Patient Safety Reporting System for Nursing Homes
Patient Safety Authority
Commonwealth of Pennsylvania

Government to Business (G to B)

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B. Executive Summary:

Healthcare-associated infections (HAIs) are a major threat to patient safety and are among the most common adverse events a patient can face while receiving care. Each year, approximately two million hospital and long-term care patients in the U.S. develop HAIs, resulting in roughly 90,000 deaths. HAIs are also responsible for billions of dollars in additional treatment costs each year.

In response to these sobering statistics, Pennsylvania enacted the Health Care Associated Infection and Prevention Control Act (Act 52 of 2007), which requires reporting of HAIs by nursing homes. The Patient Safety Authority (Authority), working with contractors ECRI Institute and Hewlett-Packard, developed the Pennsylvania Patient Safety Reporting System for Nursing Homes (PA-PSRS-NH), the nation’s first comprehensive statewide nursing home HAI reporting system. The Pennsylvania PSRS (pronounced “pacers”) nursing home system was released into production on June 1, 2009 and serves as a single input data capture system, fulfilling reporting requirements to both the Authority and the Pennsylvania Department of Health (DOH).

PA-PSRS-NH generates HAI reports through a series of adaptive questions and answers related to infection type, diagnostic criteria and specific organisms, as well as other descriptive data. Utilizing conditional logic, 15 to 17 data fields are captured in each report. In the 22 months since its release, PA-PSRS-NH has collected 64,329 infection reports from 711 nursing home facilities in Pennsylvania.

PA-PSRS-NH data allows the Authority to identify best practices and educate nursing homes about effective techniques for preventing and controlling HAIs. This data also supports research articles in the Authority’s Patient Safety Advisory quarterly, such as Clostridium Difficile Infections in Nursing Homes, which details strategies for infection prevention, environmental care and judicious use of antibiotics. The PA-PSRS-NH system also allows individual facilities to monitor performance and improvement through detailed reports analyzing HAI data specific to each facility.

PA-PSRS-NH runs on the .Net Framework 4.0 on the Windows platform and was developed using Visual Studio 2003 (now VS 2010) and written in Visual Basic.Net.

The complete PA-PSRS-NH system development required a total of 4,250 labor hours over 18 months at a project cost of approximately $450,000, including the system’s Intake and Reporting Modules which were released in under eight months at a project cost of $221,000. In addition, over the past two years, 4,279 hours were dedicated to HAI education for both hospitals and nursing homes and 739 hours of direct HAI support were provided by the Authority’s IT help desk.

The PA-PSRS-NH system represents a breakthrough for infection control in the long-term care patient population and industry by collecting data that previously was generally not available for analysis. The benefits of this system should be felt throughout society in reduced medical costs, reduced suffering, and possibly reduced pressure on our regulatory and judicial infrastructures.
C. Description of the Business Problem and Solution:

- **Problem Statement:** The Health Care Associated Infection (HAI) and Prevention Control Act (Act 52 of 2007) required the Pennsylvania Patient Safety Authority (Authority) to deliver a nursing home HAI data collection and reporting system and provide system training to 700+ nursing homes throughout the state. This would be the first mandatory statewide nursing home HAI reporting system in the nation.

- **Legacy and Leverage, Challenges and Opportunities, Barriers and Innovation:** In June 2004, The Authority had developed and placed into production the Pennsylvania Patient Safety Reporting System (PA-PSRS) for acute care facilities, including hospitals, ambulatory surgical facilities, birthing centers and abortion facilities. With the Act 52 mandate to develop an HAI reporting system for nursing homes (PA-PSRS-NH), the Authority faced the challenge of designing a reporting system for a distinctly different set of healthcare facilities with their own unique issues, specifically, a patient population that is much older, more susceptible to illness and falls, and receives care for much longer periods of time (months or years, rather than days or weeks). While certain elements of the existing system could be leveraged (such as the facility set-up functions in classic ASP), the Authority needed to start fresh in developing the nursing home event reporting and input systems.

