, patient safety is about where cardiac surgery was in 1950!

But we’ve already learned a lot as we open up this new field. It is becoming increasingly clear that the quest for safe defect-free care is not just about things like changing medication processes, implementing checklists, and using computers; it is much more complicated. The quest for safety requires that we reexamine almost everything related to how we practice medicine: what we know, what we do, even what we are.

WHAT WE KNOW

To begin with, if we are going to make health care safe, we need to learn a whole new body of knowledge. Not in biomedical science, but in the translation and application of that science to care of our patients, to the delivery of care. It is worth noting that biomedical science has profited immensely by learning from other disciplines such as biochemistry, physics, biomechanics, and genomics. Similarly, in safety we must learn from other disciplines such as ergonomics and human factors engineering, cognitive psychology, operations research, organizational management, and sociobiology.

Some of the lessons we have already learned from these disciplines are incredibly powerful. First among these is the concept of latent errors.14 These are defects in the design and organization of our systems and processes that are the primary cause of the errors that individuals make. This idea, that the causes of errors are bad systems, not bad people, is truly transforming. It challenges the conventional wisdom that proper training, practice, and conscientiousness were all that was required to avoid mistakes. Recall the power of unit dosing and computerized prescribing.

The implication that by changing our systems, ie, by designing our work using human factors principles such
as standardization, simplification, use of forcing functions, avoiding reliance on memory, and standardizing communication, we can eliminate errors is powerful.\textsuperscript{13} And as we are now seeing, it works as well in health care as in other activities. This concept of system design is the cornerstone of patient safety; make it easy to do it right and hard to do it wrong.

Another set of intriguing insights concern how the mind works, or can suffer a short-circuit that leads our thinking astray. Jerry Groopman’s new book, \textit{How Doctors Think}, explains these miscues eloquently, showing how they can lead the radiologist to miss the cancer of the lung, for example, or the surgeon to mistake the ureter for a vein.

The technical term for these characteristics is cognitive dispositions to respond, and there are many of them, many ways in which we don’t think straight. Wrong mental models are common. One of the purposes of using human factors design principles such as guidelines, checklists, and protocols, is to make it more difficult for us to be trapped by these cognitive misfires.

A third body of knowledge we have benefited from is organizational management and operations research, which provide new insights into making our work more efficient as well as safe. At the Massachusetts General Hospital, for example, application of these principles has greatly streamlined the function and efficiency of the operating room. Next up: emergency departments!

Commercial aviation has been held up as an example of how to become safe, but flying airplanes is very different from taking care of sick patients, and many aviation practices have no application in health care. One that does, however, is teamwork. In both airliners and hospitals, when people collaborate in teams, they are more satisfied with their work and they make fewer mistakes. Planes and patients have fewer crashes.

We’ve had some dramatic examples of this close to home. Gerry Healey at Children’s Hospital has had United Airlines train his otolaryngology team, with impressive results. Ben Sachs and his group at Beth Israel–Deaconess Medical Center cut complications in labor and delivery dramatically with team training, over 50\% reduction for the premature infants.\textsuperscript{16} Team training has taken off in hospitals all over the country. It works so well that 6000 hospitals to begin to implement 6 safe practices. Many of them had trouble doing it. Similarly, many of you have been involved in the SCIP [Surgical Care Improvement Project] program and know how difficult it is to carry out. It is not easy to change practice! It is even harder to make a new practice work 100\% perfectly in 100\% of patients 100\% of the time.

\textbf{Which Brings Us to the Other Half of What We Do: How?}

James Reason, probably the foremost contributor to error theory and the originator of the concept of latent errors, says that safety is more about relationships than about systems design. He should know; he’s been studying it for 40 years in all kinds of environments, from oil drilling rigs to ferries to commercial aviation and, thankfully, now in health care.

What relationships does he mean? I think at least 3 aspects are important. The first is that there is no room for autocratic, demeaning, humiliating behavior to nurses, residents, students, anyone. It never was right, but now we know how devastating it can be, how it stifles creativity and saps the joy from everyday life, how it leads to mistakes and patient harm as nurses, residents, and students shy away from warning the abusive physician of an error in the making, avoid communication with those who put them down, are inhibited in their thinking about the patient’s welfare as they try to protect their own ego and self-image from attack.\textsuperscript{17}

We don’t teach respect in medical school. We should. All members of the team, nurses, residents, orderlies, therapists, as well as physicians, are essential. Each brings something special and essential to the care we are trying to orchestrate for our patients; they need to feel valued, listened to.

A second insight, which we’ve already noted: everything goes better in teams. If there is any 1 characteristic that defines 21st century medicine, surely it is that modern health care is far too complicated to be delivered by any 1 person. It is estimated that 80\% of Medi-
care funds are spent on the 20% of patients with 1 of 8 serious chronic diseases (diabetes, coronary disease, chronic pulmonary disease, etc). All of these conditions require multidisciplinary care involving medical and surgical specialists, nurses, therapists, and many others—a team. None of these patients can be taken care of properly by any 1 individual acting alone.

Teams also do better at preventing mistakes. They develop routines and standardized procedures that ensure consistency and reduce errors. They increase efficiency by distributing tasks to those most qualified to do them. Team members identify and intercept each other’s mistakes.

