

# How to Use Data to Improve Patient Safety

By Stanley Pestotnik

Vice President Patient Safety

Health Catalyst

Avoiding patient harm is intrinsic to the work of healthcare professionals. Hippocrates (ca. 460–377 BCE), known as the Father of Modern Medicine, [helped set this precedent](#) when he said, “The physician must...have two special objects in view with regard to disease, namely, to do good or to do no harm.”

Contemporary medicine, however, still struggles to realize its primary mission. Today, researchers estimate that [one in three hospitalized patients experiences preventable harm](#) and over [400,000 individuals per year](#) die from these injuries.

There is a gap in healthcare safety culture and the way health systems uses [data](#) (or think they use data) to understand patient harm and what to do about it. Much of the data collection is manual and not integrated with financial, operational, and other data, resulting in a fragmented approach to safety analytics that’s not actionable or predictive. Scores are recorded and boxes are checked, but the real work to make patients safer—closing the loop between information and action—is incomplete.

The status of patient safety moving forward, however, stands to improve. Despite the discouraging statistics above, in today’s era of data-driven healthcare, [machine learning](#), and [predictive analytics](#), the industry can turnaround decades of lost ground in patient safety and finally make much needed improvement. This white paper describes the problems in safety culture and how [healthcare analytics](#) and new-generation tools will fix them.

## What Is Patient Safety?

A [Harvard Medical Practice Study](#) defines patient harm as, “an injury that was caused by medical management (rather than the underlying disease) and that prolonged the hospitalization, produced a disability at the time of discharge, or both.” Adverse events can affect quality of life, delay treatment, lead to [readmission](#), cause permanent disability, and more; at their worst, patients die.

Examples of patient harm include:

- Hospital-acquired infections (HAIs).
- Falls at the healthcare facility.
- Wrong diagnosis.
- Wrong treatment/medication.

## Dangers of the “Illusion of Completeness”

In his [keynote address](#) at the 2017 National Patient Safety Foundation Patient Safety Congress, Don Berwick, MD, president emeritus and senior fellow at the Institute for Healthcare Improvement, called out the “illusion of completeness” among the seven key areas of concern in patient safety. “There’s an illusion that we’ve worked on safety,” he stated.

Dr. Berwick explained that an industry emphasis on scores for patient harm events (e.g., central-line associated bloodstream infections [CLABSIs] and catheter-associated urinary tract infections [CAUTIs]) and compliance (e.g., medication reconciliation) has encouraged a “box-checking” attitude toward safety. Health systems may fail to develop real insight into risks for patient harm, and to develop appropriate intervention protocols.

“The concept of safety as a box-checking enterprise, where we start and finish, is lethal to patients of the future,” Dr. Berwick said.

## Patient Safety Also Impacts the Bottom Line

With the transition from fee-for-service (FFS) to value-based [reimbursement](#), patient safety extends beyond patient welfare to increasingly impact a health system’s financial bottom line. Reimbursement will be tied to patient safety (and quality metrics, as determined by [CMS](#)). Health systems that aren’t currently engaged in driving down patient harm, or have high readmission rates, risk reduced reimbursement.

This is a significant shift in how hospitals are compensated for services; formerly, added services due to complications or readmissions made the organization money. As the industry moves toward safety-driven reimbursement, however, health systems risk not only loss of revenue if they don’t prioritize safety, but also the possibility that insurance companies will refuse to work with them.

## Key Weakness in Patient Safety Today

Two significant studies published in the 1990s put patient safety in the spotlight: [Incidence of Adverse Events and Negligence in Hospitalized Patients — Results of the Harvard Medical Practice Study](#) (1991) and [To Err Is Human](#) (1999). The reports concluded, respectively, that a) patient harm occurs frequent and is often caused by substandard care and b) adverse events are more likely the result of systemic flaw, rather than individual negligence.

Further, adverse events in healthcare are the [third leading cause of death](#) in the U.S.—proving that while the industry may have done work and performed research to improve patient safety, it's made little to no progress. In fact, patients today are experiencing [10 times the rate of preventable harm as they were in the 1990s](#).

If anything, the industry has regressed in the realm of patient safety. The system is inefficient: The industry repeatedly looks at the same HAIs when it needs to look at all-cause harm. Without a data-driven, all-cause approach to patient safety, history will continue to repeat itself.

