PREVENT
HAIs
Healthcare-Associated Infections

AHRQ Safety Program for Surgery

AHRQ
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CUSP

AHRQ Safety Program for Surgery

Final Report

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Contents

Figures

Tables

Executive Summary

Surgical site infection (SSI) prevention remains a global public health priority. Patients in acute care hospitals underwent more than 16 million surgical procedures in the United States in 2010.[1] Using National Healthcare Safety Network (NHSN) definitions and surveillance methods, the overall national SSI rate is approximately 1.9 percent. SSIs are the third most costly healthcare-associated infection (HAI) per event, accounting for more annual healthcare costs than any other major infection.[2] SSIs are among the most common HAIs: A recently published point-prevalence survey of HAIs across 10 States showed that 4 percent of patients had one or more HAI by NHSN definitions, and SSIs accounted for approximately 20 percent of all HAI cases.[3] SSIs continue to impart an enormous burden on patients, their families, employers, and society.

From September 2011 through August 2015, the Agency for Healthcare Research and Quality (AHRQ) contracted with the Johns Hopkins Medicine Armstrong Institute for Patient Safety and Quality to create a scalable change package for SSI reduction–the AHRQ Safety Program for Surgery–and disseminate and evaluate it. During the course of the contract, project participants referred to the AHRQ Safety Program for Surgery as the Comprehensive Unit-based Safety Program [CUSP] for Safe Surgery, or SUSP. The Armstrong Institute partnered with the American College of Surgeons, the University of Pennsylvania, and the World Health Organization to form the National Project Team (NPT). Five cohorts of hospitals enrolled in the AHRQ Safety Program for Surgery. Nineteen coordinating entities (CEs)–9 State hospital associations and 10 Hospital Engagement Networks–recruited 220 hospitals from 37 States to implement the program. One hospital from Canada and one from England also joined. After recruitment, 197 hospitals and 376 perioperative teams enrolled in the project and provided SSI and safety culture data.

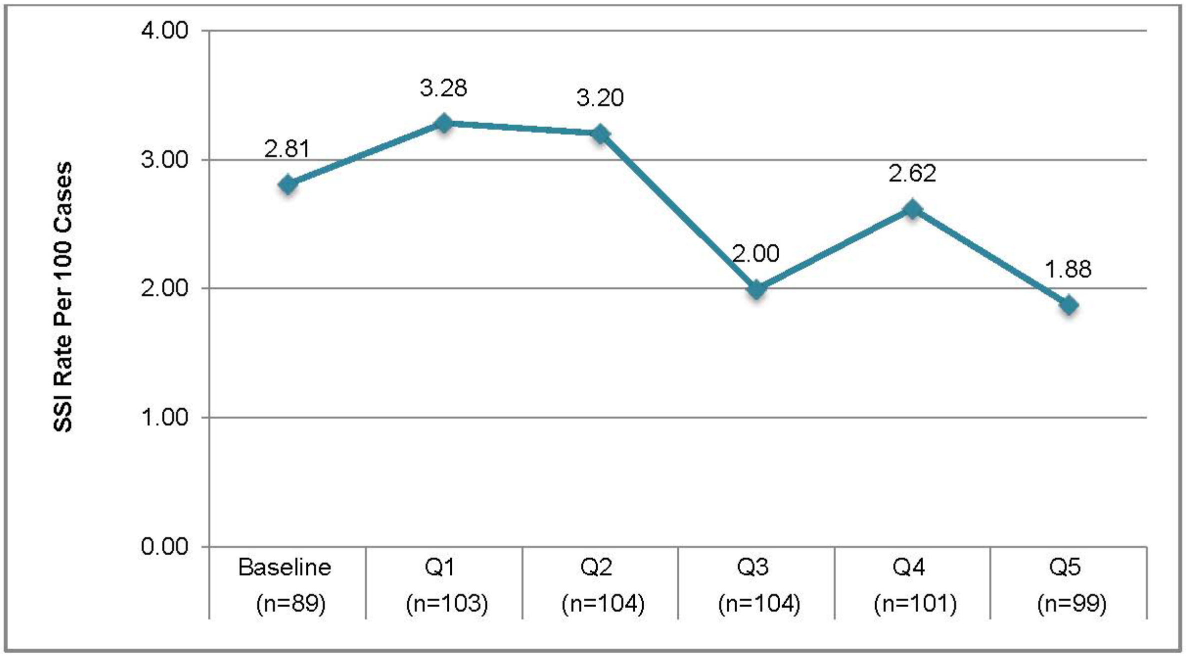
The AHRQ Safety Program for Surgery was a multifaceted intervention including CUSP implementation to improve local culture and application of the Translating Research into Practice (TRIP) model to improve adherence with evidence-based SSI prevention therapies. Participating hospitals were encouraged to form perioperative improvement teams comprising frontline clinicians. Teams were encouraged to identify local system defects and use the TRIP model to operationalize and implement evidence-based practices to address those defects. The NPT emphasized three core activities for the development and implementation of locally relevant SSI prevention bundles:

1. Tap the wisdom of frontline staff by asking them how the next patient will develop an SSI;
2. Audit local practice to identify opportunities for improvement; and
3. Apply emerging evidence for SSI reduction.

In addition, teams were encouraged to investigate all SSIs to identify opportunities to improve.

