

Envisioning Patient Safety in the Year 2025: Eight Perspectives

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Abstract

Envisioning the future of patient safety is more than an academic exercise. Appealing visions can help channel human energies, set new directions, and open the doors to alternative approaches. Eight thought leaders participated in an exercise of envisioning patient safety in the year 2025. Two tasks were assigned for preparing a brief response. The first task simply called for the invited thought leaders to envision patient safety in the year 2025 as they would like it to be from the vantage point of their particular area of expertise. The areas of expertise included health care system change, design of the physical environment, health information technology, patient-centeredness, device safety, simulation, transitions of care, and complex systems. For the second task, they were asked to describe what changes need to “fall into place” between now and then in order for their visions to be realized. Concluding observations are provided.

Introduction

Much of the change that happens in health care occurs in a reactive, piecemeal mode with the crises of the moment serving as the prime drivers. Rarely is the time taken to reflect upon and envision the safety and quality of care that patients, providers, and health care professionals would like to have. One way of responding to the changes occurring in health care is to get out in front of them and consider them an opportunity to shape the future as we would like it to be. Visions help to do this. Clear and compelling visions start us along a path of generating a future we deserve to have – a journey that very much needs to be taken in health care. They have the power to dislodge the status quo, alter comfortable patterns of behavior and infuse the uncertainties of tomorrow with a new sense of opportunity and purpose.

Toward these ends, and in keeping with the subtitle of this publication, *New Directions and Alternative Approaches*, the first two authors in the byline identified eight different areas of patient safety expertise and asked the remaining authors (a deliberate sample based on their particular area of expertise) if they would be willing to envision patient safety in the year 2025. All the invited thought leaders accepted the invitation. Eight domains of patient safety expertise are represented: health care system change, the design of the physical environment, health information technology, patient-centered care, device safety, simulation, transitions of care, and complex systems.

The thought leaders were presented with two tasks: first, envision patient safety as you would like it to be in the year 2025 and beyond from the perspective of your own area of expertise; and second, describe what changes need to “fall into place” between now and then in order for your visions to be realized. Given a practical limitation regarding the length of manuscripts that could be submitted to *Advances*, the thought leaders were asked to prepare their individual perspectives within a relatively tight 600-word limit. Also, as an inducement to focus on the future and resist the magnetic pull of the present, they were encouraged to forego the need for references. Their perspectives appear next and flow from a broad, macro-level of analysis to a more micro-level and then onto an analysis of technical work and complexity issues.

Health Care System Change

Lucian L. Leape. In 2025, the health care system has been transformed at all levels: national, regional, local, and institutional. At the institutional level—hospital, group, ambulatory care center, nursing home—we have achieved a culture of safety. Safety is truly the first priority for the board, the leadership, and the staff, and every individual feels personally responsible for ensuring safe care. The environment is nonpunitive for errors, which are seen as opportunities for learning, but intolerant of deliberate unsafe acts. Caregivers are open and transparent with patients. Patients are truly partners in their own care. We treat each other with respect and work well together in teams.

An outside observer is struck by three characteristics that are very different from the culture of the early 21st century: a deep sense of individual and institutional accountability for safety, an emphasis on fairness and transparency, and pervasive collaboration and teamwork based on mutual respect.

Our processes have been redesigned, resulting in elimination of 90 percent of current adverse events, including virtually all infections, postoperative complications, and medication errors. Managers no longer talk about the “business case” for safety. When errors do occur, our pride leads us to respond with surprise (*This should never happen here!*), curiosity (*How could this have happened?*), and commitment (*This will never happen again.*) Patients are fully compensated for all costs of injuries; we provide emotional support for patients and caregivers after adverse events.

At the macro level, all institutions and caregivers are members of integrated care networks (true managed care organizations), which are held accountable by the national government to submit quality and safety data to verify that they are meeting national standards of care. Federal agencies, such as the Food and Drug Administration (FDA), ensure that all drugs, devices, products, and procedures are safe, effective, and ergonomically sound. Whatever the financing system, there are no barriers for anyone to receiving appropriate health care.

