



## The Value of Improving Patient Safety in Pennsylvania

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### INTRODUCTION

Progress in patient safety has been made since the Institute of Medicine's two landmark reports were published: *To Err is Human: Building a Safer Health Care System*<sup>1</sup> in 1999 and *Crossing the Quality Chasm: A New Health System for the 21st Century*<sup>2</sup> in 2001.<sup>3,4</sup> The Pennsylvania Patient Safety Authority, established under the Pennsylvania Medical Care Availability and Reduction of Error (MCARE) Act of 2002, is charged with reducing and eliminating harm from medical errors by collecting and aggregating data, identifying problems, and recommending solutions that promote patient safety in hospitals, ambulatory surgical facilities, birthing centers, and abortion facilities.<sup>5</sup> The Authority was charged subsequently with also reducing healthcare-associated infections (HAIs), under Act 52.<sup>5,6</sup>

Those engaged in patient safety and quality improvement initiatives must continually question whether safety is improving and whether the industry's efforts are yielding meaningful results. Current literature supports the contention that measuring patient safety is not an easy task.<sup>7-13</sup> Randomness and rarity of certain events, differing event definitions, and the paucity of standardized, meaningful metrics are among the barriers to successfully implementing a measurement strategy. Determining the value of patient safety improvements is equally challenging. The Authority found it necessary to use estimates and projections when attempting to quantify the value of improvement related to specific measures. One estimate of lethal harms originating from suboptimal care during hospitalization posits that 400,000 Americans have their lives significantly shortened each year by preventable adverse events.<sup>14</sup> Broad estimates of lethal harms originating from suboptimal care during hospitalization have ranged from 250,000 to 400,000 annually.<sup>14,15</sup> Although these estimates are extrapolations that likely vary from reality, even if they are overestimated, the number of preventable harms is still large. The five measures the Authority chose are a small subset of the manifold ways in which hospitalized patients can be harmed.

Over the years, the Authority has shown reductions of several types of patient-harm events associated with patient safety initiatives, including falls with harm, wrong-site surgery, and HAIs. Likewise, the number of high harm events has decreased statewide. In a commentary on the national progress of patient safety, Drs. Pronovost and Wachter stipulate that evidence exists to support the contention that safety and quality are improving, and they cite a number of successes, such as bar coding implementation and decreased numbers of central line-associated bloodstream infections.<sup>16</sup> They acknowledge that although safety efforts are "...encouraging and display significant improvements in certain aspects of patient safety, the absence of a valid global measure to evaluate whether safety is broadly improving makes it difficult to support a claim that safety is improving overall—just as this absence makes it difficult to say that it is not."<sup>16</sup> In light of this dilemma, can the Authority assert that the combined efforts of healthcare facilities and the Authority have been effective in reducing and eliminating harm from medical errors in Pennsylvania? Although limitations exist, the Authority describes its methods and estimates for the value of the many improvements made by healthcare provider organizations.

The Authority is neither the sole impetus nor the only contributor to improvement efforts in Pennsylvania. Other motivations include the federal government's non-reimbursement policy for "never events," the Centers for Medicare and Medicaid Services (CMS) Value-Based Purchasing program, facility-specific publically reported data (e.g., Joint Commission's quality check, the Leapfrog Group's hospital safety scores), and providers' own natural incentives to improve quality and reduce claims.<sup>17-20</sup>

### ABSTRACT

*The Pennsylvania Patient Safety Authority estimated the value of data aggregation, analysis, dissemination, and statewide collaborative learning to reduce healthcare-associated patient harm in the state. Improvements in patient safety have occurred with concentrated efforts directed at discrete issues. Measuring and appropriately attributing these improvements has been difficult. A select set of patient safety measures was chosen to demonstrate the results of the combined efforts of Pennsylvania healthcare facilities, statewide quality improvement entities, and the Authority. Using data submitted to the Pennsylvania Patient Safety Reporting System and the National Healthcare Safety Network, the Authority computed event trends and used evidence-based mortality and economic estimates to calculate theoretical lives and dollars saved over reporting periods of 11 to 12 years. The Authority estimates that through 2015 more than 2,600 lives and more than \$147 million dollars were saved. Using a standardized methodology, the value of safety improvements can be estimated to stimulate a conversation about the program's effectiveness. Fostering an environment that encourages and supports effective patient safety programs is inherent to the Authority's mission. (Pa Patient Saf Advis 2016 Dec; 13[4]: 125-136.)*

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To coordinate these other motivators, various organizations, including the U.S. Department of Health and Human Services' Agency for Healthcare Research and Quality (AHRQ), Centers for Disease Control and Prevention (CDC), and CMS, along with public-private collaborations such as the Partnership for Patients (P4P) espoused comparable goals to address quality and patient-safety improvement opportunities.<sup>9,10</sup> The P4P is a large, national, quality improvement learning collaborative with two aims: to improve safety in acute care hospitals through the reduction of hospital-acquired conditions and to improve coordination of care at discharge to prevent readmissions.<sup>21,22</sup> CMS invested in 26 hospital engagement network (HEN) contractors\* nationally, including The Hospital and Healthsystem Association of Pennsylvania, which collectively enrolled about 3,700 acute care hospitals.<sup>9,10,21</sup> In Pennsylvania, 109 acute care hospitals joined a HEN 1.0 project (December 2011 to December 2014).<sup>23</sup>

