New Approaches for Monitoring and Reporting Healthcare-Associated Infections

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## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>3</td>
</tr>
<tr>
<td>COMMON GOALS &amp; COMMON OBSTACLES</td>
<td>5</td>
</tr>
<tr>
<td>A MEASURE-FIRST APPROACH</td>
<td>5</td>
</tr>
<tr>
<td>THE PROCESS PERSPECTIVE</td>
<td>7</td>
</tr>
<tr>
<td>INTEGRATION AND PROCESS MATURITY</td>
<td>7</td>
</tr>
<tr>
<td>TODAY’S INTEGRATION TECHNOLOGY</td>
<td>9</td>
</tr>
<tr>
<td>EVENT-DRIVEN QUALITY CONTROL OF HAIS IN ACTION</td>
<td>10</td>
</tr>
<tr>
<td>RAISING THE BAR AND REAPING THE BENEFITS</td>
<td>12</td>
</tr>
<tr>
<td>WHERE TO BEGIN</td>
<td>13</td>
</tr>
</tbody>
</table>
INTRODUCTION

Lost amid the noise of the recent debate about healthcare reform is one of the most difficult issues confronting providers, patients and payers alike – hospital, or in a broader sense, healthcare acquired infections (HAIs). And according to the 2009 National Healthcare Quality Report issued by the U.S. Department of Health and Human Services’ Agency for Healthcare Research and Quality (AHRQ), the problem is, by most measures, getting worse:

- Rates of postoperative sepsis, or bloodstream infections, increased by 8 percent.
- Postoperative catheter-associated urinary tract infections increased by 3.6 percent.
- Rates of selected infections due to medical care increased by 1.6 percent.

The AHRQ report concluded that the problem of HAIs requires “urgent attention.”

The human costs of HAI are staggering: “Healthcare-associated infections ... are among the leading causes of death in the United States, accounting for an estimated 1.7 million infections and 99,000 associated deaths in 2002” alone. The financial costs are equally staggering: “It is estimated that HAIs incur an estimated $28 to $40 billion in excess healthcare costs each year.”

With Medicare and other payers declining to pay hospitals for HAI-related care, HAIs can have a significant financial impact in terms of non-reimbursable length of stay (LOS). The possibility of HAIs also increases hospital workloads in reporting and in defending billing to payers. For example, a small chain of hospitals with 700 beds can incur the yearly costs of HAIs that may range from $4M to as high as $20M when all of the impacts are evaluated.

For care providers, HAIs are a particularly sensitive problem because they are, by definition, adverse outcomes of care itself. Such infections damage reputations and carry negative connotations about cleanliness, quality and, most importantly, patient safety.

With new and growing HAI reporting requirements and as more HAI and other hospital-centric quality of care metrics are publicly reported and available, the pressure to reduce the number of preventable infections and other adverse outcomes is growing. Twenty-seven states now require some level of public HAI reporting. Under the new healthcare bill signed into law in March 2010, hospitals with high rates of infections will be penalized by the government starting in the 2015 fiscal year. Meanwhile, more and more patient-customers are looking at quality-of-care metrics as they decide which hospitals they prefer for treatment.

1 March 2010. Although rates of postoperative pneumonia did improve by 12 percent, rates of bloodstream infections associated with central venous catheter placements remained unchanged.


3 Scott Rd. The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention, 2009. Division of Healthcare Quality Promotion, National Center for Preparedness, Detection, and Control of Infectious Diseases, Coordinating Center for Infectious Diseases, Centers for Disease Control and Prevention.
Hospitals are understandably ambivalent about self-reporting because of the significant reputational and financial risks it carries. In the absence of improved performance in the prevention of HAIs, increased reporting is likely to result in loss of patients, more withheld payments from payers, and greater exposure to legal liability. However, new technology-based approaches to monitoring and reporting HAIs not only provide more accurate metrics but also provide the basis for improving performance in prevention. By improving interoperability and data exchange across systems, and automating what is now a tedious, manual analysis of risk bearing procedures and adverse events, hospitals will be able to:

- Accurately measure their HAI rate
- Simplify HAI compliance reporting
- Automate deployment of infection prevent bundles and checklists
- Mitigate organization and financial risks
- Generate meaningful evidence for identifying areas for improvement
- Recover meaningful ROI from HAI prevention efforts
- Improve patient outcomes