A transformation of this magnitude requires that we address the underlying cause of our current—i.e., 2008—system failures: fee-for-service, for-profit reimbursement that rewards poor care, penalizes good care, and promotes overuse. Episode-oriented, it provides disincentives for efficient coordinated multidisciplinary care. Insurance-based, it lacks fairness through exclusions, disallowals, skimming, and high costs. Profit-driven, it rewards production over quality and safety. The experience of the past 20 years provides abundant evidence that this

commercial for-profit system is incapable of providing universal coverage, controlling costs, or assuring quality and safety.

Changing this system is the ultimate political challenge. Because of powerful vested interests, change will not occur without substantial increases in public indignation over insurance failures, lack of access, and poor quality. Four major changes are required:

- First, we must provide universal coverage, whether by tax-based, single-payer, or mandatory regulated insurance. A single (lean) standard benefits package of essential care must be provided for all, without exclusions, restrictions or copayments.
- Second, government or private payers will not reimburse individuals but only pay not-for-profit integrated networks on a capitated basis. These entities represent a new type of managed care organization that will be responsible for defined populations; they will provide evidence-based, appropriate, preventive, episodic, and comprehensive continuing care by multidisciplinary teams in all settings. Global budgets will provide strong incentives to eliminate unsafe, ineffective, and inefficient care.
- Third, the entire system requires oversight at the national level by the Federal Government, through regional organizations that assure sufficient facilities (e.g., emergency rooms, cardiac centers, transplantation centers) and monitor quality of care by plans, not by individuals. Government regulates insurance companies, sets standards (like the National Quality Forum), and requires health care organizations to compensate patients for costs of treatment-related injuries.
- Finally, we must require our professional schools to provide training in basic safety science (e.g., error theory, ergonomics, system analysis), leadership skills, respect for coworkers, teamwork, communication skills, and emotional support of patients and colleagues.

Design of the Physical Environment

Kirk Hamilton. An ideal, well-designed environment for health care in 2025 will be safe, efficient, and designed to enhance the calm, healing aspects of the setting, where advanced technologies will support clinical care delivery. The physical environment of the future will play a role in improved safety by contributing to increased compliance with hand-hygiene guidelines, reduced patient falls, improved medication administration, and reduced numbers of transfers. The environment will be constructed without the use of toxic materials and solvents, and surfaces will be far more effective in reducing the danger from infectious organisms. Surfaces will have antimicrobial characteristics, improved “cleanability,” and be made from materials designed not to harbor moisture that could support organisms. Each of these important outcomes associated with design has already been demonstrated.

One important aspect of safety in the future is the issue of isolation for patients with contagious and drug-resistant conditions. We also need to be prepared for large numbers of serious cases in the event of a pandemic. The ability to switch rooms and units to outside air that is highly filtered and not recirculated will allow many more spaces to be available for isolation cases.

Among the simplest of design interventions is the ability to reduce stress for patients, families, staff, and physicians. Stress exacerbates all known clinical conditions, increases staff fatigue, and contributes to errors. The potential impact of design to improve the quality of the patient experience and the quality of the staff experience is enormous. Noise reduction, natural light, a view to the outdoors with a glimpse of nature, and calming elements in occupied spaces are all important contributors to stress reduction.

The health care facilities of 2025 will need to be far more efficient than today's buildings. Efficiency will be required in energy consumption, as well as in the work performance of the building's occupants. Technology, including robotics, will continue to be utilized for its "best practice" standardization and labor-saving advantages. Process redesign, paired with quality improvement, will be employed to reduce waste, redundancy, and nonproductive time of highly skilled staff. Configuration of systems, departments, units, and individual work settings will lead to measurable performance improvement.

Communication is vitally important in the health care arena, and design can affect the quality of interaction among caregivers and patients, as well as among the health care professionals collaborating in teams. Improved communication will be a major factor in improved safety.

The most effective health care environments of the future will be characterized by the ambulatory-dominant campus as part of a regionally distributed health care model. The shift to a preventive care model, with a single national risk pool and full coverage for all citizens, will reduce the overall cost and workload of the health care system at a time when the need to operate with fewer trained professionals is compelling. The new ambulatory-dominant management and facility model will be paired with a regionally centralized system of critical and trauma services supported by telemedicine, which will include the remnants of today's hospital-dominant model.