Other quality improvement entities, including Quality Insights of Pennsylvania, the Health Care Improvement Foundation (HCIF), and the Healthcare Council of Western Pennsylvania, have also been active in statewide and regional improvement efforts. By aligning themselves with these programs, individual Pennsylvania hospitals were prompted to use their performance improvement strategies to focus on preventing patient harm and improving patient safety for the communities they serve. They benefited from collaborative learning. All of these activities, as well as additional programs based on needs and aspirations perceived by individual institutions, contributed to patient safety improvement efforts in Pennsylvania.

The Authority sought to provide information about the success and value of

statewide improvement efforts in reducing and eliminating harm from medical events in Pennsylvania by exploring outcome and economic estimates for a select set of patient safety measures.

## METHODS

### Measures and Sources of Data

The following patient safety measures were chosen to evaluate improvements in patient safety in Pennsylvania (Table 1):

- Falls with harm
- Central line-associated bloodstream infection (CLABSI)
- Catheter-associated urinary tract infection (CAUTI)
- Wrong-site surgery
- High harm events

These measures, with the exception of high harm events, were selected because the Authority had established focused collaboratives on these topics, standardized definitions and monitoring methods, and engaged providers in making improvements in these areas. High harm events were selected as a potential global measure of safety. The falls with harm, wrong-site surgery, and high harm measures data were reported by acute care facility type (i.e., hospitals, ambulatory surgical facilities, abortion clinics, birthing centers). They were reported according to requirements stipulated under the MCARE Act and submitted through the Authority's event reporting system, the Pennsylvania Patient Safety Reporting System (PA-PSRS).<sup>24</sup> The measures data for CLABSI and CAUTI were reported by hospitals in accordance with requirements outlined under an amendment of MCARE, Act 52 of 2007, pertaining to reporting HAIs to the National Healthcare Safety Network (NHSN).<sup>6</sup>

### Harm

PA-PSRS uses an adaptation of the National Coordinating Council for Medication Error Reporting and Prevention harm

index to distinguish between harm and no-harm events.<sup>25</sup> The harm score measures the extent to which the event "reached" the patient and the degree of patient harm that resulted, including death.<sup>26</sup> Events that do not reach the patient, because of chance or active recovery, and unsafe conditions are also reported.

The Pennsylvania Patient Safety Authority Harm Score Taxonomy is available at [http://patientsafetyauthority.org/advisories/advisorylibrary/2015/mar;12\(1\)/publishingimages/taxonomy.pdf](http://patientsafetyauthority.org/advisories/advisorylibrary/2015/mar;12(1)/publishingimages/taxonomy.pdf).

As can be seen from the taxonomy, high harm events are those that result in permanent injury or death or require life-saving measures.

### Estimations

Analysts estimated the theoretical value of avoided events based on costs of claims and/or additional cost of treatment for associated injuries reported in the published literature.

Cost data from the literature has been adjusted for inflation, using the Bureau of Labor Statistics' publically available "consumer price index—all urban consumers for medical care databases."<sup>27</sup> Cost and mortality estimates for falls with harm, CLABSI, and CAUTI were obtained from AHRQ's 2013 Annual Hospital-Acquired Condition Rate and Estimates of Cost Savings and Deaths Averted from 2010 to 2013, AHRQ's 2015 interim update of the 2103 report, and Saving Lives and Saving Money: Hospital-Acquired Conditions Update Interim Data From National Efforts To Make Care Safer, 2010-2014.<sup>9,11</sup> These costs are reported as an excess cost (i.e., a measure of the estimated additional cost per hospital-acquired condition due to the incremental cost of the hospital-acquired condition).

Cost estimates for wrong-site surgery were obtained via a special data request provided by the Physician Insurers Association of America Data Sharing

\* The Hospital and Healthsystem Association of Pennsylvania has a contract with CMS for the HEN, of which the Pennsylvania Patient Safety Authority is a subcontractor.

Project Closed Claims database and reported average indemnity payments for wrong-site surgery.<sup>28-30</sup> The Authority did not estimate wrong-site surgery mortality because there are scant metrics available that are generalizable to all surgery types.