Several issues stand out as weaknesses in the industry's approach to patient safety:

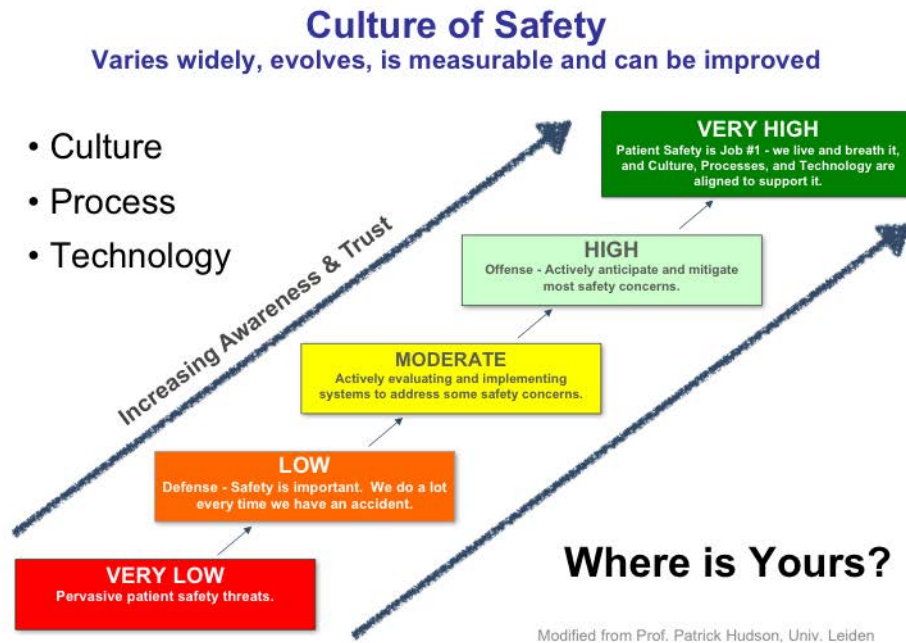
- **Lack of an all-cause harm strategy:** Health systems follow [organizational](#)—mostly governmental—mandates (e.g., what CMS determines is important to report on) and specific metrics defined as most important (e.g., pressure ulcers and readmission rates). When organizations must report on, and take a siloed approach to patient safety, selecting a few harm initiatives, they may be putting their patients' safety at risk. As a result, the industry loses a culture of always providing safety for the sake of staying safe in certain metrics.
- **Insufficient tracking of harm:** The healthcare industry hasn't developed an efficient way to track all-cause harm. Health systems lack internal automated surveillance and reporting systems. While reporting to regulatory agencies is required, these reports are not aligned with quality improvement initiatives. As a result, organizations tend to spend a lot of time on patient safety reporting, but have little time left for actual improvement; they have the data, (albeit in many cases a manual, time-intensive process), but there's no follow-through with improvement initiatives based on that data. In addition, the current voluntary approach (in which frontline staff and physicians report adverse events at their discretion) is passable at best, but largely ineffective. Employees fear repercussions if they bring an issue forward; or they believe, based on experience, that no one will follow up, so there's no use in reporting.
- **Lack of real-time harm data:** Harm data from medical coders isn't reliably accurate. The rates don't always reflect accurate trends, and they're retrospective, so there's no real-time data to show near misses or opportunities to prevent harm.
- **Lack of repercussions:** Lack of repercussions in patient safety progress yields a stagnant, or even backsliding, situation.

## Four Measures to Improve Patient Safety

Patient safety improvement centers on three actions: measure, intervene, and prevent. The health system must first identify and describe (measure) a safety issue, act to help the patient (intervene), and then avoid similar events in the future (prevent).

A proactive patient safety methodology includes four central aspects:

1. **A sociotechnical approach:** A sociotechnical approach combines culture, process, and technology. A ladder score can measure these elements to show how well a health system is doing in a culture of safety—from very low to very high.



- Culture includes: Patient- and family-centered care, leadership, teamwork, frontline staff burnout, and economic impact of culture.
- Process includes: Organizational fairness, reliability, and process improvement.
- Technology includes healthcare IT (e.g., an enterprise data warehouse [EDW], analytics, decision support, etc).

2. **All-cause harm:** All-cause harm is a cultural value—one in which, instead of focusing solely on metrics, the organization embraces what it means to be a safe environment for patients and staff. This entails a just culture, where employees feel safe voluntarily reporting adverse events and where a learning system around safety addresses factors in culture, process, and technology.