Case in Point: Central Line Infections

We all know the protocol to prevent contamination when the line is inserted. Aseptic precautions should be comparable to those in the operating room. The question is how to do it perfectly 100% of the time? Peter Pronovost from Johns Hopkins Hospital had an idea. First, believe it’s possible. Second, take it on as a team project—everyone counts. The defining moment came when they empowered the nurse to stop the procedure if there was any breach of technique. They did it perfectly 100% of the time. Results? No infections for 4 months, 6 months, 9 months.

But the sea-change happened when Pronovost took his team-based protocol to Michigan (the Keystone project) and got 68 hospitals to do it so well that they, too, were able to virtually eliminate central line infections (and ventilator-associated pneumonias as well)—none of either complication for more than 6 months in 68 hospitals. Net savings: 1578 lives and $165 million. If 68 hospitals can do it in Michigan, all hospitals can do it.

The third insight we’ve learned about relationships is that leadership is crucial. As physicians, we think of ourselves as leaders of the teams, and others often do too. For many surgeons, the model is the “captain of the ship.” In the sense that we are ultimately responsible, that is certainly true. But in the sense that we can command and all will obey, that is certainly no longer true, if it ever was. Effective command, even for a ship captain, is about leading, showing, motivating, not dictating and compulsion.

Effective leadership is about motivating people, about getting them to want to do what needs to be done. It requires not just that we set objectives, but that we listen, that we not only listen, but that we hear. As they teach at West Point and the Naval Academy, leadership is about we, not me, about helping every member of the team realize their own potential. Maybe it is time to start teaching that in medical school and in residency.

Finally, the safety movement is not just about what we know and what we do, but it also presses us more deeply to ask what we are as individuals.

WHAT WE ARE

In the final analysis, safety is about character. Are we trustworthy? Can our patients be sure that we are doing everything we know to make health care safe, by ourselves and our colleagues? Are we honest, open, and forthcoming with our patients and ourselves when things go wrong? Nothing is more important to them. Are we respectful? Do we honestly value all of our coworkers? It sounds a bit like the Boy Scout Law! We could do worse!

What we are really talking about is accountability. But it must be 2-way. Institutions first have to hold their practitioners accountable for following safe practices. But caregivers have the right to hold the institution accountable to provide them with the tools and environment they need to practice safely. For example, it is unfair to hold a nurse responsible for safe medication administration while failing to provide medications in unit doses.

Individual accountability is more complex. We each need to hold ourselves accountable to do everything we know to make care safe. At the most basic level, this requires us to scrupulously follow established safe practices (such as hand hygiene, use of preoperative antibiotics, following surgical site protocols, etc). But it also requires us to actively participate in the implementation of new safe practices (such as reconciling medications, using time-outs), to report errors and adverse events, and to identify new hazards and take initiative to do something about them in time to prevent errors.

So we expect everyone to follow the new practices for ensuring positive identification of patient, organ, site, and procedure every time, 100%, without fail, regardless of whether you agree with time-outs or preoperative briefings or not. No individual can have a veto over safety.

It is, of course, the way the rest of the world has always behaved. Can you imagine a United Airlines pilot saying he doesn’t think he needs to file a flight plan today, or that he knows he has enough fuel, so he doesn’t have to do the weight calculations?

In addition to accountability for ourselves, each of us has a second type of accountability, the responsibility to ensure that all of our colleagues are safe and competent. The public assumes we do; who else can? But we don’t do a very good job of it, and that has to change. Like the rest of safety, it’s a systems failure; we need better systems for measuring performance and competence and for identifying doctors when their performance falls off before they injure a patient, and then to give them help to get back on track.

Finally, we need to be accountable to our patients. Not just for practicing safely, but also to be open and honest with them when we fail and hurt them. Injured patients want 3 things: They want someone to tell them what happened. They want to hear that we’re sorry. They want to know what we are going to do to keep it from happening to someone else.

It’s the right thing to do; we’ve always known it was the right thing to do, and it’s what most of us, but not all, have done. We now know that the advice from insurance companies and lawyers to not admit and not
apologize is based on a myth that it will increase the risk of being sued. There is not a shred of evidence that is so. The facts are exactly the opposite; when you conceal and fail to take responsibility you are more likely to get sued. Most patients sue because we lie to them. Hospitals and doctors who are honest, apologize, and compensate have fewer suits and lower total payouts. Apologizing is the most powerful thing we can do to heal the pain of preventable harm, both for our patients and for ourselves.

Making health care safe is a tall order; we have new knowledge and skills to master, new behaviors to learn, and new roles to play. In a sense, patient safety is about everything that is special about being a doctor, caring enough to do and be the best, putting the patient’s interest first, always, and being responsible, open-minded, and honest.

There is a lot of cynicism about health care these days. Some of it is justified; certainly we have seen more than enough conflicts of interest and greed in recent years. But the vast majority of doctors are like you and me; they put their patients first, and they really want to do a good job. It is an incredible privilege to be a doctor, to be able to use your talents so effectively to help others, to make a difference in the lives of so many. It is a sacred trust. But like the pilots and their wings, we must earn that privilege every day.

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