Cost and mortality estimates for high harm events were obtained from the research by Adler and coauthors describing the impact of patient harm on clinical outcomes and hospital finances.<sup>31</sup> Analysts calculated PA-PSRS high-harm mortality rate, expressed as harm score I (death) divided by harm scores G,H, and I (requiring life-saving measures, associated with permanent injury, or contributing to or resulting in death, respectively). The Authority likens this mortality estimate to the “failure to rescue” metric for complications (i.e., high-harm mortality rates are a metric for the failure to rescue harmful medical errors).<sup>32,33</sup>

Some data estimation was necessary. For example, all Pennsylvania facilities began reporting infections into NHSN in July 2008; therefore, only six months of data were available for CLABSI and CAUTI for that year. The number of infections during 2008 was computed by doubling the available data to represent a full year of events. Seasonality of actual infection events was considered and an analysis of the CLABSI and CAUTI data for the first and second six months of 2009 yielded a near 50/50 split in number of reported infections, rendering this doubling method sound. The rate was assumed to be consistent throughout the year and used to justify this estimate. Likewise, July 2004 was the first full month in which PA-PSRS reporting occurred therefore, the number of high harm events during 2004 was imputed by doubling the available data. Whole calendar years were used to maintain consistency.

### Value Formula

Decreases in deaths and the cost of events avoided can be used to estimate statewide improvements. The Authority used a

standardized approach to estimate the value of improvements for the patient safety measures selected (see Figure).

Starting points and timeframes for the measures listed below were chosen to capture baseline performance and actual performance that resulted from specific programs being implemented for the reduction of falls with harm, CLABSIs, CAUTIs, and wrong-site surgeries in Pennsylvania. The starting points for each measure are:

- Falls with harm: 2007
- CLABSI: 2008\*
- CAUTI: 2008\*
- Wrong-site surgery: 2007

For high harm events, the starting point is 2004, the year reporting was initiated in Pennsylvania. Additional detail on starting points is discussed in the estimations section of this article.

The actual performance (i.e., number of events [counts] per year) was plotted. For each measure, a linear regression model was calculated to fit the data using Microsoft Excel.<sup>34</sup> The starting point of the linear regression (i.e., Y intercept) was used as the baseline value. The (negative) slope was the average yearly trend over time of the estimated measure avoidance, mortality prevented, or cost saved (Table 2). The starting point or baseline value was used to estimate what would have happened had no improvement efforts been employed (i.e., expected baseline performance). The measures’ actual performance was then subtracted from the expected performance each year and totaled. This method of estimating avoided events was selected because it is applicable to all measures and valid for use with whole numbers when rates are not available. A similar approach has been used by others to estimate the value of safety improvements in hospital-acquired conditions,

\* The starting point for CLABSI and CAUTI is 2008 because mandatory reporting to NHSN began that year.

patient harm, and HAIs.<sup>10,22,31,35</sup> This method assumes a constant number of opportunities, constant compliance with problem identification and reporting, no across-the-board decrease in iatrogenic errors unrelated to interventions, and that improvements are linear. Proportional improvements become more difficult over time.

The value formulas used were estimated projections. The difference between the measures’ actual and expected performance, calculated by year and totaled, (i.e., the number of years for which there is data minus one or  $N - 1$ ) yields the cumulative estimate of the number of prevented events. To calculate estimated number of lives saved, the total estimated number of events prevented or avoided was multiplied by an evidence-based estimate of mortality per event for that specific measure. The product is the estimated number of lives saved.

Similarly, for the cost-estimate calculation, the estimated number of events prevented or avoided, ( $N - 1$ ) was multiplied by an evidence-based estimate of cost per event for that specific measure. The sum is the estimated savings in 2015 dollars.

## RESULTS

Estimates of total number of events avoided exceed 21,300 (Table 3). The highest estimate of total events avoided involve the HAIs with more than 5,100 CLABSIs and 11,500 CAUTIs avoided. Estimates exceed 960 and 1,300 overall lives saved from CLABSIs and high harm avoided, respectively. Differences in the estimated additional mortality and cost per case and the varying number of events avoided account for the variation among some of the measures’ estimates (e.g., falls with harm and CLABSI lives saved and CLABSI versus any other measure in cost savings). The estimated average annual cost savings for avoided wrong-site surgery events is more than \$636,000 and for CLABSI is more than \$14.1 million.



Table 1. Patient Safety Measures Definitions

MEASURE	EVENT DEFINITION	DATA SOURCE
Falls with harm	Any fall (see definition*) that requires more than first-aid care. Treatment beyond first-aid care includes a laceration that requires physician intervention (e.g., sutures). <sup>1</sup>	Pennsylvania Patient Safety Reporting System
Central line-associated bloodstream infections	Laboratory-confirmed bloodstream infection (LCBI) that is not secondary to an infection at another body site. <sup>2</sup>	National Healthcare Safety Network and healthcare-associated infections in Pennsylvania Patient Safety Reporting System
Catheter-associated urinary tract infections (UTIs)	A UTI in a patient who has had an indwelling urinary catheter in place for >2 calendar days on the date of event, with day of device placement being day 1, AND an indwelling urinary catheter was in place on the date of event or the day before. If an indwelling urinary catheter was in place for >2 calendar days and then removed, the date of event for the UTI must be the day of discontinuation or the next day for the UTI to be catheter-associated. <sup>3</sup>	National Healthcare Safety Network and healthcare-associated infections in Pennsylvania Patient Safety Reporting System
Wrong-site surgery	Surgery or other invasive procedure performed on the wrong site or patient or a wrong surgical or other invasive procedure performed on a patient. (See wrong-site surgery detail) <sup>4</sup>	Pennsylvania Patient Safety Reporting System
High harm	A subset of all harm events assigned one of the following definitions: G – An event occurred that contributed to or resulted in permanent harm. H – An event occurred that resulted in a near-death event (e.g., required intensive care unit [ICU] care or other intervention necessary to sustain life). I – An event occurred that contributed to or resulted in death. <sup>5</sup>	Pennsylvania Patient Safety Reporting System