The single most important contribution to the development of these new safe and efficient health care environments will be the widespread adoption of evidence-based design and an accompanying full investment in relevant research. At the same time, there is a need to revise standard accounting procedures, whose requirement of separating operating and capital expenses, makes it difficult for decisionmakers to adopt plans that optimize the life-cycle cost of a building and equipment. If trustees, executives, and the government align themselves to achieve the best of what has already been successfully demonstrated in piecemeal, the future is bright for far better, safer, and more productive health care environments.

Health Information Technology

David W. Bates. By 2025, it should be possible to make care dramatically safer than it is today, and information technology will be a central tool in this safety transformation. Inside hospitals, patients and providers will be tracked from the time they enter the hospital until they leave, using radiofrequency identification devices, thus improving efficiency. All monitoring data will be captured electronically, and processing will be done in the background to identify patients who appear likely to decompensate before decompensation occurs. Handoffs between providers will occur electronically. Notifications about laboratory abnormalities will be communicated directly to the responsible provider using the information system.

Medications will be ordered using computerized systems that will check orders for issues and suggest appropriate dosages, tailored to the patient's age, sex, and in some instances, genetic makeup. Drugs will be dispensed using robots for solid forms of medications and, in specialized instances, for liquids like chemotherapy. Intravenous medications will be administered using "smart" pumps, which "know" the type of medication ordered and appropriate dosage. The solid form of administered medications will be tracked using barcoding and electronic medication administration records. Patients' response to medications will be tracked by nurses using handheld devices and by patients themselves on their personal health records, available via the Web in every hospital room. All these technologies will be electronically linked, lowering the probability of error substantially.

At the same time, much more care will be delivered outside the hospital than is the case today. Outside the hospital, providers will use electronic health records as they interact with patients. All prescribing will be electronic; and prescriptions will be transmitted directly to pharmacies, most of which will be through the mail. The medication error rate will be a tiny fraction of what it is today because initial prescribing will be improved, and dispensing will be safer. Tracking to ensure that abnormal laboratory tests receive appropriate followup will be routine. Background processing will help ensure that providers do not miss important diagnoses.

Home monitoring of patients with serious medical conditions, such as severe congestive heart failure, will be ubiquitous, substantially improving both quality and safety outcomes for these conditions. Much of the monitoring will be done using "smart" devices, such as scales that are wirelessly linked to the patient's personal health record. The actual monitoring will be done largely using electronic tools that can sift through the data and notify team members when important signals, such as a significant increase in the patient's weight, are identified. Personal health records will prove to be especially valuable for patients when they need to report medication and other problems.

Transitions between care settings will be managed far more effectively. Because of seamless interoperability, critical health information will be more accessible, regardless of patient setting—hospital, nursing home, assisted living, or the home.

To realize the 2025 vision, the payment structure needs to be reformed. Payment must be higher for safer care. To pay providers for safer care, better tools and indicators for measuring safety will need to be developed. With the advent of widespread use of electronic health records, it will be possible to detect adverse events on a wide-scale basis. The computerized adverse event monitoring capability makes it possible to assess safety objectively, on an ongoing basis. Furthermore, patients will contribute a great deal of key information themselves through their personal health records. However, if computerized monitoring is to achieve a significant impact, research support to develop it effectively will be essential.

New information technology and safety interventions need to be fully tested, and continued Federal support—much more than is available today—will be needed for their development and testing. With payment reform in place, the effectiveness of new technology carefully validated, and robust indicators of safety developed and embedded in the care process itself, health care organizations will find it in their economic interests to make the delivery of care considerably safer than it is today.

Patient-Centered Care

Susan Sheridan. In 2025, the definition of patient-centered care, within the patient safety domain, will have evolved to a broader and more provocative significance, beyond simply delivering what patients say they “want.”

The health care system will have completed the shift from a model of physician self-governance, autonomy, and paternalism to a model of co-creation and partnership with patients, based on mutual respect and trust, transparency, shared decisionmaking, shared learning, and accountability. In essence, patient-centered care will transcend from being considered the redesign of health care *for* patients and families to the redesign of health care *with* patients and families.

Patient perspectives, experiences, wisdom, behavior, and participation will be considered priceless and essential resources for the design and evaluation of the health care system. They will drive funding, solutions, guidelines, patient and provider education, ethics, research, policymaking, and consumer choice of providers and health care institutions to assure that the system is safe, compassionate, and just.