As [To Err Is Human](#) concluded, organizational culture is arguably the most influential dynamic in patient harm: “...errors are caused by faulty systems, processes, and conditions that lead people to make mistakes or fail to prevent them.” Several factors support the all-cause harm cultural value:

- An [electronic methodology](#) looks for more critical events to support the all-cause harm culture. This may include surveilling pharmacy management, coagulation utilization, and sedation management.
- Real-time [trigger tools](#) identify and measure adverse events also enable the all-cause harm culture. These tools take safety to the patient level by prompting immediate intervention or prevention at the frontline.
- A standard approach to measuring organizational safety culture tracks its evolution. The [Agency for Health Research and Quality \(AHRQ\) Safety Attitude Questionnaire \(SAQ\)](#) is a collection of surveys that measure attitudes toward safety throughout an organization.

## Culture Matters – It Drives Safety

Culture of Safety – Culture of Accountability – Culture of Caring



**Organizational Culture as a Source of High Reliability**

Karl E. Weick

**Creating high reliability in health care organizations**

Pronovost PJ, Berenholtz SM, Goeschel CA, Needham DM, Sexton JB, Makary MA, Hunt E.  
Department of Anesthesiology & Critical Care Medicine, Surgery, and Health Policy University, 1901 Thames Street, 2nd floor, Baltimore, MD 21231, USA.

The NEW ENGLAND JOURNAL of MEDICINE

**Time for a Culture Change?**

Richard Platt, M.D.




**Perceptions of Hospital Safety Climate and Incidence of Readmission**

Luke O. Hansen, Mark V. Williams, and Sara J. Singer

**3. Transparency and patient engagement:** Transparency—openly discussing risks for safety events with patients and families—ensures that everyone involved is aware of risk and can therefore put in place prevention and mitigation strategies. Engaging patients in conversations about prevention (e.g., falls, meds, pressure ulcers, etc.) makes them partners in their own safety. Effective engagement happens at the beginning of the healthcare experience (before admission), with education on how patients can help keep themselves safe and encouraging them to speak up if don't feel they're receiving safe care.

Patient engagement needs to outweigh compliancy with guidelines and checklists. For example, when a pharmacist asks a patient if they want to be counseled about a prescription and the patient declines, the pharmacist checks the “no” box and moves on. Real engagement entails determining whether the patient thoroughly understands how to take their medication and risks associated with missing doses or dangerous interactions.



**4. Breakdown of the shame-and-blame culture:** Transparency extends to healthcare professionals, as communication and collaboration across all teams (e.g., surgical technicians, nurses, and physicians) is essential. A culture of shame and blame is too common in the industry—one in which, often for fear of repercussions or hierarchical professional structures, team members see an advantage in ascribing blame elsewhere, rather than addressing the adverse event or taking preventive measures.

Transparency among healthcare professionals relies on a cultural intervention—with buy-in at senior leadership and board levels to promote teamwork, collaboration, and communication, and avoid isolation and fragmentation between different factions of an organization (e.g., between leadership and frontline staff). A continued lack of full interoperability around safety will contribute to poor quality, high-cost care.

### Integrated Data Can Make Patients Safer

Fortunately, in the new era of data-driven patient safety, health systems will have incisive tools to achieve better [outcomes](#). Analytics tools will leverage integrated clinical, cost, and operational data and predictive analytics, machine learning, and more to address organizational weakness in patient safety and enable improvement.