\* **Falls:** The definition of falls includes:

- Assisted falls, in which a caregiver sees a patient about to fall and intervenes, lowering them to a bed or floor.
- Therapeutic falls, in which a patient falls during a physical therapy session with a caregiver present specifically to catch the patient in case of a fall.
- Physiologic falls, in which a patient falls as a result of a seizure or syncope.

The definition of falls excludes failures to rise, in which a patient attempts but fails to rise from a sitting or reclining position.

† **Wrong-site surgery detail:** Surgery begins in the perioperative area at point of surgical incision, tissue puncture, or insertion of instrument into tissues, cavities, or organs.

Surgery includes:

- Minimally invasive procedures involving biopsies or placement of probes or catheters requiring entry into a body cavity or orifice and through a needle or trocar.
- A range of procedures from minimally invasive dermatological procedures (biopsy, excision, and deep cryotherapy for malignant lesions) to extensive multi-organ transplantation.
- Preoperative anesthetic blocks and postoperative pain-management blocks, if administered in the perioperative area.

Table 1. Patient Safety Measures Definitions (continued)

**Surgery does *not* include:**

- a. Use of instruments such as otoscopes.
- b. Phlebotomy.
- c. Preparation of the wrong site. Example: prepping and draping the wrong leg, as long as the procedure is not performed on the improperly prepped and draped body part.
- d. Insertion of incorrect implants (e.g., left/right); however, it must be the correct type of implant. Example: implantation of a left-knee prosthesis in the (correct) right knee. However, implantation of an automatic implantable cardioverter defibrillator instead of a pacemaker would be considered a wrong-site event.
- e. Incorrect interpretation of anatomical structures when verification by radiography is not tenable. An event would be included or counted as a wrong-site event if imaging for verification were the evidence-based best practice or if the incorrect anatomic structure was targeted. For instance, placing a gastrostomy feeding tube in the transverse colon would be excluded because it is not a recognized procedure; conversely, placing a feeding tube into the jejunum would be included because it is not a clinically accepted procedure.
- f. Procedures performed outside the perioperative area.

(Items d through f have been customized for the Authority's wrong-site surgery program.)

Notes

1. Pennsylvania Patient Safety Authority. Training manual and users' guide. Version 6.5 June 2015.
2. Centers for Disease Control and Prevention. Patient safety manual—CLABSI [online]. [cited 2015 Jul 27]. [http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC\\_CLABScurrent.pdf](http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABScurrent.pdf)
3. Centers for Disease Control and Prevention. Patient safety manual—CAUTI [online]. [cited 2015 Jul 27]. <http://www.cdc.gov/nhsn/pdfs/pscManual/7pscCAUTICurrent.pdf>
4. National Quality Forum's definition as outlined in the serious reportable events in healthcare—2011 update: a consensus report. Washington DC: National Quality Forum; 2011.
5. Pennsylvania Patient Safety Authority. Harm Score Taxonomy—High harm [online]. [cited 2015 Jul 27]. [http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2015/mar;12\(1\)/PublishingImages/taxonomy.pdf](http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2015/mar;12(1)/PublishingImages/taxonomy.pdf)

An estimated \$147.2 million was found in total cost savings over the reporting periods, with an average annual total cost savings of \$20 million.

To assess the strength of the relationship between the actual and predicted number of events per measure per year, a Pearson's product-moment correlation coefficient was calculated per measure and, as seen in Table 4, the majority of the results were statistically significant at the  $P < .05$  level. CAUTI had the greatest rate of improvement per year; that is due, in part, to the statewide initiatives described below.

### DISCUSSION: THE VALUE

Measuring the value of improvements in patient safety is challenging, and any estimations will be inherently imprecise. This limitation notwithstanding, the Authority believes the improvements made by

Pennsylvania healthcare providers in these focused areas are substantial and meaningful. Even if the estimated annual values of \$20 million are off more than marginally, one could argue that these improvements are meaningful on moral grounds and reduced human suffering. The general efficacy of patient safety initiatives is supported by AHRQ's research on national rates, cost savings, and deaths averted, which shows an estimated 17% decline in PFPs' hospital-acquired conditions from 2010 to 2013 and again from 2013 to 2014.<sup>9,11</sup> Although AHRQ acknowledges that reasons for this progress are not fully understood, financial incentives, public reporting of hospital results, guidance and assistance from quality-improvement organizations and the Health and Human Services' PFP are cited among contributing factors.<sup>9,10</sup>