The design phase could not begin until an HAI Advisory Panel was appointed to establish a set of recognized standards for reporting nursing home HAIs on a patient-specific basis. After thirty days of public comment and response, the advisory panel’s reporting requirements and criteria were published in the *Pennsylvania Bulletin* in September 2008.

Another challenge was the requirement under Act 52 that nursing homes submit HAI reports to both the Authority and the Pennsylvania Department of Health. While the Authority’s mandate is analytical and educational, correlating infection rates to identify best practices, DOH has regulatory and licensing responsibilities over the nursing homes. To meet this requirement, the system was designed as a single input data capture system with dual reporting capability.

- **Assessment, Decision Process and Solutions:** The team responsible for project assessment and decision process was made up of the Authority’s senior staff, the clinical and program directors from the Authority’s primary contractor the ECRI Institute, and ECRI’s sub-contractors, EDS [now Hewlett-Packard (HP)] and Infection Control Consulting Services, LLC (ICCS). The Authority managed this process through weekly vendor status meetings to review ongoing operational issues and IT and educational planning. Additionally, the Authority worked closely with its board and healthcare industry groups to assemble the mandated HAI Advisory Panel. Once the advisory panel’s final recommendations were published, the PA-PSRS-NH project team evaluated design requirements and factors affecting the use of existing systems.

Early in the design process, the development team considered leveraging the Acute Care PA-PSRS data structure to build the HAI system by replacing the
Event Type fields used in the Acute Care system with Type of Infection fields in the HAI database and input forms. However, when the Advisory Panel suggested that detailed Symptom criteria be added to the input criteria specifications, it became clear that a comprehensive system redesign would be necessary. The system logic and data formats required significant revisions in order to meet this request, as the Type of Infection would determine which Symptom criteria would be presented to the user. Additionally, PA-PSRS-NH would require encryption for patient identifiers and patient history reports. The Authority’s development team was asked to meet these challenges while maintaining an aggressive development schedule. With a planned production release date of June 1, 2009, the team had less than eight months from system requirements to complete PA-PSRS-NH development and conduct user training and acceptance testing (UAT).

- **Architecture:** PA-PSRS-NH was developed with Visual Studio 2003 (now VS2010) and written in Visual Basic .Net. The system runs on .Net Framework 4 on the Windows platform.

- **Timeline, Training, and Communications Plan:**
  
  - The HAI Advisory Panel’s final reporting requirements were published by the Authority and DOH in the Pennsylvania Bulletin on September 20, 2008.
  - The PA-PSRS-NH system requirements were presented to HP on October 7, 2008, and finalized on November 10, 2008.
  - In December 2008, the Authority hosted a web-based conference attended by over 600 nursing homes to define and outline the criteria for tracking infections.
  - From January through March 2009, the Authority completed 30 live-training sessions for over 1,200 nursing home employees throughout the state to prepare them for mandatory reporting. An HAI training curriculum, including an extensive user guide and training manual, was provided at the training sessions.
  - In April 2009, user acceptance testing (UAT) began.
  - In May 2009, the Authority hosted a webinar training session for facilities that did not attend the live training.
  - On June 1, 2009, the PA-PSRS-NH Intake and Reporting System Modules were released into production.
  - In October 2009, the Analytical Reporting Modules were released.
  - In April 2010, post-production development support was completed.
  - In addition, ongoing educational programs, help desk and PassKey Knowledge Exchange Forum (a secure website built with Microsoft SharePoint to share information, ideas and solutions) are supporting PA-PSRS-NH user needs.

- **Cost (Dollars, People, Time):**
  
  - System design and development expense totaled approximately $450,000:
    - $221,399 through the June 1, 2009 production release date of the Intake and Reporting System Modules.
    - $153,595 through October 2009 for the Analytical Reporting Modules release.
$78,544 through April 2010 for post-production support.