This white paper will explain how hospitals can achieve those benefits by:

- Understanding the obstacles that impede progress in reporting and monitoring
- Taking a “measure-first” approach
- Assuming a process orientation
- Adopting the technological breakthrough that enables interoperability, data exchange across systems, and the automation of analysis of risk-bearing procedures that is essential to reducing HAIs

In addition, it will describe what an integrated and automated system looks like in action and, most importantly, the broad benefits such a system provides.
COMMON GOALS AND COMMON OBSTACLES

Everyone involved in providing patient care shares the same goals: clinical quality and safety, clinical efficiency, and operational effectiveness. They would like to be able to consistently maintain zero HAIs and to maintain the institution’s reputation. Despite these common goals, some significant institutional obstacles stand in the way of change. Most hospital IT departments are already fully absorbed in electronic health record (EHR) rollouts that have temporarily put improved HAI reporting and monitoring on the back burner. Many such IT departments also find themselves in reactive mode, looking for quick, patch-like, answers to the latest clinical needs.

In the absence of electronic and automatable strategies for improved reporting and the improved prevention it enables, key personnel like Infection Control Practitioners (ICPs), must chase the difficult measurements and insights for HAI improvement as if they were 19th century detectives sleuthing through disconnected fragments across disconnected islands of information and stacks of paper records. With patients’ lives hanging in the balance, these overburdened professionals often experience the heartache of looking for a needle in a haystack. Further, they may have to spend far too much of their time focusing on reporting and defending outcomes rather than on driving improvement and better quality. In the meantime, identification of infections and coaching and feedback are delayed.

From a quality improvement standpoint this is chaos. The ICP’s only choice is to function as a “hunter-gatherer” and limit surveillance to the highest risk areas, like the ER or ICU. And they must somehow throw themselves at a broad range of associated challenges: the need for coaching of personnel, the enforcement of protocols, and the frequent need to prove to payers that an infection was not the hospital’s fault but was present on admission of the patient.

This is a serious waste of critical skill and talent. ICPs, and other quality-focused practitioners, are the best hope for gaining the insights to help eliminate HAIs and other adverse outcomes. They need the best tools available, tools that will help them devote most of their efforts to gaining insights about causes and to coaching personnel, not chasing or producing paper or wasting time on redundant data entry. Hospitals that cling to today’s status quo approach will meet only a few short-term goals in HAI monitoring and even those minimal objectives will require huge manual and non-repeatable efforts that essentially leave the organization fighting a steep uphill battle. Recognition of this fundamental reality is the first critical step toward sustainable improvement.

A MEASURE-FIRST APPROACH

To aid those who are at the forefront of care, hospital IT departments must shift their focus from archaic silo-ed IT approaches and look towards an agile, process-centric integrated application infrastructure. This approach is not a rip and replace strategy, nor the addition of another niche application. It is about altering IT infrastructure in a way that enables new uses and broader participation of existing systems and tools lending agility to meet new needs. Integration and process enablement provide the capabilities to make truly meaningful, repeatable, and long-term impact on quality issues like HAIs and their many ramifications. It begins with a “measure-first” approach and a focus on the fundamental importance of accurate counting. It focuses on the tying together of disconnected pools of data and applications to enable automated counting and therefore continuous measurement, visibility and improvement.
By gluing together the currently dysfunctional, ad hoc collection of applications and tools, or through opening up closed, silo-ed, all in one systems, awareness and counting occurs in real-time, nearing the threshold of care. This nearness and awareness provides crisp visibility into risks and causes, correlating events and actions to outcomes. It answers the classic enigma of, “If I had known about it at the time, of course I would have done something about it…” by alerting key staff members about risk-bearing events now, not after months and a forensic effort when the outcome is a fait accompli. Measure-First is an active approach that provides hope and the ability to act and discover. It provides event-driven counting where the count and facts are harvested and exposed within the event horizon of care, when outcomes can still be affected.