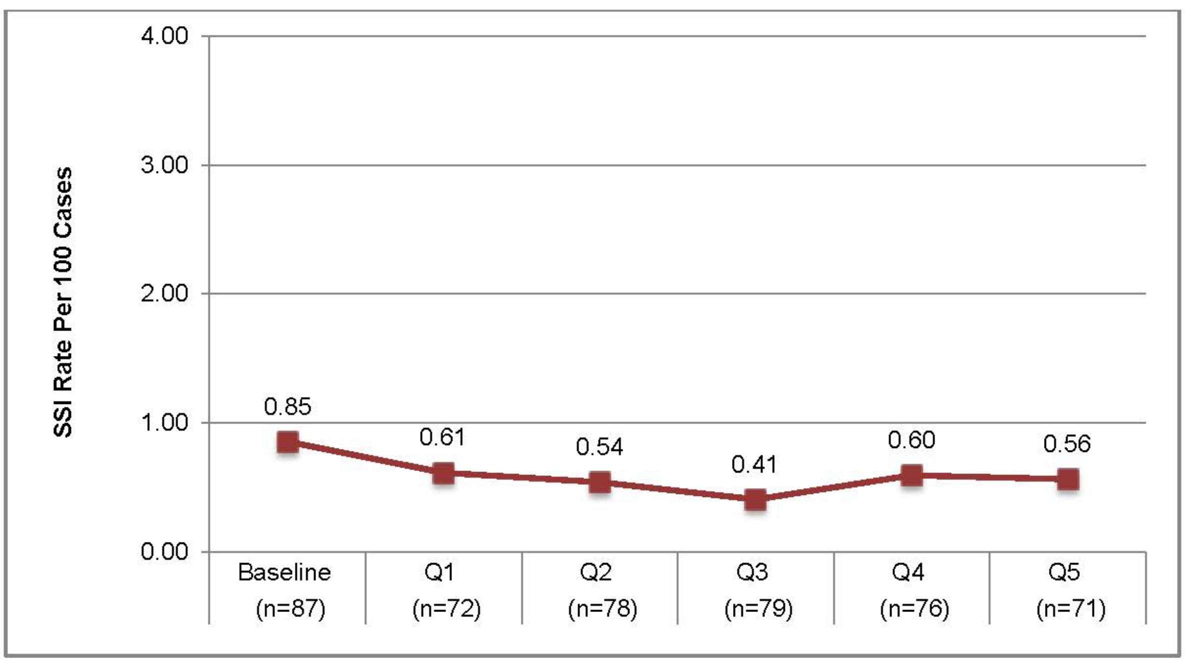
Among hospitals enrolled in the AHRQ Safety Program for Surgery, analyses of unadjusted SSI data from perioperative teams that completed the program indicate a significant decrease in SSI rates. Participating hospitals reported their SSI rates using standardized definitions for SSI defined by NHSN, American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP®), or rarely both. Among hospitals reporting NHSN data, there was a 33 percent relative reduction in the SSI rate for colon surgery (p=0.012) (Figure 1) and a 33 percent relative reduction for non-colon surgery (p=0.046) (Figure 2). Among hospitals reporting ACS NSQIP data, there was a 25 percent relative reduction in the SSI rate for colon surgery (p=0.027) (Figure 3) and a 40% relative reduction for non-colon surgery (p=0.005) (Figure 4). Hospital-level analysis of safety culture data also showed improvement in multiple safety culture domains using the AHRQ Hospital Survey on Patient Safety Culture (HSOPS).

Figure 1. NHSN Colon Procedures: Perioperative Team-level Unadjusted SSI Rate Over Time[a]



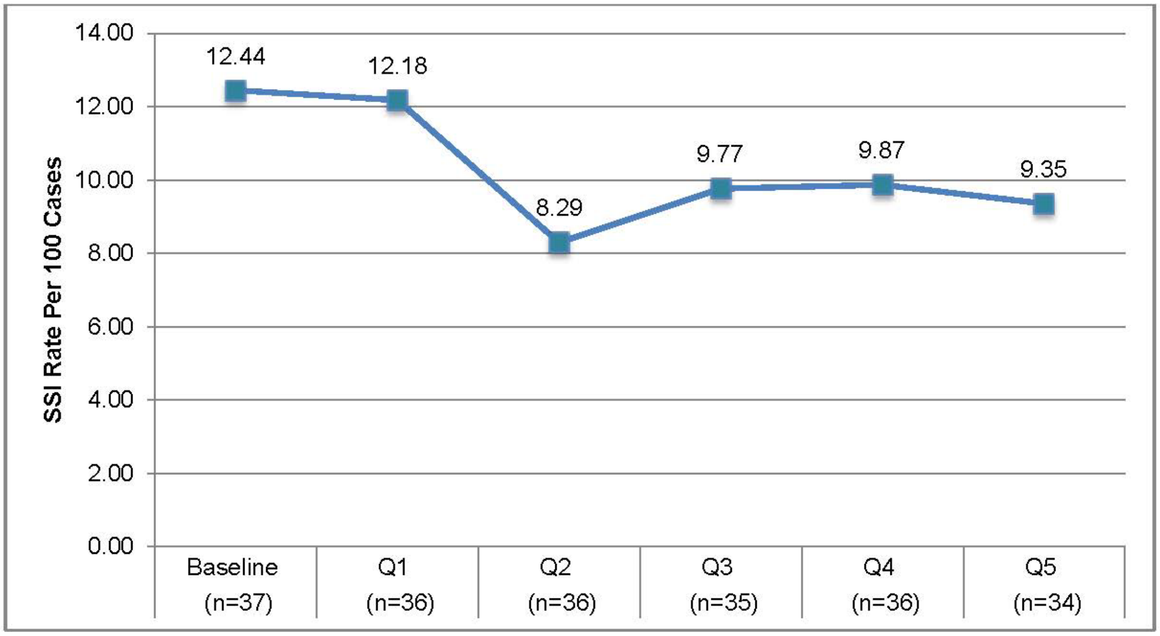
n = number of perioperative teams; Q = quarter; SSI = surgical site infection
Baseline period was 12 months before program implementation.
For each quarter, the average SSI rate across a 3-month project period is shown.
[a]Paired analysis of unadjusted data from perioperative teams reporting baseline data and followup data for any project quarter shows similar significant reduction in SSI rates (see Appendix).

