In 2002, Ascension Health, the largest Catholic and nonprofit health care system in the country, articulated a call to action with a commitment to provide 100% access to safe, effective care. Its Strategic Direction promises Healthcare That Works, Healthcare That Is Safe, and Healthcare That Leaves No One Behind, and identified four enabling strengths—inspired people, trusted partnerships, empowering knowledge, and vital presence—needed to fulfill the promise.

As part of its Healthcare That Is Safe strategy, Ascension Health identified eight priorities for action and adopted a goal of clinically excellent care with no preventable injuries or deaths by July 2008. Two alpha sites—Sacred Heart Hospital (SHH) in Pensacola, Florida, and Columbia St. Mary’s (CSM) in Milwaukee, were identified to address perioperative safety, one of the eight priorities for action.

Annually, more than one million people in the United States are affected by a POAE, resulting in costs of approximately $25 billion.\textsuperscript{1,2} The Institute of Medicine report \textit{To Err Is Human}\textsuperscript{3} and subsequent reports\textsuperscript{4-6} have highlighted the need for all aspects of patient safety, including surgical safety. A collaboration between the Centers for Medicare & Medicaid Services (CMS) and the Centers for Disease Control and Prevention (CDC), Surgical Infection Prevention (SIP), began by focusing on the morbidity and mortality of surgical site infections (SSIs) and has broadened its focus as the Surgical Care Improvement Project (SIP) has evolved.

### Article-at-a-Glance

**Background:** For Ascension Health’s Healthcare That Is Safe strategy, Sacred Heart Hospital (SHH) and Columbia St. Mary’s (CSM) served as alpha sites to develop strategies to eliminate perioperative adverse events (POAEs). The alpha sites set an interim goal of a 50% reduction of POAEs, then 100%, or elimination of POAEs by July 2008.

**Implementation:** The alpha sites identified a process for data management to establish clear, measurable elements for each of the five strategies of the alpha initiative; created an infrastructure to foster transformational change in the operating room suite; and implemented tactics to measure the success of the five strategies.

**Strategies and Tactics:** The sites implemented tactics for five strategies: (1) prevention of errors due to human factors, (2) prevention of surgical site infections, (3) prevention of adverse perioperative cardiac events, (4) prevention of postoperative venous thromboembolism, and (5) prevention of postoperative hemorrhage.

**Results:** SHH achieved a 90% reduction in the POAE rate, CSM a 58% reduction.

**Discussion:** A number of key learnings were drawn from the alpha experiences, including the need to adjust to evolving definitions and guidelines for implementation and measurement of perioperative care.
(SCIP) to focus on SSIs, venous thromboembolism (VTE), cardiovascular, and respiratory events. The Ascension Health alpha sites drew on the consensus recommendations from this previous work and joined the Institute for Healthcare Improvement (IHI) Impact Program, thereby gaining access to an evidence-based patient safety change packet and a community with multimodule methods for interaction.

SHHS, a 462-bed tertiary care facility with an additional 60-bed hospital in Destin, Florida, averaged 930 inpatient operating room (OR) procedures monthly on its main campus in 2004. CSM, a multihospital system with three hospitals performing surgery, averaged 620 inpatient OR procedures monthly in 2004. The main campus of SHHS—Sacred Heart Hospital (SHH)—and the three campuses of CSM participated in the alpha initiative. The surgical procedures performed at the alpha sites encompassed a large patient population, including open-heart, orthopedic, neurological, gynecological, and general surgery.

This article describes how these alpha sites collaborated to implement plans that significantly reduce POAEs in their institutions.