In HAI measurement, counting is particularly important because what must be counted includes self-determined adverse outcomes shown against all the hospital’s risk-bearing care events. To try to calibrate across variations in hospital size and types of care, federal and state guidelines use a ratio, casting HAI rates in terms like ‘1.13 per 1000 central line insertion days’ — a ratio of adverse outcomes divided by the amount of care that is provided by the hospital. Arriving at this ratio requires two distinct modes of counting, one for the numerator and one for the denominator.

The numerator of the ratio is a hard-won and painful number, and its accuracy is a true test of a hospital’s introspective integrity. This number not only exposes the hospital to significant adverse imputations of quality, but also may be disputed in such venues as malpractice lawsuits. This counting needs to be transparent and defensible, and consistent across the organization. Accurate counting is the first step in risk mitigation.

In many hospitals, due to the workloads required merely to determine the counts, it is impossible to find or study available data that can point to root causes and drive improvement. It is therefore not enough to just count adverse events. Their associated attributes and contexts should be used to drive insight and improvement. Fundamentally, the better we count, the more accurately we count, the more facts we count, the more broadly we count, the more we use analytical tools and methodologies to illuminate details on these adverse events, the more likely we will reach the goal of driving this numerator down to zero.

With all the pressure on counting the number of infections, the denominator of the ratio is just as critical, because it is the measure of how much care is given. Denominator counts reveal directly where the pockets of significant risks occur and help establish priorities for control and improvement. The denominator also carries risk for hospitals. If they undercount their care, the magnitude of adverse findings grows when patients and payers evaluate hospital quality — 1 in 100 is far worse that 1 in 1000.

Paper-based methods, requiring endless transcription and data entry, are too cumbersome, time-consuming, and prone to error for capturing and correlating all of the relevant contexts of events — the information that when analyzed might reveal the causes of such events. That means that we must be able to digitize the actual event, thereby freeing staff members from endless drudgery and enabling broader and deeper collection of facts and more accurate counting. Further, the more that the counting and measurement of these events is digitized, the more transparent and trusted they become, providing a more reliable basis for analysis and for more defensible reporting.
THE PROCESS PERSPECTIVE

The great pioneers in quality taught industries of all kinds that all work gets done in processes – processes that can not only be measured but also broken down into their components in order to get at the root causes of problems and correct them. A process approach makes clear the connected and inherent correlation of sequence, measured facts and their surroundings.

The delivery of healthcare is no less a process than is the manufacturing of a semiconductor chip. Healthcare delivery involves discrete events, runs over a period of time, and includes multiple actors and a sequence that is both historical and forward looking.

Most significantly, the healthcare delivery process has a desired outcome that every participant desires and works for – the improved health of the patient. It requires empathetic care, resulting from thoughtful actions and regimes, care bundles and protocols, but delivery is nevertheless a process that can be measured, tracked and improved. Process understanding encompasses time relationships, trends, and most importantly the specification of key markers for reporting – what in business are called “key performance indicators” (KPIs). All of these aspects of a process can be measured, and what can be measured can be improved.

HAIs are defects or unacceptable variations in healthcare delivery processes. When searching for insights into HAIs it is not enough merely to measure the event. It must be placed within a correlated family of associated attributes, the kind of context that a process approach provides. When events are studied within this setting of a family of facts and measured then patterns may emerge that lead to the root cause of a problem.

INTEGRATION AND PROCESS MATURITY

The ability to improve outcomes and gain insights grows significantly as the electronic capture of the care event moves closer to the actual event horizon of care. The closer the event capture is to the actual event, the more meaningful is the data, the better the data’s context is understood, and the greater is our ability to react in beneficial ways.

However, the timely capture of information, the ability to analyze it, and the process improvement it leads to are constrained by the degree of integration among various information gathering processes, applications, and actors. In fact, the current state of healthcare process maturity and integration resembles that of high-tech manufacturing 20 to 30 years ago.

Like high tech in those days, healthcare processes today are often characterized by:

- Numerous disconnected applications
- Islands of data
- Abundance of paper and manual processes
- Barriers to collaboration
- No visibility, resulting in time spent catching up through the use of charts when shifts change
- Unconnected actors walking across a common stage taking actions and making changes
- No clear task-actor focus
- No automation of measurement
- Rapid change and resistance to change
Most telling, there is a general lack of rigorous process improvement methodologies like Six Sigma, the measurement-centric methodology developed by Motorola more than 30 years ago to drive defects out of processes and thereby improve quality. And few hospitals use the great families of tools that have been developed to facilitate process improvement.