Figure 2. NHSN Non-Colon Procedures: Perioperative Team-level Average SSI Rate Over Time



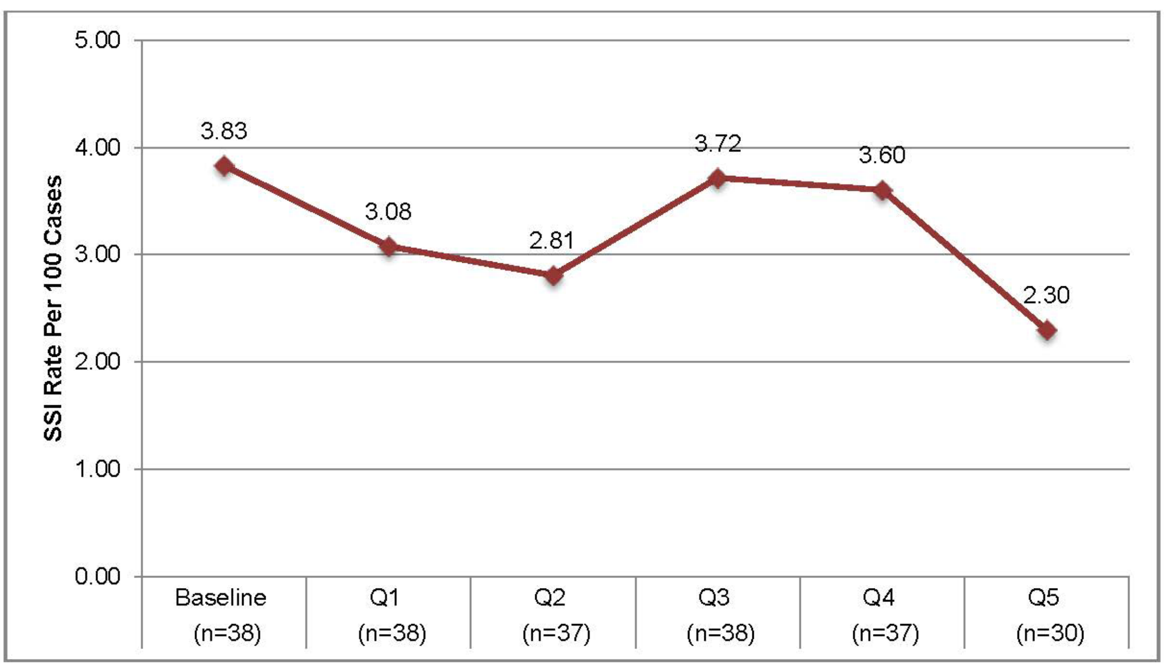
n = number of perioperative teams; Q = quarter; SSI = surgical site infection
Baseline period was 12 months before program implementation.
For each quarter, the average SSI rate across a 3-month project period is shown.

Figure 3. NSQIP Colon Procedures: Perioperative Team-level Unadjusted SSI Rate Over Time



n = number of perioperative teams; Q = quarter; SSI = surgical site infection
Baseline period was 12 months before program implementation.
For each quarter, the average SSI rate across a 3-month project period is shown.

Figure 4. NSQIP Non-Colon Procedures: Perioperative Team-level Unadjusted SSI Rate Over Time



n = number of perioperative teams; Q = quarter; SSI = surgical site infection
Baseline period was 12 months before program implementation.
Quarterly rate represents the average SSI rate across a 3-month project period.

The NPT included a qualitative research team from the University of Pennsylvania that conducted an ethnographic evaluation to understand how and why CUSP worked in perioperative settings. The evaluation was conducted via site visits at 17 hospitals in 5 States, and included observations, over 300 interviews, and 30 focus group interviews. Eleven sites were visited twice. The qualitative research team also worked with the NPT and CEs to inform project implementation. Findings from the qualitative analysis highlight the impact of 3 major contextual variables: engagement, turnover, and nonpunitive response to error.

We have gained important insights from participating hospitals and CEs, our partners, and our experience. The AHRQ Safety Program for Surgery has advanced our collective understanding of surgical safety and the conduct of large-scale perioperative improvement projects. CUSP is an effective framework for the implementation of perioperative quality improvement and patient safety programs.

Our experience supports the lessons learned from other successful HAI prevention projects. Specifically, the importance of clearly communicating goals; the need for an enabling infrastructure to provide project management, data, and improvement science; the need to engage, train, and support clinicians in local work areas and connect them in peer learning communities; and the need to transparently report performance and create accountability systems.