Goals and Strategies
The alpha sites’ initial goals were to reduce POAEs by 50% in inpatient OR procedures at CSM by February 2006 and by April 2006 at SHH. The alpha sites’ ultimate goal was to eliminate POAEs by July 2008. To accomplish the 50% reduction goal, the alpha sites focused on five strategies:

- Prevention of errors due to human factors
- Prevention of surgical site infections (SSIs)
- Prevention of perioperative cardiac events
- Prevention of postoperative venous thromboembolism
- Prevention of postoperative hemorrhage

Implementation
The alpha sites’ initiative implementation included the following three activities:

- Identification of a process for data management to establish clear, measurable elements for each of the five strategies of the alpha initiative
- Creation of an infrastructure to foster transformational change in the OR suite
- Implementation of tactics for the five strategies to decrease and eventually eliminate POAEs

DATA MANAGEMENT PROCESS AND MEASUREMENTS
The first step in this process was to establish baseline data through a chart review at both alpha sites using the IHI 2004 Trigger Tool to determine possible patient harm (with assignment of a harm category). The “triggers,” such as unplanned return to the OR, positive postoperative blood culture, and unexpected change in procedure (for example, a laparoscopy that turns into an open procedure), are clues that require more complete retrospective chart review to identify possible POAEs. Each of the four hospitals randomly selected 20 surgical cases per month drawn from all inpatient surgical cases and performed an audit in which the documenting reviewer identified triggers. Baseline data collection began in November 2003 at CSM and January 2004 at SHH. The monthly data recorded during subsequent chart reviews were evaluated by members of the perioperative safety committee that each hospital established as part of the initiative. These committees helped to establish and foster ongoing interrater reliability across all four hospitals regarding the use and interpretation of the Trigger Tool. This methodology was repeated monthly during the course of the alpha initiative through June 2006.

In the early months of the initiative, the two alpha sites independently reviewed and analyzed their hospital data from the Trigger Tool reviews. Each alpha site developed its own reporting methods using a variety of control and run charts for statistical analysis and trending. As the initiative evolved, SHH and CSM collaboration became more formally structured through monthly conference calls, monthly data submission to Ascension Health, and periodic face-to-face meetings.

INFRASTRUCTURE
After identifying a process for data management and establishing measurements for the alpha initiative, the alpha sites created infrastructures to foster transformational change in the OR suite. Infrastructure development began with the creation of a multidisciplinary perioperative safety team for each of the four campuses. Campus-based teams were composed of anesthesiologists, surgeons, surgical technicians, pharmacists, clinical excellence coordinators, OR directors, nursing executives, bedside nurses representing pre-admission testing, and clinicians from the OR, postanesthesia care unit, intensive care unit (ICU), and...
infection control. The campus-specific and organization-wide meeting agendas included discussion of the following:

- “Tests of change” cycles and evaluating performance improvement regarding the goals
- Analysis of chart review results
- Analysis of Safety Attitude Questionnaire (SAQ) results
- Strategies and assignments to overcome barriers to perioperative safety

**STRATEGIES AND THEIR TACTICS**

In April 2004, with the infrastructure established and measurements in place, the alpha sites began identifying tactics for the strategies selected, as discussed earlier, on the basis of data analysis and the literature. Each tactic represented a measurable action; thus, success in implementing each strategy was gauged by the success achieved in executing its tactic.

**Prevention of Errors due to Human Factors** (as measured by compliance with preprocedural briefings). Targeting, measuring, and understanding caregiver attitudes about safety are critical to improving safety. Ascension Health administered the SAQ systemwide in 2004 and 2006 to explore the relationship between safety climate scores and patient outcomes. The SAQ collected input from front-line personnel to determine the hospital’s organizational strengths and weaknesses. Both alpha sites used the results of the survey to develop an action plan to promote a culture of safety, focusing on teamwork and standardizing processes.

To strengthen its perioperative safety climate, the alpha sites restructured their risk assessment processes. At each site, the preadmission staff developed a screening tool that incorporated DVT risk, bleeding risk, and perioperative cardiac risk.