Some signs of progress can be seen in the movement toward checklists, evidence-based guidance, and infection prevention bundles, but in most cases they are performed manually, within limited islands of adoption, and with measurement still paper-based. A big step in the right direction has come with the emergence of electronic health records (EHR). However, far too much of the data is still transcribed and delivered as paper or faxes prior to the entering of the information into the EHR, creating a gap between the actual event and its electronic capture. And much of the information about events – and the knowledge it could yield – remains buried in disconnected data pools or piles of paper.

Such lack of integration is typical of most hospitals. Even when new tools or technology are added to the application space they are implemented in a disconnected manner or are only partially connected in brittle a point-to-point manner. It is common to see IT diagrams that look like spaghetti, showing connectivity between, say, 50-80 applications. Each boutique or niche application requires its own data feed or entry, its own transcription of inputs and outputs, and its own translation. Further, new tools like decision-support modules or surveillance analytics require connections to multiple applications, which causes an explosion of point-to-point connections, each different, each with distinct requirements and each of which must be supported. To take just one example of such chaos, a surveillance support module for HAI requires five connections just to access the most basic sets of information. Each new module then requires another five, or more. And in the absence of connectivity, the IT staff is required to make connections manually.

Tying applications together like spaghetti can be a very expensive activity. For example, a hospital that was involved in the implementation of a well known EHR system began the effort with a $9M budget. To date they have spent $30M and still are not finished.

In the absence of integration, the people who seek to improve the quality of care often become the point of integration themselves. They have to forensically search for the facts and contexts surrounding events and correlate them to outcomes. They have to ask nurses and care givers to fill out paper forms to gather facts about how care was administered. If they don’t find an event or fact, it does not get counted; its impacts are left undiscovered. This results in uneven reporting, missed insights, and huge workloads for many senior practitioners whose valued skills could be better employed in making front-line impacts instead of being consumed by paperwork.
TODAY’S INTEGRATION TECHNOLOGY

Years of experience in process improvement have demonstrated that the best foundation for process improvement lies in integration and automation. The technology to accomplish it has been proven over several years. The critical breakthrough came more than 15 years ago with the development of the Enterprise Service Bus (ESB), which elegantly and efficiently integrates all applications and databases through a single connection to a bus, which allows data to be shared among multiple, previously incompatible, applications.

To take the first steps – defining and measuring – in a rigorous quality improvement process, events and their context must be made available for measurement. Integration through an ESB accomplishes this for significantly less than tying these applications to an EHR via brittle point-to-point connections. By enabling the automation of evidence-based measurements, this mode of integration can help lead practitioners to the insights and actions that will drive the scourge of HAIs from our hospitals.

An ESB provides the foundation of a new, event-driven world for healthcare. In an ESB environment, when a nurse, doctor, practitioner, administrator, or nurse’s aid enters data into a system, any system, it becomes an event that is consumable by any tool, application, or record on the bus. And there is no back seat on this bus. The bus handles the care and feeding, the format translations, and the special requirements of each individual application or module.

By digitizing the care event through the use of an ESB, the EHR becomes a near real-time record of truth. Further, this digitization provides significant additional benefits. The exposing of the act of care facilitates efforts to measure and understand root causes, trigger faster responses to symptoms, and transform diligence efforts so that senior practitioners can focus more on feedback, coaching and improving the quality of care.

By transforming the entry of an event in one system into a consumable event for other systems, the ESB enables events to be exposed to analytical tools and rule-based triggers. Further, the bus enables the harvesting of all contextual facts beyond the EHR to facilitate the automatic assembling of case facts to support HAI determination.

For example, a digitized lab report that shows, say, an MRSA infection can be placed directly into the EHR, then triggering infection treatment protocols and HAI case review. With the integration of clinical applications and use of standard taxonomies, procedures like a central line insertion or use of a Foley Catheter can be automatically counted and placed directly into real-time dashboards and reports. Rules can be used to automate the identification of a patient readmission and trigger review and action if HAI protocols need to be instituted.