The success of the AHRQ Safety Program for Surgery highlights the importance of addressing both technical and social complexity. SSI reduction has high technical complexity (requiring multiple interventions in multiple care locations) and high social complexity (requiring the collaboration of multiple teams). As such, it takes time to build the relationship and implement interventions to address both technical and social complexity.

Future surgical collaborative programs should focus on creating an enabling infrastructure within participating organizations, engaging clinicians from across the perioperative care continuum, and fostering participation from patients.

Project Background

Surgical site infection (SSI) prevention remains a global public health priority. Patients in acute care hospitals underwent more than 16 million surgical procedures in the United States in 2010.[1] Using National Healthcare Safety Network (NHSN) definitions and surveillance methods, the overall national SSI rate is approximately 1.9 percent. SSIs are the third most costly healthcare-associated infection (HAI) per event, accounting for more annual health care costs than any other major HAI.[2] SSIs are among the most common HAIs: A recently published point-prevalence survey of HAIs across 10 States showed that 4 percent of patients had one or more HAI by NHSN definitions, and SSIs accounted for approximately 20 percent of all HAI cases.[3] SSIs continue to impart an enormous burden on patients, their families, employers, and society.

Despite significant effort, progress towards reducing SSI and other complications in the surgical population has remained an elusive goal. Recent data from the Medicare Patient Safety Monitoring System found that rates of adverse events did not substantially decline for patients with conditions requiring surgery from 2005 to 2011.[4] In fact, infection-related events (e.g., central line-associated bloodstream infection, ventilator-associated pneumonia) and post-procedural adverse events (e.g., postoperative venous thromboembolic events) significantly *increased*.

The Department of Health and Human Services and other agencies have established goals toward the elimination of SSI and other complications as part of the National Action Plan to Prevent HAI; however, broad generalizable models for improvement do not exist. Multiple studies have demonstrated that compliance with the Centers for Medicare and Medicaid Services (CMS) Surgical Care Improvement Project (SCIP) process measures is necessary but not sufficient for SSI prevention.[5] More recently, the Michigan Health and Hospital Association's Keystone Surgery project, a statewide quality improvement collaborative that combined SCIP compliance and an intervention to improve local safety culture, demonstrated no significant difference in SSI reduction compared to nonparticipating hospitals in the state.[6]

The lack of national improvement in surgical safety is in contrast to other successful HAI prevention projects. During 2009 to 2012, more than 1,000 hospitals joined AHRQ's CUSP project to eliminate central line-associated bloodstream infections (CLABSI) in their intensive care units (On the CUSP: Stop BSI) and achieved an overall 43 percent decrease in CLABSI rates.[7]

Unit-level improvement teams implemented three interventions as part of the national program[8]:

1. Multifaceted intervention to prevent CLABSI that included checklists of evidence-based practices for catheter insertion and maintenance;
2. Comprehensive Unit-based Safety Program (CUSP) to engage frontline teams and improve safety culture and teamwork; and
3. Measurement and feedback of CLABSI data to improvement teams and senior leaders.

Their indisputable success shows that engaged teams can transform care when they own a problem, apply proven improvement strategies, and learn from each other.[9,10]

Progress towards eliminating SSI and other surgical complications will require a multifaceted strategy to—

- Engage frontline clinicians and hospital leaders;
- Utilize performance measures clinicians believe are valid;

- Adapt methods based on local context to ensure patients receive evidence-based therapies; and
- Implement a process to improve culture and teamwork and learn from mistakes.

Program Implementation

National Project Team and Clinical Community

The National Project Team (NPT) tapped the collective wisdom of quality improvement experts, diverse stakeholder groups, and clinicians to develop, implement, and evaluate the AHRQ Safety Program for Surgery as an innovative national project to help hospitals develop a sustainable infrastructure for perioperative quality improvement and reduce surgical complications. Building on the success of the *On the CUSP: Stop BSI* program, the NPT aimed to cultivate a clinical community–an enduring network of organizations accountable for efficient and effective sharing of knowledge, and supportive of improvement and innovation. The NPT envisioned the clinical community within a broader project structure, similar to a fractal.

"Fractals, such as ferns, have self-similar patterns, wherein the whole object has the same shape as one or more of its parts, and all of the parts are connected to support and shape the larger structure in which it resides." [11] The NPT served as the centralized improvement core, including a diverse group of experts in multiple improvement disciplines and worked to create horizontal peer-learning structures across all levels of project participation, spreading similar improvement structures to coordinating entities, hospitals, and surgical teams. The NPT included faculty from the Armstrong Institute for Patient Safety and Quality, the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP®), the University of Pennsylvania, and the World Health Organization, informed by a Technical Expert Panel (Table 1).