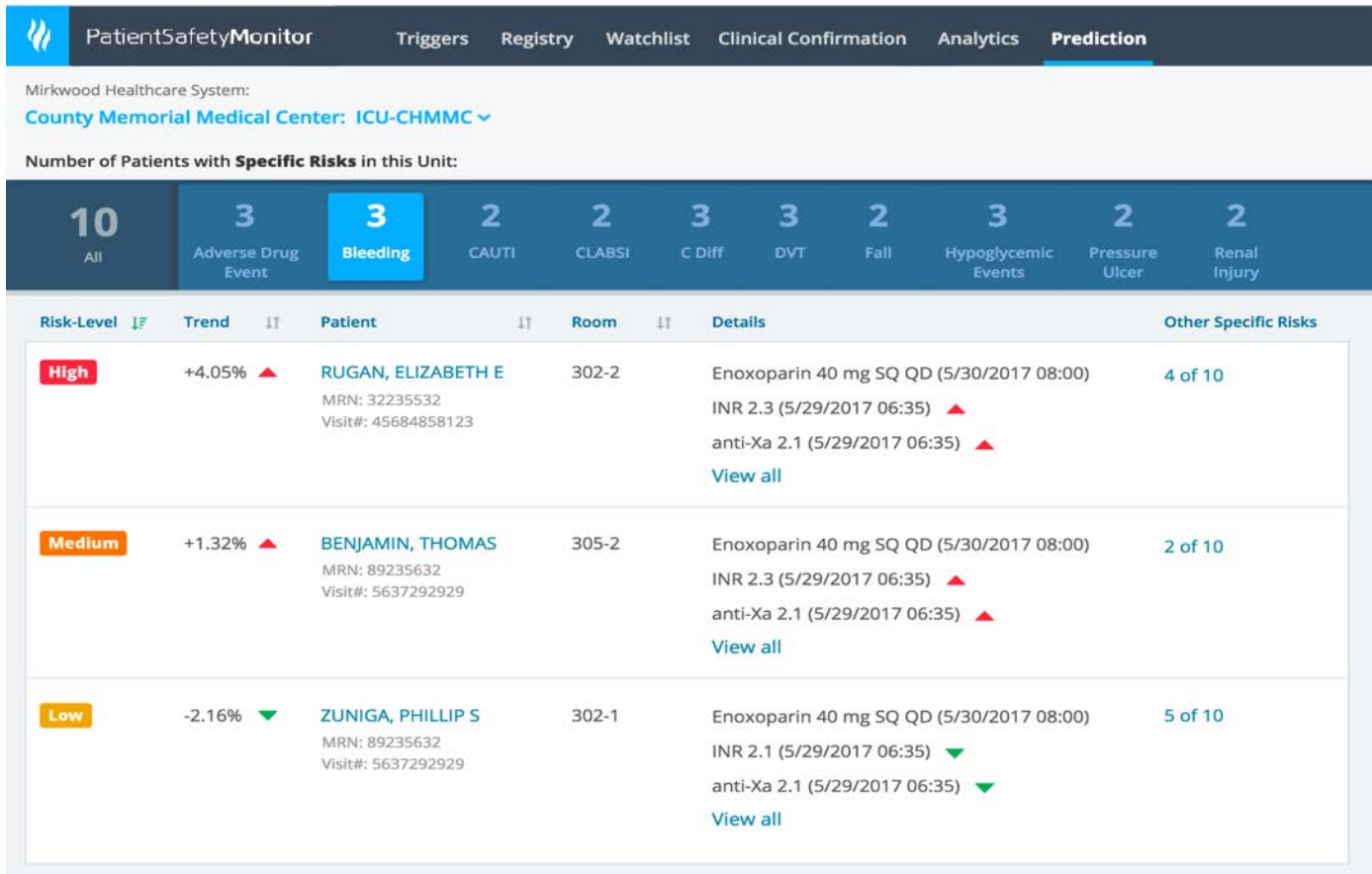
### Three Key Capabilities of Machine Learning in Patient Safety

Machine learning supports patient safety improvement with capabilities that are reactive, proactive, and fully integrated.

**1. Reactive capabilities:** With automated triggers, the safety tool reacts to potential harm by identifying risk and notifying frontline caregivers. This adds a layer of critical thinking to the tool—the frontline user clicks on a patient name, sees their individual risk, and can follow-up with appropriate interventions.

**2. Proactive capabilities:** Once the safety tool determines risk within a patient set, predictive analytics identifies interventions to reduce or prevent harm. This proactive capability makes the information from risk triggers actionable—by suggesting intervention—and accessible—by putting otherwise hard-to-find procedures and protocols at the user’s fingertips. For example, the application might show that a patient is at risk for pressure ulcers and remind the caregiver to rotate them regularly and follow safe skincare practices to reduce risk.

**3. Full integration capability:** Because the safety tool is integrated across workflow tools and across the health system, it enables improvement across the continuum of care. This allows improvement efforts to not be isolated and fragmented within departments—potentially impacting only a few patients—but implemented across an organization to impact many. In the long-term vision for patient safety, patients will have access to safety applications on their mobile devices, making them true partners in their care.