As another example, post-hospitalization readmission due to surgery is a prime marker of the blooming of an HAI. If discovered in real-time, quality-focused staff can act and interview while the patient is still in the hospital, not months later. The gathering of infection facts in real-time may yield deeper insights and more defendable present-on-admission findings, and increase patient satisfaction and acceptance if this incident turns into an adverse outcome.

Having clearly defined, transparent, rigorous, and auditable HAI guidance and adjudication processes surrounding the determination of an HAI finding greatly eases the effort required and improves a hospital’s ability to defend a specific finding. And the same automations can drive adoption of bundles and checklists at the point of care, while simultaneously measuring compliance with this vital infection preventing guidance.
The ESB also brings order to a chaotic application infrastructure. It not only radically reduces the number of connections, but also creates a pluggable architecture where special-use tools like clinical analytics, surveillance, and decision-support applications can be connected into the application infrastructure non-disruptively, and in a broadly useable manner. The ESB is the simple home for these tools with enhanced access and broader usage of the knowledge and targeted insights that they might provide.

Beyond exposing events and easing the cost and impacts of bringing in new tools and services, the ESB provides the foundation for a robust human workflow automation capability. It enables the automation of the HAI guidance and adjudication processes, the reporting process, and processes around use and measurement of infection prevention checklists and bundles, and to other areas needing quality improvement. And it eliminates duplicate data entry. It also enables new bundles to be rolled out broadly in new automations that require less of the nursing staff’s time and automatically documents compliance.

Key to helping the caregivers is making the data-capture side of their tasks easier and more useful. Acceptance is a huge challenge to making improvements and changes. If an improvement can be shown to make their job easier and has clear and meaningful benefits, acceptance can be achieved. Adding to a stack of forms needing to be filled out and transcribed, or another system that needs the same information entered into it will defeat acceptance and mire quality initiatives in failure. Integration and automation are the keys to reducing effort and eliminating duplicate entry and paper forms.

The result of a Measure-First approach is a comprehensive HAI event-driven quality control process architecture. This broad and generally reusable solution architecture can be extended easily beyond HAI and into such areas as ER diversions and preventing patient falls, as well as other areas of quality concern. It can also be used to help make sure that guidance around drug interactions and ramifications are event-driven, and that the right drug is delivered to the right patient, in the right quantity, and at the right time.

**EVENT-DRIVEN QUALITY CONTROL OF HAIs IN ACTION**

In the case of HAIs, the conjunction of integration, the ESB, care events, and responding processes would include events originating from existing information entry and applications, events originating from lab reports, reports from surgery, the ICU, Admissions, and the ER, and so on. They would be automatically published to the ESB and introspected by a family of rules and triggers. One portion of the rules would count all care events and be fed automatically into an event-count analytic engine to automate the reporting of the HAI denominator.

A second portion of rules, including those sourced from 3rd party analytic tools, would automate the targeting of suspicious HAI cases. For example, rules that were triggered by readmissions or from an adverse lab report or group of symptoms would drive an automated HAI response and adjudication processes.

In a triggered HAI adjudication process, the first step is the automated collection of case facts from all applications and records. This automatic harvesting of case facts speeds the time for review and can drive more timely reactions and instigate appropriate responding protocols. The harvesting should include interviews and fact-gathering from the affected family, conducted while the patient is in the hospital and the family is present, rather than weeks or months later.
Once a HAI finding is reached, it is handed off to a full suite of automated reporting able to deliver the reporting in whatever format or form required. Additionally, with an HAI finding, all the assembled case facts will be moved into an analysis phase to drive quality improvement.

For the ICP, these supporting automations will remove many of the barriers to their focus on analysis, coaching and seeking insights to drive a quality improvement methodology that will lead to better outcomes. It will provide a deeper and broader pool of facts to draw upon, and these case facts can easily be shared with others, like the Centers for Disease Control, who seek evidence broadly across all hospitals.

An ESB-enabled rules approach also provides a dynamic environment in which new rules can be added over time as a result of more knowledge and the refinement and broadening of surveillance. Further, each new rule expands and deepens the capabilities of this reusable infrastructure. Rules are exposed externally and codelessly so they are fully available to the ICP and other interested participants. ICPs could automatically ask questions about any future care event they found interesting. If the triggered rule returned an interesting answer, the case would be opened for review and a process triggered.