- System design and development effort totaled 2.16 FTE in vendor support, including 1.96 FTE from HP.
- HAI educational programs supporting long-term care and acute care facilities totaled 2.32 FTE, with $267,300 spent on training through the June 2009 production release, and $218,237 in follow-on support through October 2010.
- Additionally, an HAI help desk and patient safety knowledge exchange (HAI PassKey) user forum were established for continuing user support, involving 0.40 FTE and $74,316 in expense through October 2010.

D. Significance of the Project:

The Authority is the first governmental agency in the U.S. to develop and launch a mandatory statewide HAI reporting system for nursing homes. The infection criteria on which the system is based were developed by an elite panel of infection control professionals and is maintained under their scrutiny. The adaptive conditional logic designed into the data intake module makes data entry very efficient. Adding to this efficiency for the facilities is the single input data capture, multiple reporting feature of the system to satisfy reporting requirements to the Authority and DOH.

Besides fulfilling nursing home reporting requirements, the system serves as an HAI risk management and infection control assessment tool for each facility, presenting these businesses with a valuable return on MCARE Act assessments, which total approximately $800,000 annually from Pennsylvania nursing homes and are based on bed counts, with larger facilities paying higher assessments than smaller ones. Pennsylvania’s Act 52 of 2007, which mandated the PA-PSRS-NH system, is an amendment to Act 13 of 2002, the Medical Care Availability and Reduction of Error (MCARE) Act. One effect of the Acts is to enable the Authority, as an independent agency of the Commonwealth, to access, collect and analyze patient safety data from health care facilities in order to identify and report best practices and to monitor improvement at the facility, regional and state levels. Before the protections in Acts 13 and 52, this data was generally not available for analysis. For this reason alone, the HAI data collected through the PA-PSRS-NH system established a breakthrough for infection control in the long-term care patient population and industry. The benefits of this system should be felt throughout society in reduced medical costs, reduced suffering, and possibly reduced pressure on our regulatory and judicial infrastructures.

E. Benefits of the Project:

Value: The system’s value in reducing infections and the associated costs to society and the facilities is immense; the monetary value of which is still being measured.

Regarding the system’s product value, the Authority recently conducted a value analysis to determine what nursing homes would pay if facilities were to purchase similar commercial products and services. These values were drawn from pricing data received from vendors marketing similar non-surveillance incident reporting modules to healthcare facilities. The annual cost per system was estimated to range from $2,500 to $4,655 per facility, depending on bed count. Based on this analysis, the cumulative
value of PA-PSRS-NH to the 714 nursing homes licensed in Pennsylvania falls between $1,785,000 and $3,323,000 a year, far exceeding the current Act 52 nursing home industry-wide assessment of $800,000 per year.

**Adoption Metrics:** In the first month that PA-PSRS-NH was in production, 483 facilities submitted HAI reports. During the first seven months (Jun-Dec 2009), 700 out of 714 facilities reported at least one HAI event, with an average of 26.8 reports per facility during that period. By the end of March 2011, 711 facilities (99.58%) had submitted 64,329 HAI reports through PA-PSRS-NH in the first 22 months of the program.

**Process Improvements:** The Authority uses this nursing home data to identify facilities that are successful with their HAI prevention efforts. The Authority then assists nursing homes through the HAI educational programs to develop methods for implementing improvement strategies. The PA-PSRS-NH data also supports research articles in the Authority’s Patient Safety Advisory quarterly. Articles such as *Clostridium Difficile Infections in Nursing Homes* detail strategies for infection prevention, environmental care and judicious use of antibiotics. The PA-PSRS-NH system also provides individual facilities with the ability to generate on-demand detailed reports analyzing their specific HAI data. In addition to collecting HAI reports, PA-PSRS-NH maintains data quality through monthly validations, updating usage data such as patient days, catheter days, etc. Data analysis is reported through *Advisory articles*, *educational programs*, and the *Authority’s Annual Report* (See Nursing Home HAI data pp. 58-72). Additionally, the Authority conducts an annual survey of each nursing home’s Infection Prevention Division (IPD) to gain feedback on system features and utility.