In 2025, patient safety materials, available to the public in a variety of mediums, will be significantly retooled to integrate the triggers and human dimensions that motivate patients and families to become engaged in their own safety. They will be research-based, tested by patients, action-oriented, and “medically honest” in that they will communicate all risks no matter how small.

Patient safety education will encourage and support patient and family participation to ask questions about risk, guidelines, processes, treatments, medications, and patient rights, as well as providers’ and hospitals’ safety indicators and performance measurements. Patients will be encouraged to collect and understand personal medical records, test results, and medication orders and, in general, to seize opportunities to contribute to their own safety.

However, the ultimate litmus test for authentic patient-centeredness will be when harm occurs. In 2025, patient-centered care will be viewed as a comprehensive continuum and will not cease when a medical error occurs or because of the perceived threat of liability; it will honor and respect the needs of the patients and their families who have been harmed.

Disclosure, no longer optional in 2025, will be understood as simply the “right thing to do” and as the cornerstone of patient-centeredness, not just a strategic maneuver. Disclosure and apology will be validated by compensation when appropriate and/or the implementation of sincere changes in policy and practice to prevent similar events in the future. Patients and families will be considered a valued source of input to policy and practice changes by being integrated into root cause analyses, accrediting surveys, and other investigations.

Also, in the event of medical error, patients and family members will be able to report errors to a responsive, authoritative entity via a national consumer reporting system that assures accountability and systemic learning and improvement.

To realize this vision of “patient-centeredness” within patient safety in 2025, the necessary changes that need to occur include:

- Legislative action for the creation of an authoritative national commission or board at the “helm,” made up of health care professionals and consumers who will be accountable to health care consumers for their safety and who will respond to reports of medical errors and harm with urgency to assure safety to future patients. (Similar to the National Consumer Product Safety Commission.)
- Creation and implementation of alternatives to the tort system that are honorable, fair, reliable, equitable, fast, and that directly influence safety in health care.
- Mechanisms to incubate and support consumer groups to assure authenticity, to accelerate progress in patient safety through public pressure, and to collect, package, and communicate patient wisdom and expectations regarding patient safety to all stakeholders in health care.
- The repositioning of patient safety research so that patient priorities, research agendas, and science are aligned, integrated, and complementary. Some topics include:
 - Significant investment in learning about the human dimensions of the patient population and how to transform passive patients to active participants.
 - Exploration of the depths of the human toll and total economic impact to society from medical errors.
 - Research on the dynamics of communication of risk and the impact on patient engagement.
 - Identification of the effects and contributions to patient safety of a patient reporting system of medical errors.
- The reengineering of patient safety solutions and “best practices,” identifying opportunities for patient involvement as part of the processes of care to contribute to safety.
- Leadership that is courageous, passionate, innovative, and willing to offer tools and training to providers and staff to transition to patient-centered care
- Creation of a consumer reporting system that directly influences standards of care, protocols, and guidelines and is responsive to patients.

Device Safety

Mark Bruley. From the viewpoint of 2025, improvements in medical device safety are quite evident. Improvements over the past 20 years have resulted from advances in information technology, enhanced regulatory oversight, and increased concentration on human factors in device design.

Advances in radio frequency identification (RFID) technology have made medical devices readily identifiable and traceable in the hospital, home, supply chain, and inside the patient. Virtually all devices, regardless of size—including implants, surgical instruments, and consumables (needles, staples, sponges)—now have embedded RFID tags. This has vastly enhanced device identification for adverse event and problem reporting and for tracking recalled, contaminated, reprocessed, reconditioned, or obsolete devices. At the regulatory level, RFIDs

have enhanced surveillance to identify counterfeit devices. The unification by regulatory authorities of RFID information protocols and device nomenclatures has enhanced this oversight, streamlined problem reporting databases, and facilitated data mining and analysis of adverse events.

RFIDs in medical devices have helped to virtually eliminate two of the three most notorious surgical errors—wrong site/wrong side/wrong patient surgery and retained instruments. Linking patients' identification and health care information in the hospital wrist band RFID tag to the electronic medical record (EMR) and to therapeutic and life support devices (e.g., infusion pumps, enteral feeding pumps, ventilators, anesthesia machines, linear accelerators) has helped eliminate delivery of inappropriate procedures, medications, and therapies.