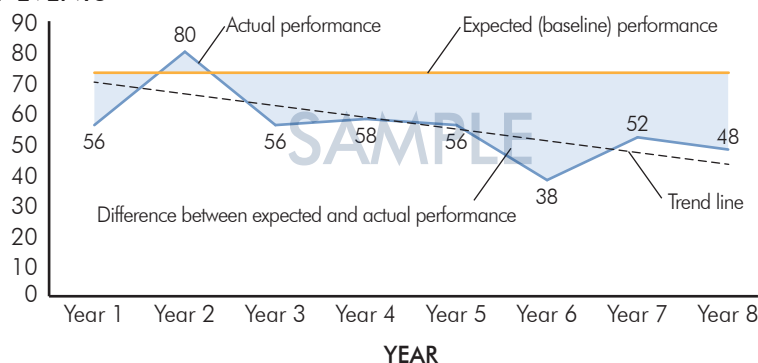
### Falls with Harm

The improvement (decline in number of falls with harm) is due in part to regional and statewide learning and improvement efforts. These include the 2008–2010 joint effort between the Authority and HCIF to establish a falls reporting initiative to assist hospitals in their falls-prevention efforts and the Authority-led partnership with the Hospital and Healthsystem Association of Pennsylvania's (HAP's) Hospital Engagement Network (HEN) Falls Reduction and Prevention Collaboration, part of CMS's PFP initiative.<sup>36</sup> At its peak, 83 hospitals from across the Commonwealth participated in the collaboration. Simultaneously, the Authority has published articles and tools to help staff in Pennsylvania facilities assess

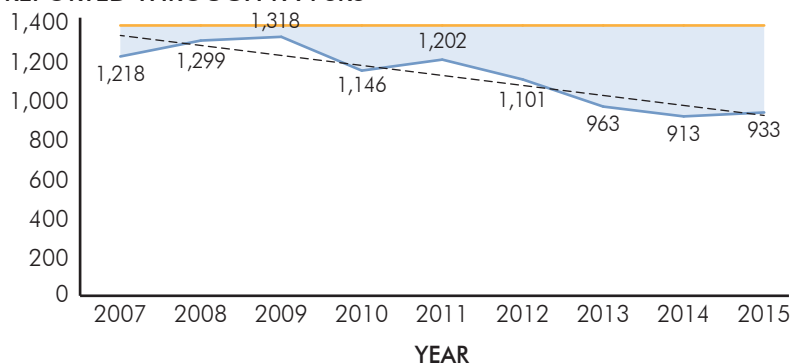
(continued on page 131)

**FIGURE. PENNSYLVANIA PATIENT SAFETY EVENTS**

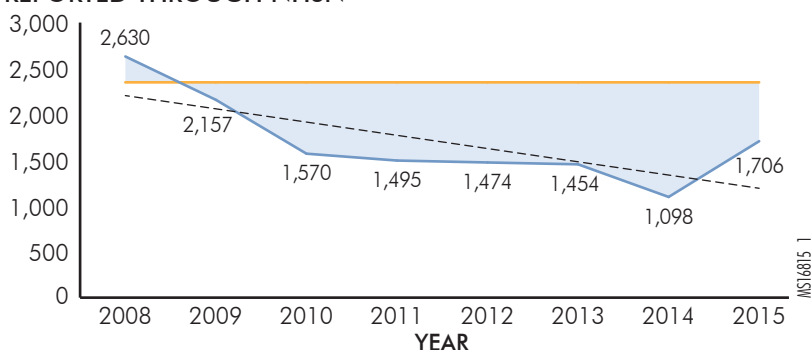
**Sample Data  
NUMBER  
OF EVENTS**



**Falls with Temporary or Significant Harm\*  
NUMBER OF EVENTS  
REPORTED THROUGH PA-PSRS†**



**Central Line-Associated Bloodstream Infections  
NUMBER OF EVENTS  
REPORTED THROUGH NHSN‡**



\* Harm: the event reached the patient, causing temporary or significant harm (Serious Event: harm scores E through I). High harm: the event reached the patient, causing significant harm (Serious Event: harm scores G through I). The Pennsylvania Patient Safety Authority's event-reporting system uses an adaptation of the National Coordinating Council for Medication Error Reporting and Prevention harm index and the Veterans Health Administration National Center for Patient Safety severity assessment code system to distinguish between harm and no-harm events. The Authority harm score taxonomy is available exclusively online at [http://patient.safetyauthority.org/advisories/advisorylibrary/2015/mar;12\(1\)/publishingimages/taxonomy.pdf](http://patient.safetyauthority.org/advisories/advisorylibrary/2015/mar;12(1)/publishingimages/taxonomy.pdf)

† PA-PSRS, Pennsylvania Patient Safety Reporting System.