## Success Stories: Data at Work for Patient Safety

Data-driven patient safety initiatives are already at work in some health systems. The following success stories show how organizations are applying data, machine learning, and predictive analytics to reduced patient harm and improve care overall. The difference with the next-generation patient safety tools discussed in this paper is that they'll address harm from an all-cause perspective, versus focusing on one specific adverse event at a time.

### Data-Driven Process Improvement Raises Patient Safety for Highest-Risk Medication

Even though health systems widely use intravenous (IV) heparin (an anticoagulant) to prevent thrombosis, the medication carries a high risk for dosing errors. When an organization determined that its hospitals used several different IV heparin protocols (high variation), it saw a need for standard practices targeted at patients' clinical needs. The health system developed an anticoagulation safety analytics application to monitor and better understand IV Heparin outcomes. As a result, the organization immediately improved the percentage of patients therapeutic by seven percent. It also made essential progress by reducing variation, and thereby risk of error, by establishing one systemwide guidelines and four systemwide protocols.

## [Leveraging Risk Assessment to Decrease LOS and Cost for PCI Patients](#)

Percutaneous cardiac intervention (PCI) is a minimally-invasive alternative to open heart surgery for some patients, but it still carries risk. A health system that performs the highest volume of PCIs per year sought to lower the risk of bleeding—the most common non-cardiac complication associated with the procedure. The organization found bleeding events were increasing length of stay (LOS) and cost for patients undergoing PCI. To lower bleeding risk, the system leveraged its analytics platform to generate a bleeding risk assessment tool that allowed clinicians to focus interventions based on risk and to reduce complications. The organization has seen a 5.3 percentage point reduction in bleeding complication rate with PCI and \$1.8M cost savings.

## [Reducing HAC Rates to Keep Kids Safe and Healthy](#)

A nationally ranked pediatric center wanted to reduce its rates of hospital-acquired conditions (HACs)—such as central line-associated blood stream infections (CLABSIs) and pressure ulcers (PUs). It knew an intervention required major systematic changes. The organization needed access to data to support improvement efforts and build custom HAC applications. With an analytics platform that enabled automated, real-time reporting, it captured the needed information for improvement teams to develop HAC interventions. As a result, the health system reduced overall HAC cases by 30 percent (a \$1.6 million savings), CLABSIs by 23 percent, PUs by 74 percent, and venous thromboembolisms (VTEs) by 68 percent.

## [Health Systems Cannot Afford to Overlook Patient Safety](#)

Whether looking at the bottom line or, more significantly, the human face of patient harm, safety is an issue that health systems must prioritize. People don't come to hospitals to suffer from or die of preventable harm, yet it's the third leading cause death in U.S. Furthermore, as value-based care escalates, patient harm will increasingly cost health systems money. No one gains when patients are hurt.

Patient safety won't be achieved without quality improvement measures that include integrated clinical, cost, and operational data; automation; actionable insight; and full integration across the continuum of care. If organizations leverage predictive analytics and machine learning to make safety an overarching cultural goal, then other factors that define a successful health system will fall into place—including reimbursement and patient satisfaction scores. Everyone stands to gain with improved patient safety. As American physician and educator [Arthur L. Bloomfield](#) (1888–1962) explained, safety is an industry imperative: “There are some patients whom we cannot help; there are none whom we cannot harm.”







Stan Pestotnik, MS, RPh  
Vice President Patient Safety

Prior to Health Catalyst® Stan has held several executive, clinical and research roles. Most recently he was the Chief Strategy Officer for Pascal Metrics a federally-certified Patient Safety Organization. Prior to that Stan was the founding CEO of TheraDoc, which he led for 10+years until its acquisition. For 2+ decades Stan was a clinician, researcher and educator at the University of Utah School of Medicine, College of Pharmacy and at IHC-LDS Hospital. Stan is clinically trained as a pharmacist specializing in infectious diseases as well and has an advanced degree in medical informatics specializing in clinical surveillance and expert system decision support technologies.



Valere Lemon, MBA, RN  
Senior Subject Matter Expert

Valere joined Health Catalyst® in March of 2017 as Senior Subject Matter Expert. Prior to joining HC, Valere worked at Pascal Metrics as a Client Services Manager. She has worked as a Pediatric Hematology/Oncology nurse at 2 children's hospitals, Children's National Medical Center and Riley Children's Hospital. Valere holds a BSN from Purdue University and a MBA from University of Maryland University College



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