**Impact of Project:** In 2010, PA-PSRS-NH captured reports from nursing homes totaling 22,493,930 resident days, 1,054,592 catheter days and 34,247 infections – information that was not previously accessible. The detailed reports behind these numbers have given the Authority and DOH the ability to analyze infection control in nursing homes and to monitor HAI improvement at the facility, regional and statewide levels. The impact of PA-PSRS-NH goes beyond the tens of thousands of patients residing in our long-term care facilities to include the millions of individuals and families throughout the commonwealth whose lives and loved ones will be dramatically affected by improved HAI control in nursing homes. PA-PSRS-NH is the foundation of a process already improving the care, health and comfort of our most helpless citizens.

**In addition to PA-PSRS-NH addressing Health Care (A3) solutions, this project aligns with the following NASCIO’s State CIO Priorities for 2011** (Parenthetical references correspond to NASCIO Priority rankings):

- **IT Governance (A6):** The Authority is an independent state agency directly funded through annual assessments levied by DOH on all Pennsylvania healthcare facilities that report to PA-PSRS. The Authority’s use of these funds is governed by its Board of Directors, the membership of which is appointed by the governor and legislative leadership. In addition, PA-PSRS-NH is designed to meet the standards and criteria developed by a 15-member panel of infection control experts approved by the Authority’s Board to implement the nursing home provisions of Act 52. The HAI Advisory Panel is composed of the state’s leading infection control experts, including for-profit, not-for-profit and county nursing home professionals. The overall effect of
this governance and funding places the Authority’s stakeholders in positions of clear accountability in the decision-making process for the design, development, implementation and success of the nursing home system. This close interaction between the Authority and its stakeholders provides Pennsylvania’s citizens with significant value by optimizing opportunities for patient safety improvement and leveraging stakeholder expertise in the IT development process.

- **Virtualization (B1), Consolidation/Optimization (A1), Cloud Computing (A4,B2):**
The Authority relocated its systems in December 2010 from the Commonwealth’s co-location self-managed server environment to a centrally-managed virtual server facility. This move centralized and consolidated services and operations, leveraged operational capabilities and freed Authority staff and budget for future development needs. The move enhanced system security, processing, availability and bandwidth. This government-public cloud service provides nursing homes with reporting tools and business analytics on an on-demand/as-needed basis, allowing the Authority to track user metrics, not for billing, but to monitor reporting compliance and to aid in refining system design.

- **Shared Services (A5):** PA-PSRS-NH provides single entry data capture directly to multiple agencies (i.e., the Authority and DOH), fulfilling mandatory reporting requirements independent of organizational structure.

- **Legacy Modernization (A9,B4), Business Intelligence and Analytics (B8):**
With the transition to the virtual server environment, PA-PSRS systems were upgraded from Windows 2000/SQL Server 2000 to Windows 2008/SQL Server 2008. Among the benefits of this upgrade were increased data security, higher availability, added performance and functionality. The end-user experience improved with rich analytical and reporting capabilities utilizing familiar Microsoft Office applications. Additionally, SQL Server 2008 provides a scalable and reliable data warehouse and business intelligence platform, improving capabilities to monitor facility performance and best practices.

- **Security (A7), Security Enhancement Tools (B7):**
PA-PSRS-NH is accessed via a secure, password-protected website via the internet. The system has several layers of security including Secure Socket Layer (SSL) encryption technology, automatic logoff, and intrusion detection systems. Facility data can only be accessed by that facility, the Authority, its contractors, and DOH. Data is strictly confidential and protected by statute from civil legal discovery and state public records requests.

The Authority conducted a comprehensive security assessment of PA-PSRS-NH in May 2010 to identify and remediate potential system vulnerabilities. Vendor laptops were also tested by the Commonwealth’s Digital Forensics group. To ensure system availability, a complete DR test was successfully conducted from April 6-18, 2011.

- **Budget and Cost Control (A2):**
The Authority produced PA-PSRS-NH within budget and on schedule, and continues to track all programming, infrastructure, educational and analytical related expenses directly to this project. The system is delivered to nursing home facilities without charge (beyond the annual MCARE assessment), and requires only a web browser and Microsoft Office to operate.