Table 1. AHRQ Safety Program for Surgery National Project Team

PARTNER	ROLE
Armstrong Institute for Patient Safety and Quality	The mission of the Armstrong Institute is to partner with patients, their loved ones, and all interested parties to end preventable harm, to continuously improve patient outcomes and experience, and to eliminate waste in health care. The Armstrong Institute enhances the value of care internationally by advancing the science of patient safety and quality through discovery, implementation, education, evaluation, and collaborative learning. As prime contractor, the Armstrong Institute was responsible for project management, budget oversight, recruitment of coordinating entities (CEs), and development of CE resources. As content experts, Armstrong Institute faculty provided educational content and resources for AHRQ Safety Program for Surgery implementation at the hospital level.
American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP)	ACS NSQIP is a validated, risk-adjusted, outcomes-based program to measure and improve the quality of surgical care in private sector hospitals. More than 600 hospitals currently participate in the program. ACS NSQIP staff participated substantially in hospital recruitment with a focus during year one on States with significant NSQIP participation. The ACS provided ongoing perspective and technical expertise for the development of interventions to reduce surgical complications. Recognizing the critical role of surgeons in this work, in collaboration with leading surgeon thought leaders, they developed a leadership course for surgeons focused specifically on quality improvement. The course has been administered twice and will become an enduring offering of the ACS.
University of Pennsylvania	The ethnography team from the University of Pennsylvania assessed the efforts to reduce surgical complications in participating hospitals using qualitative techniques, including observation, interviews and documentary analysis. The team aimed to develop the evidence base on how context impacts the outcome of quality improvement initiatives. Throughout the safety program, the team presented their findings to facilitate program implementation.
World Health Organization (WHO)	The WHO Patient Safety Program selected, engaged, supervised, and evaluated international sites participating in the safety program. A key aspect of this activity was the translation of program materials into other languages as well as adaptation of the protocols and tools for implementation in settings with limited resources.
Technical Expert Panel (TEP)	The TEP was composed of clinicians, researchers, quality improvement experts, and State hospital association staff. The TEP provided guidance on program messaging, implementation, and evaluation.

The clinical community consisted of peer hospitals, coordinating entities (CEs) and other stakeholders (Table 2) connected via a variety of peer-learning structures described later in this report.

Table 2. AHRQ Safety Program for Surgery Stakeholders

STAKEHOLDER	DESCRIPTION
Department of Health and Human Services (HHS)	HHS is the United States Federal Government's principal agency for protecting the health of all Americans and providing essential human services, especially for those who are least able to help themselves.
Agency for Healthcare Research and Quality (AHRQ)	One of the 11 agencies within HHS, AHRQ works to improve the health care delivered to Americans. The AHRQ mission is to produce evidence to make health care safer, higher quality, more accessible, equitable and affordable, and to work with HHS and other partners to make sure that the evidence is understood and used. AHRQ funded this Safety Program for Surgery.
Coordinating Entities (CEs)	CEs recruited hospital perioperative teams, led monthly coaching calls, and coordinated the project at the State or regional level. CEs were State hospital associations (SHAs) or Hospital Engagement Networks (HENs). The Center for Medicare & Medicaid Innovation (CMMI) HENs coordinate a range of collaborative improvement activities with hospitals, including efforts to reduce surgical site infections, among other harms. Both CMMI and AHRQ agreed that CMMI-funded HENs could use the AHRQ Safety Program for Surgery to fulfill their responsibility to reduce preventable harm from SSI.
Perioperative Teams	CEs recruited hospitals and ultimately perioperative teams, often spanning the preoperative unit, operating room, post-anesthesia care unit, and surgical intensive care unit or floor. Perioperative teams were responsible for collecting and submitting project data (surgical site infection data and safety culture data), implementing program interventions in their work area, and participating in coaching and content calls.
Patients and Families	Patients and families were the ultimate target audience for this improvement collaborative.

NPT Structure

Successful conduct of large-scale implementation research in a dynamic health care environment requires a clear strategic vision, operational flexibility, and the engagement of diverse stakeholder groups. A team structure featuring decentralized leadership and decision-making improved the NPT's capacity to navigate the complexities of a national implementation research project. We structured the team to feature a strategic and operational leadership core of lead faculty and a program and project manager. The leadership core informed and was informed by faculty co-investigator and staff leads of integrated workgroups (e.g., intervention development and implementation, database management and evaluation, contracts and financial management). Restructuring was associated with improved timeliness of deliverables, data acquisition rates, and hospital recruitment.

Project Participation

Recruitment Strategy

In the development of a recruitment strategy, the NPT addressed two concurrent project aims:

1. The demonstration of a surgical unit-based safety program, and
2. Hospital participation in that program on a national scale.

Two key questions shaped the NPT's recruitment plan:

1. How do we reach the most participants while maintaining a rigorous program evaluation design?
2. How do we evaluate the program in near real time to determine if our approach is working, especially with a 6-month SSI data lag?

All acute care hospitals across the United States and Puerto Rico were eligible to participate in the AHRQ Safety Program for Surgery. The NPT used narrow recruitment criteria in the base year and progressively expanded it over option years one and two. In the project's base year, the NPT recruited hospitals participating in ACS NSQIP. In option year one, following development of a mechanism for CEs to transfer NHSN data files into the project database, the NPT expanded recruitment criteria to include NHSN-participating hospitals reporting colon procedure data. In October 2013, the NPT opened recruitment to hospitals conducting any procedure for which there was an ACS NSQIP® or NHSN surgical procedure code. Cohort 5, recruited after October 2013, was the largest in the project, likely due to expanded recruitment criteria and a streamlined recruitment process.