To strengthen its culture of safety at CSM, the alpha team revised the OR record to include documentation of all elements of the Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery™. In addition, the team emphasized executive participation in the alpha initiative. In June 2004 informal executive walkarounds were developed and conducted in the OR. These walkarounds heightened the focus on patient safety and solicited staff feedback on improving patient care. The executive walkarounds evolved in December 2005 into culture-of-safety rounding, in which a safety expert, executive champion, and unit director led a monthly staff meeting dedicated to the education, discussion, and monitoring of the OR safety action plan. A key goal of culture-of-safety rounding was to establish a relationship between the executive and OR personnel that could help break down barriers that prevent development of safe patient care processes. In addition to culture of safety rounding, mock tracer rounds were established in September 2004 to educate, monitor, and reinforce The Joint Commission National Patient Safety Goals applicable to the OR.

Both alpha sites adopted preprocedural briefings. They each identified key persons—the surgeon at CSM and the circulating nurse at SHH—to conduct a “time-out” once all members of the team were present in the OR. The time-out allowed the staff to review for right patient, right procedure, right site (site was marked), right position, and the presence of correct equipment. During the time-out, if any discrepancy was noted, anyone in the OR could stop the procedure until consensus was reached by the team to proceed.

**Prevention of SSIs** (as measured by on-time delivery and appropriate selection of prophylactic antibiotics, maintenance of normothermia, perioperative blood glucose control, and appropriate hair removal from surgical sites).

1. **On-time delivery and appropriate selection of prophylactic antibiotics.** In 2004, both alpha sites committed to delivering prophylactic antibiotics within 60 minutes before incision time, with the exception of vancomycin, which requires an infusion time of ≥ 90 minutes. Each site standardized an approach to antibiotic delivery by assigning responsibility to specific perioperative personnel.

To maximize appropriate selection of prophylactic antibiotics, SHH created an antibiotic protocol and standardized preprocedural surgical order sets in 2005; CSM adopted both in early 2006.

2. **Maintenance of normothermia.** Both alpha sites recognized the importance of maintaining normothermia in the perioperative setting as a tool to help prevent SSIs. All four campuses used disposable, heat-controlled blankets and intravenous (IV) fluid-warming devices. Two of the three CSM campuses warmed the orthopedic surgery suites to 70ºF (± 3º). These devices assisted in keeping temperatures within desired ranges preoperatively, intraoperatively, and postoperatively. SHH and CSM monitored patients’ temperatures before surgery, during the
procedure, and on arrival to the postoperative care unit (PACU) to ensure temperatures were > 96°F.

3. Controlling Perioperative Blood Glucose. Blood glucose control has been shown to correlate with the prevention of SSIs, which had been in the forefront of CSM’s quality improvement initiatives on the inpatient units before the alpha initiative. CSM drafted guidelines for perioperative diabetes management for all surgical patients (target range, 90–150 mg/dl). SHH focused on controlling perioperative diabetes management for the cardiac surgical patient only (target range, 70–150 mg/dl). To support compliance, both alpha sites purchased glucose monitoring devices for the ORs.

The momentum from CSM’s earlier work carried over to the development of an insulin-drip protocol for intraoperative and postoperative management. SHH utilized insulin-infusion protocols in postsurgical patients who went to adult ICU.

4. Appropriate Hair Removal from the Surgical Site. The literature suggests that shaving surgical sites is generally contraindicated in the prevention of SSIs. Both alpha sites addressed this tactic by removing razors from the ORs except for the campus on which burn surgery is performed. Razors were replaced by clippers for hair removal with the intent that no exceptions would be made; however, chart reviews revealed occasional variances, which were handled on a case-by-case basis.

Prevention of Perioperative Cardiac Events (as measured by screening for indicators of such an event and implementing the recommendations for beta blocker use when indicated). CSM and SHH assessed their patients for moderate-to-high risk for perioperative cardiac events, based on a series of indicators. The patient was deemed at moderate risk if not currently treated with a beta blocker and carrying two or more risk factors (smoker, hypertension, diabetes, age greater than 65 years, hypercholesterolemia, family history of heart disease, and/or obese); the chart was flagged for the anesthesiologist and surgeon to discuss delivery of intravenous (IV) beta blockade in the OR and PACU settings. Patients at high risk included those with previous myocardial infarction (MI) or coronary artery disease (CAD), peripheral vascular disease (PVD) and/or current treatment with a beta blocker.

