A Comprehensive Patient Safety Program Can Significantly Reduce Preventable Harm, Associated Costs, and Hospital Mortality

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Objective To evaluate the effectiveness of a hospital-wide initiative to improve patient safety by implementing high-reliability practices as part of a quality improvement (QI) program aimed at reducing all preventable harm.

Study design A hospital wide quasi-experimental time series QI initiative using high-reliability concepts, microsystem-based multidisciplinary teams, and QI science tools to reduce hospital acquired harm was implemented. Extensive error prevention training was provided for all employees. Change concepts were enacted using the Institute for Healthcare Improvement's Model for Improvement. Compliance with change packages was measured.

Results Between 2010 and 2012, the serious safety event rate decreased from 1.15 events to 0.19 event per 10 000 adjusted hospital-days, an 83.3% reduction ($P < .001$). Preventable harm events decreased by 53%, from a quarterly peak of 150 in the first quarter of 2010 to 71 in the fourth quarter of 2012 ($P < .01$). Observed hospital mortality decreased from 1.0% to 0.75% ($P < .001$), although severity-adjusted expected mortality actually increased slightly, and estimated harm-related hospital costs decreased by 22.0%. Hospital-wide safety climate scores increased significantly.

Conclusion Substantial reductions in serious safety event rate, preventable harm, hospital mortality, and cost were seen after implementation of our multifaceted approach. Measurable improvements in the safety culture were noted as well. *(J Pediatr 2013;163:1638-45)*.

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Progress in reducing harm in US hospitals has been slow.[1,2] Although real progress has been made in harm reduction for central line–associated bloodstream infection (CLABSI)[3] and ventilator-associated pneumonia (VAP),[4] there have been few reports of transformational change efforts aimed at hospital-wide preventable harm reduction. The Ascension Health adult health care system began such a journey in 2002 with a goal of eliminating preventable injuries by July 2008. Although that goal was not attained, they did report a significant reduction in hospital mortality.[5,6] The Baylor Health Care System embarked on a similar effort and reported a decrease in hospital standardized mortality rates.[7] Recently, both Cincinnati Children's Hospital[8] Medical Center and Helen DeVos Children's Hospital[9] reported harm reduction, as measured by the rate of serious safety events (SSEs),[10] after implementation of interventions to improve safety and increase high-reliability practices.

In 2008, our hospital adopted the goal of eliminating all preventable harm by the end of 2013. Our 2-pronged approach involved culture transformation to become a high-reliability organization (HRO) and significant expansion in our quality improvement (QI) program capacity. A key component of our approach was adoption of the Preventable Harm Index (PHI),[11,12] which provides a summation of all harm events occurring in 8 different domains. This report describes our methods and documents results through 2012.

Methods

Nationwide Children's Hospital (NCH) is a large free-standing urban children's hospital with roughly 25 000 hospital admissions, 85 000 Emergency Department visits, 130 000 urgent care visits, and 22 000 operating room and ambulatory surgery center procedures in fiscal year 2012. Our effort began with the presentation of PHI data to the Quality of Care Committee of the hospital's

ADE	Adverse drug event	NCH	Nationwide Children's Hospital
CAUTI	Catheter-associated urinary tract infection	PHI	Preventable Harm Index
CLABSI	Central line–associated bloodstream infection	PU	Pressure ulcer
HAI	Hospital-acquired infection	QI	Quality improvement
HRO	High-reliability organization	SAQ	Safety Attitudes Questionnaire
ICU	Intensive care unit	SSE	Serious safety event
IHI	Institute for Healthcare Improvement	SSER	SSE rate
		VAP	Ventilator-associated pneumonia

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Board of Directors. This created a sense of urgency, and culminated in a call to action from the Board to management to drive the PHI toward zero—"aspire to eliminate preventable harm." The Institutional Review Board, under expedited review, approved the safety culture interventions and assessment tools.

Culture Change: Development of the "Zero Hero" Patient Safety Program

With the help of an external consultant (Healthcare Performance Improvement, limited liability corporation, Virginia Beach, Virginia[10]), past SSEs were analyzed and reviewed for common causes. Error prevention tools were selected to address the common causes, and formed the basis of a basic training course in error prevention. The goal was to move our hospital toward becoming an HRO, the most important characteristic of which is consistent performance by everyone, top to bottom.