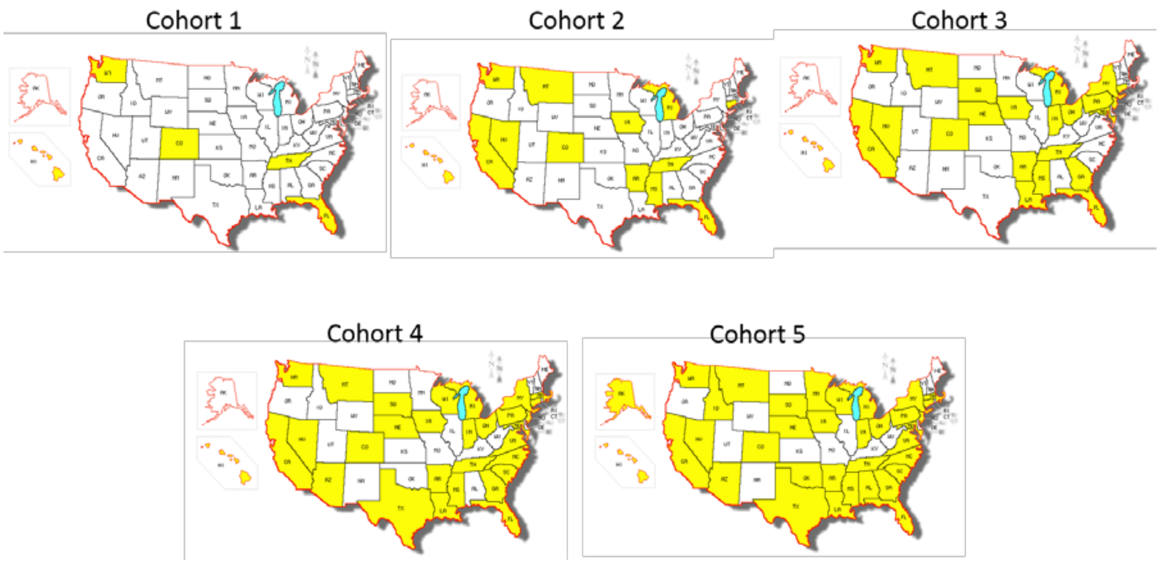
Aligning Efforts With the CMS Center for Medicare and Medicaid Innovation's Partnership for Patients

In December 2011, the Center for Medicare and Medicaid Innovation funded HENs to address 10 areas of patient harm, including SSI, as part of its Partnership for Patients. AHRQ Safety Program for Surgery research faculty met with the HEN National Content Developer and determined that hospitals within a HEN could leverage this program as an opportunity to address SSI. The program team partnered with state hospital associations and HENs to recruit hospitals, distinguishing it from other surgical safety efforts and emphasizing those hospitals could fulfill HEN requirements through participation in this safety program.

Recruitment, Enrollment, and Retention

The NPT defined hospitals as "recruited" if they returned a nonbinding participation agreement signed by the hospital CEO. Nineteen coordinating entities (CEs)–9 State hospital associations (SHAs) and 10 Hospital Engagement Networks (HENs), recruited 220 hospitals from 37 States to implement the AHRQ Safety Program for Surgery (Figure 5).

Figure 5. Cumulative State Enrollment by Cohort



The NPT defined hospitals as “enrolled” if they returned a project registration form and data use agreement (DUA) to the NPT. Five cohorts of hospitals enrolled in the AHRQ Safety Program for Surgery. Cohort 1 enrolled during the base year, cohorts 2 and 3 during option year one, and cohort 4 and 5 during option year two. One hospital from Canada and one from England also joined in cohort 5. Overall, 197 hospitals, representing 376 perioperative teams, completed the enrollment process. Of 197 hospitals, 17 hospitals or 8.6 percent representing 26 perioperative teams or 6.9 percent, withdrew from the project before the conclusion of their cohort.

Hospital Demographics Comparison Between NHSN and NSQIP Hospitals

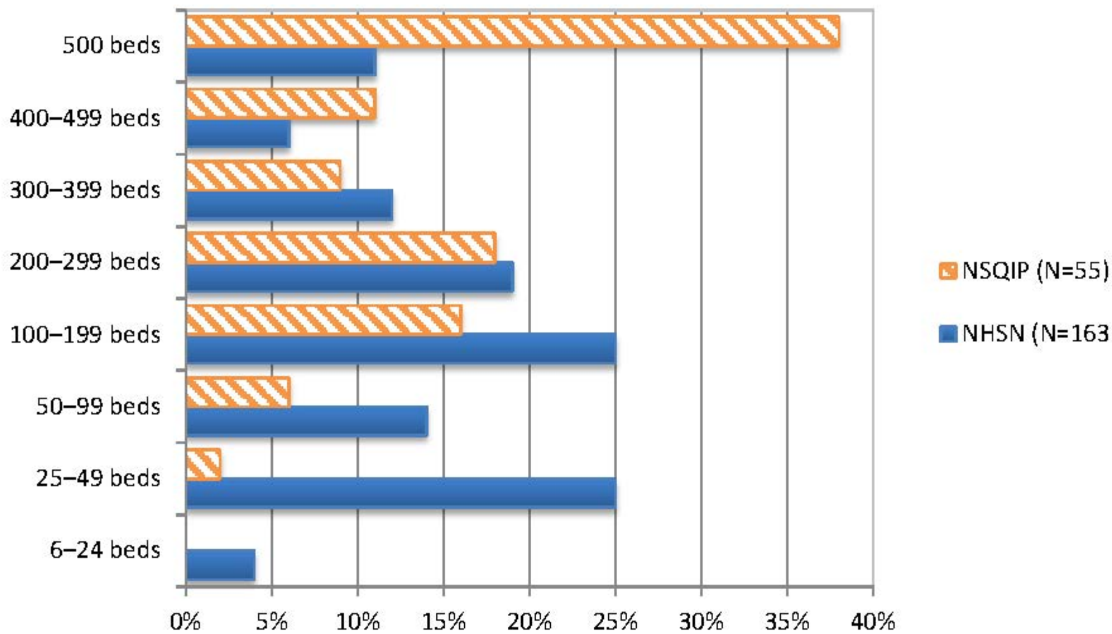
The majority of enrolled hospitals were community hospitals, followed by tertiary centers and critical access hospitals. Many hospitals were also academic/teaching hospitals. Hospitals were fairly evenly spread between urban, suburban, and rural settings. A breakdown of these demographics is provided in Table 3.