In April 2005, CSM initiated a small test of change to further support the use of beta-blocker therapy to reduce perioperative cardiac events. CSM sent a letter, supported with literature and recommendations, to a select group of primary care physicians. This letter encouraged physicians to initiate beta-blocker therapy in the weeks before surgical procedure on moderate- to high-risk patients.

Both alpha sites reexamined their position on beta-blocker therapy in July 2005 with the publication of an article that suggested that beta blockers should not be delivered to preoperative patients presenting with moderate risk. SHH subsequently shifted to screening exclusively for patients at high risk for adverse perioperative cardiac events. CSM shifted to screening exclusively for patients at high risk in the hospital but continued its primary care provider (PCP) program addressing patients that were at moderate-to-high risk for adverse perioperative cardiac events.

Compliance on the perioperative-cardiac-events tactic of the alpha initiative was variable because of changes in national guidelines.

Prevention of Postoperative VTE (as measured by compliance with a presurgical screening tool and implementing the order sets incorporating guidelines for mechanical and pharmaceutical DVT prophylaxis when indicated). Before the alpha initiative, SHH had recognized a need for risk screening and prophylaxis against VTE in its medical and surgical populations and, in 2001, completed a retrospective chart review of 116 VTE cases.

The review indicated that surgery was the greatest common risk factor for development of VTE. Drawing on the American College of Chest Physicians guidelines for screening and implementing prophylaxis for the at-risk surgical population, SHH set the goal of screening 100% of its inpatient and outpatient surgical populations and using appropriate prophylaxis through a standardized order set. In late 2001, SHH began educating its physician and nursing staffs on the underrecognized threat of VTE. The hematology/oncology unit, which had a good case mix of both surgical and medical patients and was averaging seven to nine symptomatic DVTs per month, was chosen to pilot the program. To ensure continuity with the pre-alpha VTE initiative, the screening tool was incorporated into the patient admission history for both medical and surgical patients. Once the patient was determined to have two or more risk factors, a protocol was placed under the orders that guided the physician in a mechanical or
pharmaceutical approach to prophylaxis. The DVT screening and prophylaxis protocol was spread throughout the facility to include surgical preadmissions and the emergency room.

CSM adopted many of the same processes and focused on prophylaxis in surgical patients. It developed a presurgical screening tool, which included risk factors known to contribute to the development of DVT. Staff in the day surgery and pre-admission testing centers identified patients with two or more risk factors and flagged the medical record with stickers to alert the surgical team.

Both CSM and SHH order sets incorporated the ACCP-recommended guidelines for the use of mechanical and/or pharmaceutical DVT prophylaxis.

Prevention of Postoperative Hemorrhage (as measured by compliance with a standardized screening tool). The alpha sites implemented a standardized screening tool to increase physician and staff awareness of potential bleeding risk. Patient charts were flagged if there was a personal or family history of bleeding/bleeding disorder and/or any suspected bleeding conditions. The screening tool also included a review of medications that affect coagulation—platelet-inhibitors, salicylates, anticoagulants, aspirin, and herbal supplements. SHH developed a contingency plan for patients who were at high risk. The patients were blood typed and screened before surgery, and a protocol to mobilize resources in case of an emergency was amended to include blood products and devices that can rapidly infuse products to restore homeostasis.

**Results**

**Prevention of Errors Due to Human Factors**

CSM and SHH incorporated documentation of the preprocedural briefing into existing systems, which allowed for monitoring of the completion of preprocedural briefings (Figure 1, above). Compliance at SHH and CSM was at 100% for the last six months of the initiative. Both...
alpha sites focused on incorporating screening for risk factors in the operative preadmission process, which was an important first step in identifying patients at risk for POAE (Figure 2, page 260).