Medical errors, such as retained surgical instruments and sponges, are now virtually unheard of due to RFID tags and the advent of routine patient RFID scanning at the completion of surgery using RFID readers in the operating table or those now present in all wearable computers, vidcom cell phones, and PDAs.

Surgical fires, the third notorious error involving devices, continue to pose technologic challenges because of the complex physics of ignition and flame spread. No advances have been made in fire-retardant surgical devices and materials for safe use in the oxygen-enriched atmospheres (OEAs) that continue to be present during surgery. Attempts to interconnect anesthesia machines with electrosurgical units and lasers to prevent them from activating when a surgical site OEA is automatically detected have resulted in adverse patient outcomes from hypoxia, delayed therapy, or exsanguinations and have been abandoned. Surgical fire prevention continues to require surgical team vigilance and perioperative communication.

Device interconnectivity has helped to ensure proper patient monitoring during laparoscopy (e.g., prevention of laparoscopic CO₂ insufflation if heart rate and blood pressure are not monitored), and to alert anesthesia and cardiopulmonary bypass personnel if the anesthesia ventilator is turned off when weaning the patient from bypass. Other device interconnectivity and safety interlocks continue to be explored with mixed results. More successful have been advances in arrhythmia detection algorithms in physiologic monitors and the enhanced linkage of those monitors to alarm systems that successfully address the cognitive limitations of health care staff.

Medical device accidents caused by user error have decreased significantly due to an increase in the device industry's focus on enhancing human factors design and usability testing. This has proven true for capital equipment (e.g., physiologic monitors, defibrillators, infusion pumps, anesthesia machines, imaging and radiation therapy equipment), surgical instruments, and clinical laboratory and pharmacy equipment. Devices commonly used in the home (e.g., glucose monitors, insulin pumps, portable ventilators, nerve stimulators) have become much safer to use because of better human factors designs that take into account the limitations of the patient or lay caregiver using the device.

Finally, devices have been made "user friendly" and more tolerant of users' errors through critical analysis of the four device interfaces (device-user, device-patient, device-accessories, device-environment). Semi-intelligent software in electromedical devices has reduced errors and enhanced user skill. Virtual user manuals embedded in equipment are instantly viewable via

wireless personal area network links to the user's computer, vidcom, or PDA and have also served to significantly reduce errors.

Simulation

David Gaba. Over the next 20 years, health care will have caught up with the rest of society's high-hazard undertakings, such as commercial aviation and nuclear power, and adopted a comprehensive strategy of intensive training and periodic performance assessment for health care personnel. The system in place in 2008 emphasizes an initial period of "book learning" followed by apprenticeships—work with real patients with varying levels of supervision. Once a clinician achieves full staff status, there is only a modicum of recurrent training and even less assessment of skill. In the future, there will be an integrated system of "learning by doing" and checking of performance, much of it taking place away from real patients. These activities will be required periodically for all clinicians—as individuals, teams, work units, and whole institutions—regardless of years of experience. A variety of modalities will be used in these efforts, including verbal simulation or role playing, network-based multiplayer virtual worlds, standardized patient actors, part-task and procedural trainers, and mannequin-based or virtual reality replications of complete patients.

Training and performance assessment are not panaceas and must act synergistically with process improvement and design in order to improve patient safety. Simulation also has a role to play in these approaches. In the future, medical equipment (and user interfaces) will be tested in advance using simulations. Clinical processes will be probed with *in situ* simulations in actual clinical environments. Simulation will be used, not only for clinicians, but also for health care executives, regulators, and legislators.

Simulation is a "technique," not a technology, to replicate important aspects of the real world, to amplify them, or to replace them for the appropriate purposes. It facilitates training and assessment in ways that cannot be accomplished in real patient care. In particular, simulations can:

- Be scheduled as needed to accomplish key goals.
- Be targeted to the personnel in need of training or assessment.
- Be about routine processes and events or about unusual and critical events.
- Be intense whenever desired.
- Address issues ranging from psychomotor performance on invasive procedures to cognitive and behavioral performance as individuals and teams.
- Require clinicians to interact with a variety of medical equipment and a diversity of personnel and personalities.
- Facilitate intrusive and detailed recording and assessment of performance.
- Present no risk to patients.