The use of human workflow automation technologies can transform how bundles and checklists are implemented and how compliance is reported at the event-horizon of care. Nursing activities around central line insertions can be transformed into discrete, infection-bundle compliant tasks, in a Central-Line-Insertion (CLI) process, that are assigned by an individual or workgroup task inbox. Each of these tasks can be shaped to drive behavior and compliance with coaching guidance and checklists. And they can be automated to drive time-based behavior like daily central line reviews, and acknowledgement by doctors that the line is still needed.

A common way these tasks can be presented is with a task inbox, the task, and supporting information enabling rapid decision and acknowledgement of task completion. Such workflow automation measures and drives the compliant behavior that is critical for HAI prevention.

Further, automated workflow creates a transparent sequential record of care that is automatically documented and fully available as part of the defense approach when a payer refuses payment or a patient seeks redress for an adverse outcome. These processes clearly demonstrate intent and measured compliance with the best practices and guidance available.

Additionally, these workflows and user interfaces can be created and modified with ease in codeless graphical design environments, greatly reducing demands on IT staff, and facilitating rapid roll outs of new bundles and guidance protocols. And since these workflows are built on a comprehensive integration and ESB, no reentry of data is required, and many tasks are reduced to simple acknowledgements, with the results automatically posted to the EHR. This approach preserves the value of the already installed application portfolio while nondisruptively enabling the addition of new capabilities at a greatly reduced cost point.
RAISING THE BAR AND REAPING THE BENEFITS

The integration and automation of HAI monitoring and reporting in a Measure-First approach provides a holistic example of the process-centric approach to the improvement of care outcomes. This approach to the HAI challenge and other quality focus initiatives will yield wide-ranging and meaningful benefits, in the least costly and disruptive manner. From an IT perspective, the implementation of a pluggable, event-driven architecture can:

- Reduce risks and impacts from change
- Reduce cost to integrate new applications
- Improve IT’s ability to respond to new needs
- Lower the costs of responding to new needs
- Eliminate data inconsistencies across application silos
- Achieve a secure, reusable and extendable, agile architecture

As transformative as the solution is, it can be rolled out non-disruptively, rapidly, and through incremental targeted projects with minimal impact on IT staffs.

From a financial perspective, the tools and technology, implementation, and the adoption of automation pay for themselves rapidly and bring significant return on investment (ROI). For example, a small hospital group with 700 beds could see an ROI of approximately $50 million in just five years, as a result of reduced integration costs, reductions in length of stay and incremental elimination of preventable infections. Benefits will also come from improved productivity across the entire patient-facing team and the ICP staff. The hospital reaps further financial benefits through recouping disputed payments, defending care, and increasing bed utilization as a result of improved reputation.

Most importantly, by improving the ability of skilled knowledge workers to address the problem of HAIs, integration and automation provide a key step towards the digitally-enabled hospital and the event-driven care that mean better outcomes for patients.
WHERE TO BEGIN

Technology is no obstacle. The technology for achieving enterprise integration and real-time decision-making is proven, flexible, and available. The real barriers holding back most institutions are inside: Performance metrics are based on internal politics and functional silos, instead of being designed to guide behavior toward better patient and business outcomes.

Decisions are made on the micro level, without considering the macro level. And, perhaps most importantly, IT and the business are misaligned.

Software AG’s team of senior advisors has spent many years helping organizations of all kinds overcome those barriers to optimal performance. They have long experience in formulating strategies for businesses in multiple industries, including healthcare, that specifically focus on achieving efficiency and differentiation through the application of technology.

Our approach is not to change systems but rather to overlay them with intelligence, enabling organizations to leverage their existing IT investments while overcoming the limitations of those legacies. Our methodology is applicable to any service line. And our strategy is to work with our customers to find the best area in which to begin improvement so that they can realize value in weeks rather than months or years. We then move to the next area for improvement, building on the momentum of success and harnessing the enthusiasm of all constituencies for ways of working that benefit patients, caregivers, and the bottom line.

We invite you to contact us for a conversation on ways to help increase the health of your institution and make it the best choice for patients and staff. To learn more, please contact us at info@softwareag.com or call 877-724-4965.
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