**Prevention of SSIs**

*On-time Antibiotic Delivery and Appropriate Selection of Prophylactic Antibiotics.* CSM and SHH approached on-time antibiotic delivery differently. CSM assigned responsibility to the anesthesiologists and the holding room staff, achieving a 19.8% improvement (Figure 3, right). SHH first assigned the responsibility to the preoperative holding area. Because of delays in surgeries, reflecting physician or room availability, the responsibility shifted to the OR circulating nurse. SHH was able to achieve better results with this change in process and observed gradual improvement in the first and second quarters of 2006 (Figure 4, right).

SHH achieved > 88% compliance with appropriate selection of prophylactic antibiotics with the use of a universal surgical antibiotic protocol (Figure 5, page 262). CSM began measuring this process at the beginning of 2006, with initial compliance at the three campuses documented at 95%.

*Maintaining Normothermia.* Both alpha sites addressed normothermia in the same manner, on the basis of published recommendations. The process was monitored for a year at SHH, where compliance was > 90%. SCIP finalized the normothermia measurement in July 2006, and monitoring with this measurement was initiated at both sites.

*Controlling Perioperative Blood Glucose.* SHH monitored blood glucose levels throughout the perioperative process on all cardiac surgical patients. These patients were administered insulin drips for blood glucose > 150 mg/dl when they transitioned to the adult ICU. CSM monitored blood glucose levels on all surgical patients. CSM protocol called for these patients to transition to an insulin drip if blood glucose was > 150 mg/dl during the perioperative
All campuses included the SCIP guidelines to monitor blood glucose levels at postoperative day 1 (day 2 on the cardiac surgical population), with monitoring of future data.

**Appropriate Removal of Hair from the Surgical Site.**

By June 2004, a 100% compliance rate for proper hair removal with clippers was achieved at SHH and two of the three CSM campuses.

**PREVENTION OF ADVERSE PERIOPERATIVE CARDIAC EVENTS**

By June 2006, 100% of CSM patients deemed as appropriate candidates for beta-blocker therapy (those with cardiac risk factors, previous MI, current beta-blocker treatment, known CAD, or PVD) received a beta blocker in the perioperative period (Figure 6, left).

**PREVENTION OF POSTOPERATIVE VTE**

Assessment of DVT risk and delivery of either mechanical and/or pharmaceutical prophylaxis was a focus at SHH, with > 90% compliance beginning in March 2006 (Figure 7, page 263). Within four months of beginning its program on the hematology/oncology unit, a dramatic decrease of its symptomatic DVTs was evident, averaging zero to two symptomatic DVTs per month. CSM averaged 93.9% compliance on using either mechanical or pharmaceutical DVT prophylaxis (Figure 8, page 263).

**Prevention of Postoperative Hemorrhage.** Bleeding risk was successfully screened in > 90% of the patients at CSM and SHH as of June 2006.

**Perioperative Harm Rate.** CSM (Figure 9, page 264) and SHH (Figure 10, page 264) each achieved targeted reduction of ≥ 50% in the POAE rate of inpatient surgical patients.

**Discussion**

The alpha sites encountered a number of challenges during the course of the initiative to reduce inpatient POAEs, many of which related to evolving definitions and guidelines for the implementation and measurement of perioperative care. Thus, to stay abreast of the most current thinking in the field, the alpha sites adjusted the tactics in the initiative over time.
Prevention of Errors Due to Human Factors

At CSM and SHH, the preprocedural briefing was initiated with documentation of the main elements of the Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery™. To ensure that the briefings were occurring, at CSM surgical educators performed observational audits. The audits revealed that occasionally all elements were not completed for each patient and that CSM nursing staff were leading the briefing. With the support of the Surgical Services Steering Committee, CSM continued the audits with more surgeons taking the lead. SHH recently adopted the CSM audit process to ensure that the briefing is consistent and complete.