How will this revolution in health care be accomplished? It will be implemented by the same institutions that already oversee the operations of health care, such as professional societies,

professional schools, liability insurers, risk managers, clinical payers, and accrediting organizations. They will, in turn, be “driven” by a variety of forces, all of which translate the demands of the public, the ultimate driver.

Transitions of Care

Robert Wears. Here in 2025, it is hard to recall that around the turn of the century, transitions in care were uniformly viewed at best as disorganized ramblings that badly needed to be standardized and “rationalized,” or at worst, as unmitigated hazards that needed to be reduced or eliminated. The value we place on transitions today differs dramatically from the offhanded casualness with which we considered them not too long ago.

In fact, today we would not even speak of “transitions” as a single entity, anymore than we would speak of “inflammations” as being representative of anything in particular. Although the episodes that were once called “transitions” are still united in that they involve transfers of authority, responsibility, and yes, information, today’s appreciation of the variegated and heterogeneous nature of these episodes—necessarily resulting from the variegated and heterogeneous nature of human physiology, of illness and injury, and of clinical work—does not allow us to think of, say, shift changes, as having anything in common with interservice transfers (e.g., from the ward to the intensive care unit), which in turn, have nothing in common with transitions into or out of the hospital. Each of these events has its own context, characteristic problems, opportunities, affordances for recovery, and social dynamics, such that we treat them each quite differently. In fact, even within these broad classes, many distinctions, both overt and nuanced, remain.

“Transitions in care,” to use the old term, are dramatically better today than they were in 2008, but the improvements did not come from interventions that were thought important back then; most of those (e.g., standardized templates, written turnover documents, and fads like SBAR [Situation-Background-Assessment-Recommendation]) fortunately died quiet deaths along the way, unmourned victims of new ways of thinking that led to better understanding.

To develop those new ways of thinking and better understanding, three fundamental changes must occur: demedicalization, increased understanding of technical work, and changed views of transitions.

Although there is general agreement that safety problems in health care are problems of psychology and engineering, not problems of medicine, patient safety research and improvement efforts today are dominated by health care professionals, mostly physicians. This dominance of safety work by socially powerful groups within a field of practice is strikingly different from other high-hazard industries.

Health care professionals and human performance experts have highly divergent views of transitions that derive from differences in the scientific and philosophical underpinnings of their fields. Health care professionals commonly see transitions as excessively variable, *ad hoc* procedures badly in need of standardization. Human performance experts see them more appreciatively, as exquisitely situated in context, and worry about the consequences that might follow well-intended mandates for standardization. Bringing experts in human performance to

the forefront of safety research—in substantive and sustained collaborations with clinical experts—is an essential first step toward producing anything of value.

The detailed study of technical work in health care is just beginning, but an early surprising result has been the recognition of the role that transitions play in recovery from adverse events in-the-making. The combination of a deep and well-grounded understanding of technical work in context, combined with the insight that imposing a simple structure on a complex process does not result in simplicity, will ultimately lead to interventions that mitigate weaknesses in transitions without placing what is good at risk or driving it underground.

Finally, a fundamentally different understanding of transitions is needed. Rather than being the unidirectional movement of chunks of information, they must be viewed as conversations aimed at jointly constructing shared understandings under important constraints. Instead of the goal of comprehensiveness (transmission of complete, standardized data sets for each patient), the new goal should be saliency (what must we pay attention to based on the complexity of the situation, the extent of common ground among participants, the time available, and competing goals).

Complex Systems

Paul Schyve. By 2025, evidence-based safe practices will be rapidly and universally adopted in and between clinicians’ offices, hospitals, and other health care organizations. Risk of unintended harm will be rare, quickly identified, and successfully mitigated. But this transformation can only be achieved when health care delivery is recognized as being composed of complex systems, the characteristics of complex systems are understood, and systems thinking guides change.

Health care delivery is composed of complex systems. The macrosystems of health care organizations and the microsystems of patient care teams and patients—even at the level of the practitioner’s office—are all complex. And, these systems are open systems—that is, other systems (e.g., educational, financing systems) provide inputs to them.

Fortunately, complex systems exhibit characteristics that can be leveraged to improve safety. First, they are “adaptive”; they self-adjust in response to internal changes and external inputs. Second, small changes at one point in the system can result in large changes elsewhere. Third, they defy comprehensive modeling (complexity), face unanticipated situations (contingency), and contain decision points for which the correct choice is unclear (uncertainty). This complexity, contingency, and uncertainty are helpful reminders to participants to be appropriately cautious, and humble, in creating change.