The program was branded the "Zero Hero" patient safety program. A logo and signage were created to convey a consistent message. The branding was important because it gave the program a "face" and rallied staff behind the zero harm message. Basic error prevention training was provided to all 8000 clinical and nonclinical staff members, including physicians. In addition, 600 leaders received training in leadership methods, focused on techniques to reinforce the HRO concepts taught during basic training. The root cause analysis process was significantly augmented. System failures required corrective action plans including an "owner," a timeline, and a monitoring plan. A performance management decision guide, adapted from Reason,[13] was used to adjudicate individual failures. Finally, a "safety coach" program was implemented to train front-line staff in coaching their peers on effective use of the error prevention techniques.

Transparency is widely considered essential to creating and maintaining an HRO.[14] Hospital internal and external transparency has been increased with full knowledge and approval of our Board of Directors. All PHI data are posted on the NCH intranet, and in November 2011 we became, to our knowledge, the first hospital to post our SSE rate (SSER) on our Internet Web site (http://www.nationwidechildrens.org).

QI Program Enhancement

A single improvement methodology, the Institute for Healthcare Improvement (IHI) Model for Improvement, was used. A critical mass of individuals was trained in this method by attending either external QI courses or a newly established "project-based experiential learning" internal course. The number of full-time equivalent personnel in the QI Department was increased from 8 in 2007 to 33 in 2012, and the budget was increased from $690 000 to $3.3 million. QI analysts, many hired from industry, were embedded into hospital microsystems and act as project managers and data analysts, helping keep busy clinicians on task.

Harm detection is based on an event reporting system, trigger tools, pharmacy interventions, and analysis of complaints and grievances. The greatest source of harm reports is from the event reporting system. After initiation of the Zero Hero program in Q3 2009, the number of reports increased by 35%, from a quarterly mean of 1156 in Q1 2009 to 1784 in Q4 2012, and has been sustained since. Active surveillance is used in selected areas (eg, pressure ulcer [PU] detection). Trigger tools and pharmacy interventions are also used to detect adverse drug events (ADEs).

PHI Domain Definitions and Implementation

The PHI is the total number of harm events in 8 separate domains defined previously[11]: (1) hospital-acquired infections (HAIs), including CLABSI, VAP, surgical site infection, and catheter-associated urinary tract infection (CAUTI); (2) ADEs, severity level 4-9 (D-I); (3) preventable non–intensive care unit (ICU) cardiac arrests; (4) significant postsurgical complications; (5) serious falls; (6) PUs; (7) miscellaneous significant harm; and (8) SSEs. The SSER is the rolling 12-month average of SSEs per 10 000 adjusted patient-days. Importantly, the PHI includes only the number of detected events, not event rates, and thus the numbers can be summed to indicate the total harm events for a given time period. The PHI concept was introduced to all members of the organization from the Board of Directors on down during Zero Hero program training sessions. Unit-specific PHI data are posted on the NCH intranet.

Tactical Operations

Multidisciplinary microsystem-based teams were deployed to focus on each harm domain, with particular emphasis on the largest contributors: PUs, ADEs, and HAIs. A PU team coordinated hospital-wide efforts and supported the work of unit-focused skin teams consisting of unit nursing staff, educators, wound ostomy care nurses, and a QI analyst. A PU prevention bundle[15] was developed, and clinical unit bundle compliance was measured and posted. Units with low bundle compliance produced written action plans on how to increase bundle compliance.

ADE reduction initially focused on the processes of medication utilization (ie, administration, prescribing, dispensing, monitoring) in the ICUs and then spread hospital-wide. An ADE prevention bundle was developed, and bundle compliance was measured.[16] Implementation of a wireless communication system (Vocera, San Jose, California), making it easier to find another nurse to double-check critical medicine administration, proved very useful, as did post-ADE huddles. The use of medication pumps with dose-range checking and bar coding was implemented as well. Medication safety champions on each unit reinforced safety behaviors related to medication administration.

For HAIs, multidisciplinary teams focused on each of the HAI subsets. Compliance with established prevention bundles was measured, and huddle debriefing was conducted after each infection that occurred. CLABSI prevention work included hospital-wide implemention of the Children's Hospital Association insertion and maintenance bundle.[3] Recent