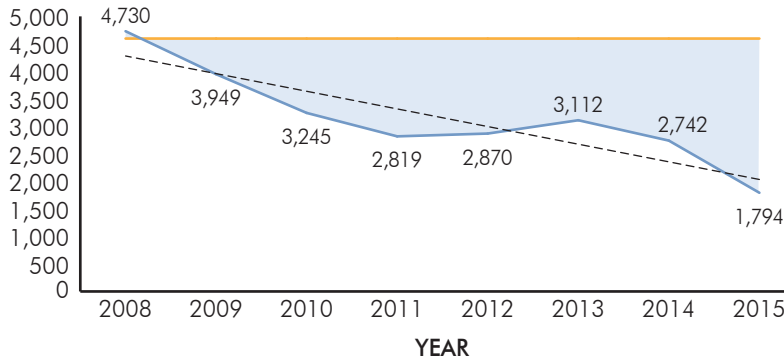
‡ NHSN, National Healthcare Safety Network; figures are from Pennsylvania reporting.

§ The number of wrong-site surgery events in this graph reflect the number of events reported through 2015 and are not consistent with the current number of events reported.

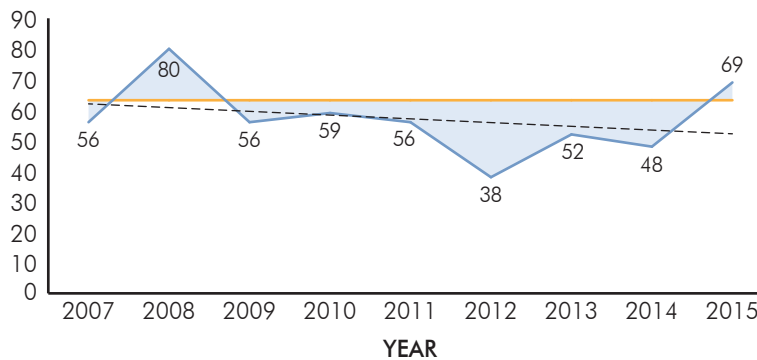
**FIGURE. PENNSYLVANIA PATIENT SAFETY EVENTS (continued)**

(continued from page 129)

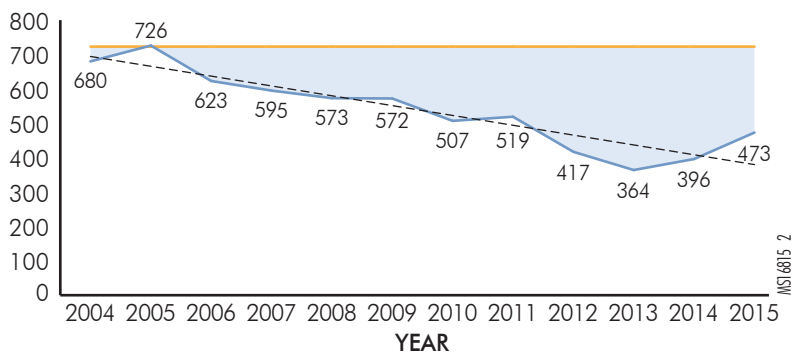
**Catheter-Associated Urinary Tract Infections**  
**NUMBER OF EVENTS**  
**REPORTED THROUGH NHSN<sup>‡</sup>**



**Wrong-Site Surgeries<sup>§</sup>**  
**NUMBER OF EVENTS**  
**REPORTED THROUGH PA-PSRS<sup>†</sup>**



**Events with Significant Harm<sup>\*</sup>**  
**NUMBER OF EVENTS**  
**REPORTED THROUGH PA-PSRS<sup>†</sup>**



and investigate falls and determine the appropriate event type classification for reporting through PA-PSRS.<sup>36-44</sup> The facility-level performance improvement work rests solely with those staff implementing best practices in fall reduction, aided by these collaborative efforts. Before these initiatives, the number of falls with harm events were on the rise.

**CLABSI and CAUTI**

The number of CLABSIs is trending down despite the most recent year's increase in number of reports, and CAUTIs reported to the NHSN have been on the decline since mandatory reporting began in 2008.<sup>6</sup> The Authority works closely with the Pennsylvania Department of Health, the Pennsylvania Health Care Cost Containment Council, HAP, the Association for Professionals in Infection Control and Epidemiology, HCIF, the Pennsylvania Health Care Quality Alliance, and other government and professional associations in infection-prevention improvement efforts.

Through prevention programs, articles, and toolkits, the Authority guides and educates healthcare facilities in detecting serious infection trends and in developing new strategies to prevent HAIs.<sup>45-49</sup>

To fulfill the responsibilities created by Act 52 of 2007, Pennsylvania established the Healthcare-Associated Infection Prevention (HAIP) website, which issues infection prevention newsletters and annual reports on HAIs. "The mission of HAIP is to protect patients, residents, visitors and healthcare personnel as well as promote safety, quality and value in the healthcare delivery system."<sup>50</sup> In 2012, Quality Insights of Pennsylvania, the Medicare quality improvement organization for the state, released a Best Practice Intervention Package: Preventing Healthcare-Associated Infections, which