Unfortunately, these same characteristics can also increase the risk of harm in health care. First, the adaptive nature of complex systems can lead to undesirable changes; self-adjustments are not necessarily guided by participants’ values and priorities. Second, the disconnect between the magnitudes of a cause and its effect can result in a minor “tweak” in one part of a system and lead to a catastrophe elsewhere. Third, failure to appreciate the complexity, contingency, and uncertainty in complex systems can lead to ineffective redesigns with unintended consequences.

How can the recognition that health care delivery is composed of complex systems and an understanding of the characteristics of complex systems be harnessed to transform health care delivery for 2025?

First, clinicians, administrators, and policymakers who want to improve safety and prevent harm must think of health care delivery as complex systems. Systems thinking does not come naturally but must be learned and practiced. People prefer simplicity to complexity, predictability to contingency, and certainty to uncertainty.

Second, clinicians and administrators must apply systems thinking to designing and implementing evidence-based changes that are specifically targeted toward reducing unintended harm in health care. If clinicians are to fulfill the ethical obligation to “first, do no harm,” they must invest in systems change, not just in their personal competence and commitment. Administrators and clinicians must recognize that the implementation of an evidence-based safe practice usually requires more than adding a new process to an existing system. Rather, it often requires a system redesign, with new forcing functions and incentives, if the implemented change is to be effective, efficient, reliable, and sustained.

Third, before being widely implemented, in order to identify potential unintended consequences, proposed changes should be subject to prospective evaluation, such as failure modes and effects analysis and computer-based simulation.

Fourth, because prospective evaluation cannot predict all the unintended consequences, vigilance must be built into the system. Vigilance must be the responsibility of each person in the system—practitioners, administrators, patients, patients’ families—and the system itself must be imbued with continuous self-measurement of processes and outcomes and mining of the measurement databases to identify early indicators of unexpected change.

Clinicians’ offices, hospitals, and other health care organizations, and the United States health care system itself, are all complex systems. With the help of systems thinking, they can become dramatically safer; without it, many of the efforts to improve safety will be wasted.

Concluding Comments

This exercise has generated eight separate visions of patient safety as their originators would like it to be in 2025 from their assigned vantage points. While the coauthors recognize a need for considerable change in their assigned domains, the level of analysis across the different domains varies from the most macro of levels, as in Leape’s national, regional, local, and institutional levels; Hamilton’s design of the physical environment; and Bates’s widespread implementation of health information technology; to a more micro-oriented focus on individual patients and families by Sheridan; improvements in medical device safety by Bruley; and different forms of simulation training and performance assessment by Gaba. Both Wears and Schyve call for new ways of thinking and a more in-depth understanding of transitions of care and systems complexity, respectively.

The first six visions place emphasis on design or redesign efforts, whether they are clinical processes, the physical environment, health information technology, patient-centeredness, devices, or simulation training. However, the last two pieces urge caution and underscore the

need to understand technical work in context and to avoid the temptation of simply adding a new evidence-based safe practice on top an existing system.

None of the coauthors suggest that their idealized visions will come easy. Many of the challenges exist at the ultra-macro level, including political willpower to overcome vested interests, Federal involvement, professional education in safety science, continued funding of evidence-based research, and realignment of misdirected incentives for decisionmakers, just to mention a few.

Finally, although the coauthors were asked to confine their visions to given areas of expertise to which they have contributed, none of the eight perspectives, in isolation from other salient factors, could be viewed as a panacea. Safety does not exist in any one component of the health care system. Instead, it emerges from multiple and intricate interdependencies among broad-based forces external to the care setting, the design of the physical spaces, the clinical work processes performed, the deployment of technology and devices, the types of training experienced by providers, our views of patients, and prevailing modes of thought.

Through a somewhat unconventional exercise, we have attempted to expand prevailing modes of thought for a safer care environment and provide some of the guideposts to a journey well worth the uncertainty and effort in taking. To be sure, vast stretches of the journey remain unmarked. The ultimate task will be up to readers—playing a significant role in shaping tomorrow’s health care—to provide the missing guideposts.

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