Prevention of SSIs

At CSM, the greatest challenge was in establishing a consistent method for antibiotic delivery and documentation. It was determined that the best practice was that the anesthesiologist deliver the medication IV push immediately before incision time (with the exception of Vancomycin) and record the delivery. SHH faced its greatest challenge with regard to personnel accountability. Frequently adapting to the changing guidelines from SIP and frequently altering the accountability of delivering medication before incision time, it noted a sharp decrease in compliance in the fourth quarter of 2005 and first quarter of 2006. In April 2006, the circulator took responsibility for starting the antibiotic and ensuring that the antibiotic was infused by incision time. This was documented in both the nurses’ electronic record and the anesthesia record. The second quarter in 2006 showed marked improvement in the process as a result.

Regarding appropriate hair removal, some of the surgical technicians and surgeons were concerned if the skin was not “buffed to perfection.” Educating the surgical team with evidence-based literature improved compliance. Whereas SHH achieved 100% compliance by eliminating all razors in the ORs, the CSM campus, which was forced to retain razors for burn surgery, failed to reach that level of compliance.

Because of concerns regarding the possibility of hypoglycemia, some anesthesiologists were reluctant to implement the tactic of strict blood glucose management in the
surgical patient. At CSM, the surgical services steering committee approved blood glucose management in the range of 90–150 mg/dl during the intraoperative phase. Insulin-drip protocols for intraoperative and post-operative management were established. In addition, the physicians agreed to management of the known diabetic patient immediately pre-surgery and with blood glucose monitoring via finger sticks hourly. SHH’s initial focus was on monitoring and controlling blood glucose levels in a range of 70–150 mg/dl in cardiac surgery patients, as established by its own surgical steering committee. Presurgical control, intraoperatively monitoring, and postoperatively initiating insulin drips in the ICU for blood glucose > 150 mg/dl were implemented. SHH recently expanded its processes to monitor all surgical patients and address the patients’ needs individually with the primary physician.

**Prevention of Adverse Perioperative Cardiac Events**

The alpha sites began this process with identification of both moderate- and high-risk patients, but SHH shifted screening to high-risk patients after July 2005. Although CSM also made this shift within the hospitals, it continued its PCP initiative (introduced in April 2005) with its screening of moderate- and high-risk patients. Although the rate of providing

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**Figure 9.** Results indicate a drop of 58%, which is significant at the 95% confidence level (CI). The POAE center line for baseline period = .1656, 95% CI (.1413, .1898). The POAE center line for follow-up period = .0688, 95% CI (.0527, .0848). OR, operating room; SCIP, Surgical Care Improvement Project.

**Figure 10.** Results indicate a drop of 94%, which is significant at the 95% confidence level (CI). The POAE center line for baseline period = .2067, 95% CI (.1042, .3091). The POAE center line for follow-up period = .0115, 95% CI (.0000, .0245).
beta blockade to eligible patients after the introduction of the PCP program improved, the program was a small part of the alpha initiative.

**Prevention of Postoperative VTE**

At CSM, DVT prophylaxis was well recognized and implemented with mechanical and pharmacologic intervention in the order sets for orthopedic, bariatric, and vascular surgery patients. CSM is in the process of developing a stand-alone anticoagulant order set for other at-risk surgical patients. CSM achieved good compliance in identifying patients at risk and applied appropriate mechanical devices. One area of controversy that remains is the use of foot pumps with orthopedic surgery.

SHH had an initiative to screen and address DVT prophylaxis before the alpha initiative. Mechanical and pharmacologic interventions were initiated within 24 hours, if indicated, for all surgical patients. SHH’s surgical charts were reviewed monthly to ensure compliance with guidelines recommended by the American College of Chest Physicians. These data were reviewed quarterly at the surgical department meeting.

**Conclusion**

Perioperative safety proved to be a complicated initiative, but despite the multifaceted challenges and the evolving national recommendations from SCIP, SHH showed a 90% decrease and CSM showed a 58% decrease in POAEs by applying evidenced-based practice and focusing on improvements in the culture of safety in the OR. CSM and SHH then developed a foundation document that detailed their recommendations for perioperative safety and conducted a series of educational conference calls to spread their lessons and experiences to all Ascension Health hospitals.

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**References**

References, continued