Table 2. Value Formula: Estimate of the Projected XYZ Measure

**EVENTS AVOIDED (SAMPLE DATA)**

CALENDAR YEAR	YEAR OF DATA	EXPECTED PERFORMANCE	ACTUAL PERFORMANCE	DIFFERENCE
2007	Year 1	68	56	12
2008	Year 2	68	80	-12
2009	Year 3	68	56	12
2010	Year 4	68	59	9
2011	Year 5	68	56	12
2012	Year 6	68	38	30
2013	Year 7	68	52	16
2014	Year 8	68	48	20
2015	Year 9	68	49	19
<b>Total estimated projected XYZ cases avoided over time</b>				<b>118</b>

**MORTALITY**

XYZ CASES AVOIDED OVER TIME	MULTIPLY	ESTIMATED ADDITIONAL INPATIENT MORTALITY PER XYZ	EQUALS	ESTIMATED POTENTIAL LIVES SAVED
118	×	0.05	=	5.9

**COST**

XYZ CASES AVOIDED OVER TIME	MULTIPLY	ESTIMATED ADDITIONAL COST PER XYZ (ADJUSTED TO 2015 DOLLARS)	EQUALS	ESTIMATED POTENTIAL SAVINGS
118	×	\$2,000	=	\$236,000

Note: Fictitious data used for example only.

provided valuable prevention resources and the structure for performance improvement activities to reduce the number of CLABSIs and CAUTIs.

Before receiving the HEN contract, HAP managed two AHRQ-funded projects from 2008 to 2011 that used the Comprehensive Unit-based Safety Program to work with hospitals to reduce CLABSI and CAUTI. Additionally, the HAP-led HENs and Reduction in CLABSI and CAUTI Collaborations were instrumental in driving improvements locally and regionally.<sup>51</sup> Before these initiatives, the number of CLABSI and CAUTI events were essentially unchanged.

**Wrong-Site Surgery**

Wrong-site surgeries in Pennsylvania trended down from 2007 through 2014, with an increase seen in 2015. The noted improvement (i.e., decline in the number of wrong-site surgery events) in the eight-year period was due, in part, to the HCIF-led Partnership for Patient Care regional Wrong-site Surgery Prevention Program (2008) and the Authority-led partnership with HAP’s HEN, Wrong-Site Surgery Collaboration, which ended in 2014.<sup>52-54</sup> Through on-site assessments, education, updates in the *Pennsylvania Patient Safety Advisory*, and toolkits, the Authority continues to provide guidance to healthcare facilities in preventing and reducing wrong-site surgery.<sup>29,30,31,55-57</sup> Because wrong-site

anesthesia blocks administered by anesthesiologists and surgeons account for nearly 27% of all wrong-site events identified in Pennsylvania operating suites, the Authority has partnered with the Pennsylvania Society of Anesthesiologists to update Authority guidance materials and to develop evidence-based resources for dissemination statewide.<sup>58</sup>

**High Harm**

High harm events, a leading indicator for Serious Events, have been decreasing annually in number and as a percentage of Serious Events.<sup>45</sup> The Authority has seen an increase in the number of Incident (non-harm) reports reported through PA-PSRS over this period,

Table 3. Estimates Summary Detail

MEASURE	TOTAL NUMBER OF EVENTS AVOIDED (YEARS, N – 1*)	MORTALITY PER EVENT	LIVES SAVED	COST PER EVENT*	COST SAVINGS	AVERAGE ANNUAL COST SAVINGS
Falls with harm	2,290 (8 years)	0.055 <sup>1-3</sup>	126	\$8,110 <sup>1-3</sup>	\$18,571,900	\$2,321,488
Central line-associated bloodstream infection	5,199 (7 years)	0.185 <sup>1-3</sup>	962	\$19,059 <sup>1-3</sup>	\$99,091,553	\$14,155,936
Catheter-associated urinary tract infection	11,544 (7 years)	0.023 <sup>1-3</sup>	266	\$1,121 <sup>1-3</sup>	\$12,940,600	\$1,848,657
Wrong-site surgery	57 (8 years)	N/A	N/A	\$162,063 <sup>†‡</sup>	\$5,095,449 <sup>‡</sup>	\$636,931
High harm events	2,230 (11 years)	0.59 <sup>§</sup>	1,316	\$5,174 <sup>§</sup>	\$11,538,020	\$1,048,911

Note: all figures are estimates, cost per event is adjusted to 2015 dollars, and lives saved have been rounded to whole numbers.

\* Calculated using the number of years post baseline.

† Inflation adjusted to 2015 U.S. dollars.

‡ Estimate is based on average amount awarded per claim, multiplied by the percentage of wrong-site surgery claims paid out (0.554).

Notes

- Agency for Healthcare Research and Quality. Interim update on 2013 annual hospital-acquired condition rate and estimates of cost savings and deaths averted from 2010 to 2013 [online]. [cited 2015 Apr 8]. <http://www.ahrq.gov/professionals/quality-patient-safety/pfp/interimhacrate2013.pdf>
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Table 4. Average Improvement per Measure

MEASURE	IMPROVEMENT PER YEAR (N – 1)*, %	P-VALUE	MEASUREMENT PERIOD, YEARS (N)
Wrong-site surgery	2.1	0.469	9
Falls with harm	4.5	< 0.001	9
High harm	5.3	< 0.001	12
CLABSI	8.4	0.036	8
CAUTI	10.1	0.002	8

\* Calculated using the number of years for which there is data minus one.

suggesting that the decreased number of Serious Event reports is not due merely to an overall decline in vigilance of surveillance or reporting.<sup>45</sup> Given that the number of medical interactions is increasing, a plausible hypothesis for this decline in high harm events is that as improvements are realized in patient safety, the number and severity of harmful adverse events is decreasing. The Authority

has seen an increase in the number of Incident (non-harm) events reported through PA-PSRS, and this is consistent with this hypothesis that there is a shift to earlier detection and reporting of events with fewer events reaching the patient and causing serious harm. The decrease in the number of falls with harm is one example. In addition to what has been discussed here, other quality improvement projects

and initiatives have been performed by the Authority and others throughout the Commonwealth in the past 11 years and have contributed to the reduction of harm to patients.

The Authority’s (PA-PSRS data) calculated high-harm mortality rate of 58.8% is in keeping with a recent study by Adler and coauthors, in which patients experiencing harm (consistent with PA-PSRS high harm



categories) had a 59% higher mortality probability than patients experiencing no harm or only temporary harm.<sup>31</sup>

## LIMITATIONS

The data presented here are from databases in Pennsylvania. Despite mandatory reporting laws, the data are subject to the limitations of self-reporting, including the complexities of selecting the appropriate event type, harm level, and harm score. Over time, the Authority has collaborated with facilities, organizations, and the Pennsylvania Department of Health to clarify definitions and reporting standards, which the Authority believes has helped to standardize and facilitate reporting.

To estimate number of lives saved and cost savings per measure, the Authority chose to use whole numbers versus rates in the calculation of the value formula. This mitigates the effect of changes in practice, such as inserting central lines and urinary catheters in fewer patients, but may not align with other reporting methods. It presumes a constant baseline of opportunities for error and at least consistent (not necessarily complete) compliance with identification and reporting of problems.

The references cited to estimate mortality and cost (i.e., Adler et al., AHRQ) use *inpatient* estimates.<sup>9,11,31</sup> The Authority acknowledges that some of the events for falls with harm, CLABSI, and CAUTI

may have come from outpatient settings (e.g., ambulatory surgical facilities, birthing centers, and abortion clinics) but by far the majority of these events (98.7%) were from acute care hospitals.

Inevitably, there was some measure *overlap* within the high harm measure in that high harm is an aggregate of all event types reported as harm score G, H, or I; for example, falls with harm accounted for 5.1% of high harm events during the time period. The overlap is minimal and the objective was to calculate and estimate lives saved and cost savings for individual measures as well as a representative whole such as high harm.

The number of admissions and acuity of inpatients fluctuated between 2004 and 2015. Since 2005 at Pennsylvania acute care hospitals, inpatient admissions have declined 13.5% and inpatient days per 1,000 population have decreased 16.1%.<sup>59,60</sup> This decrease may impact the rate of improvement estimated. Patients admitted to acute care hospitals for the same conditions are sicker and in need of more intensive care.<sup>61,62</sup> It is indeterminate which of these countervailing forces are stronger, but both could have influenced these measures.

CDC has a data validation process for CLABSI and CAUTI that includes involvement of the Pennsylvania Department of Health.<sup>63</sup> Different measures are validated to different extents and detailed validation of all measures is limited.

## CONCLUSION

The Authority sought to measure its effectiveness by determining and describing the value of data aggregation, analysis, dissemination, and collaborative statewide learning efforts in reducing healthcare-associated patient harm in Pennsylvania. This analysis is based on clinical outcomes and economic estimates for a select set of patient-safety measures. Results reflect the combined efforts of the Authority, healthcare facilities, and other quality-improvement entities in Pennsylvania after the implementation of the MCARE Act and Act 52. The Authority has found that fostering collaborative initiatives across facilities and collaborating with other agencies in Pennsylvania has helped facilities make improvements in certain areas of clinical focus.<sup>45</sup>

Although it is difficult to parse out any individual agency's contribution to a given effect, through the use of literature-based and explicit methodology, the Authority has estimated lives saved and costs avoided for selected patient safety measures. By sharing these concepts and results, the Authority hopes to enrich the conversation about improving patient safety and stimulate continued progress.

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## NOTES

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# PENNSYLVANIA PATIENT SAFETY ADVISORY

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The Pennsylvania Patient Safety Authority is an independent state agency created by Act 13 of 2002, the Medical Care Availability and Reduction of Error (Mcare) Act. Consistent with Act 13, ECRI Institute, as contractor for the Authority, is issuing this publication to advise medical facilities of immediate changes that can be instituted to reduce Serious Events and Incidents. For more information about the Pennsylvania Patient Safety Authority, see the Authority's website at <http://www.patientsafetyauthority.org>.



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