Enrollment by hospital bedside is provided in Figure 6.

Table 3. Hospital Demographics Comparison Between NHSN and NSQIP Hospitals

	NHSN	NSQIP
Participating hospitals (N=197)	83% or 163 hospitals	28% or 55 hospitals
Type of hospital	77% community	60% community
	6% critical access	5% critical access
	17% tertiary centers	35% tertiary centers
Academic/teaching hospitals	70%	64%
Hospital setting	31% urban	47% urban
	36% suburban	40% suburban
	33% rural	13% rural

Figure 6. Hospital Bed Size Comparison Between NHSN and NSQIP Hospitals



Assessing Project Retention

In option year two, the NPT initiated a plan to proactively assess hospital enrollment. Some hospitals had returned nonbinding participation agreements, but never submitted enrollment materials, such as registration forms or data use agreements. Without enrollment materials, CEs and the NPT could not transfer hospitals' surgical procedure and SSI data files into the project database. The NPT began a process of progressive outreach, often coordinated through CEs, to determine if hospitals that had not submitted enrollment materials were actively participating or intended to participate. CE leads with initially high recruitment numbers but lower enrollment explained that many of their hospitals participated in similar projects or that resource constraints prohibited meaningful project participation.

Educational Program

In contrast to HAIs like CLABSI and ventilator-associated events, evidence for SSI prevention is less mature--one simple behavioral checklist or "bundle" does not exist.[6] Process measures exist: A major success of the CMS-sponsored SCIP was the development of process measures to improve surgical care and reduce SSI (Table 4).

Table 4. Surgical Care Improvement Project Measures From CMS Hospital Compare Web Site[a]

MEASURE	DESCRIPTION
Prophylactic antibiotic received within 1 hour prior to surgical incision	Surgery patients who were given an antibiotic at the right time (within 1 hour before surgery) to help prevent infection
Prophylactic antibiotics discontinued within 24 hours after surgery end time	Surgery patients whose preventive antibiotics were stopped at the right time (within 24 hours after surgery)
Prophylactic antibiotic selection for surgical patients	Surgery patients who were given the right kind of antibiotic to help prevent infection
Cardiac surgery patients with controlled 6 a.m. postoperative blood glucose	Heart surgery patients whose blood sugar (blood glucose) is kept under good control 18–24 hours after surgery
Urinary catheter removed on postoperative day 1 or postoperative day 2 with day of surgery being day 0	Surgery patients whose urinary catheters were removed on the first or second day after surgery
Surgery patients with perioperative temperature management	Patients having surgery who were actively warmed in the operating room or whose body temperature was near normal by the end of surgery

[a]*https://www.medicare.gov/hospitalcompare/Data/Measures-Displayed.html (accessed 2015); https://data.medicare.gov/data/archives/hospital-compare*

Nevertheless, perfect adherence to these process measures did not result in reduced infection rates or improved surgical outcomes in some studies.[5] Moreover, recently published in the journal *JAMA Surgery*, a checklist-based intervention combined with a program to improve local safety culture did not lead to significant reductions in SSI and other adverse surgical outcomes.[6]

The NPT, then, needed to address two key questions in the design and implementation of the SUSP program:

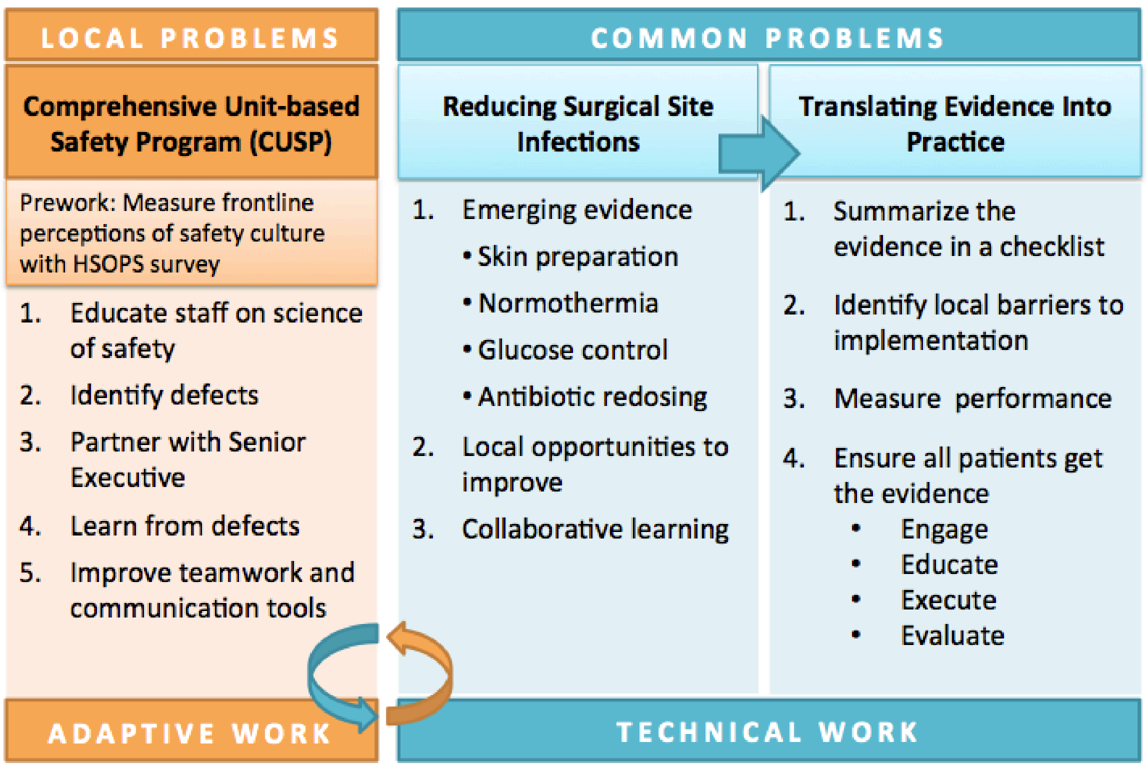
1. Why is adherence to SCIP measures necessary but not sufficient for SSI reduction (i.e., what are the right training objectives for SSI reduction)?
3. If the training objectives are more complex than consistent implementation of a checklist, how do we best convey them to CEs and safety program teams? What are the appropriate instructional strategies?

Training Objectives

SSIs are complex—procedure, patient, bacteria, and environmental factors all likely impact their development. It is likely that the SCIP processes, although important, are only a small piece of an effective SSI prevention program.[12] Defects leading to SSIs in one hospital are likely different from the contributing defects in other hospitals.[13] Additionally, for many clinicians, SCIP adherence is an exercise in documentation or "checking a box." The NPT needed to develop a program to "meet hospitals where they are" in the SSI prevention journey, help improvement teams identify local defects leading to SSIs across multiple different hospitals and surgical patient populations, and reengage clinicians to lead efforts to improve care for surgical patients and ensure that all patients received evidence-based care.

Instead of a checklist-based intervention, the NPT featured a multifaceted intervention including a modified version of the CUSP and the Translating Research into Practice (TRIP) model (Figure 7).

Figure 7. AHRQ Safety Program for Surgery Framework



The AHRQ Safety Program for Surgery emphasized three core activities for the development of locally relevant SSI prevention bundles (e.g., Step 1 of TRIP model to summarize the evidence).

Tap the Wisdom of Frontline Staff

Frontline providers understand patient safety risks in their perioperative area. They develop tactics to safeguard their patients against them in their everyday work. The NPT encouraged participating hospital teams to tap into frontline providers' knowledge about local practice to identify potential defects that may be leading to SSIs and use that wisdom to guide improvement efforts. Program teams were encouraged to query their entire perioperative staff using the Perioperative Staff Safety Assessment (PSSA).

Adapted from the CUSP Staff Safety Assessment, the PSSA asks two questions:

1. How will the next patient develop a surgical site infection?
2. What can be done to prevent this infection?

Audit Local Practice

Many organizations have documented near perfect compliance with SCIP process measures, yet additional opportunities to improve likely exist. For instance, SCIP measures adherence in antibiotic selection and timing as well as the use of convective warmers as a surrogate for maintenance of normothermia. The majority of patients may receive the right antibiotic at the right time, but may not receive the right dose of antibiotic. Alternatively, patients may be hypothermic during procedures despite the use of convective warmers. Other problems, or defects, may contribute to the development of SSIs. The NPT encouraged perioperative teams to better understand local defects through auditing of clinical practice and provided teams with practical auditing tools.

Apply Emerging Evidence for SSI Reduction

The body of evidence regarding SSI prevention continues to evolve and mature. Several professional societies recently released new guidelines summarizing effective interventions and current evidence-based recommendations. For example, the American Society of Health-System Pharmacists, Infectious Diseases Society of America, Society for Healthcare Epidemiology of America, and the Surgical Infection Society collectively released new guidelines for antimicrobial prophylaxis in surgery in early 2013.[14] These guidelines include recommendations on antibiotic dosing, redosing, weight-based dosing, and use of mechanical bowel preparation with oral antibiotics for colon surgery. In addition, the Healthcare Infection Control Practices Advisory Committee also released a draft version of updated SSI prevention guidelines in 2014 that incorporated updated evidence on, for example, glycemic control, normothermia, and oxygenation. The NPT reviewed updated SSI prevention guidelines with hospital teams and encouraged teams to consider incorporating these recommendations into their SSI prevention bundles.

The AHRQ Safety Program for Surgery encouraged teams to review the findings of these activities with their team and decide what interventions to include in their SSI prevention bundle. Thus, the program did not advocate for a single SSI prevention bundle. Rather, the SSI prevention bundles were developed locally and varied widely among participating hospitals. While we did not collect information regarding SSI prevention bundles across all participating hospitals, we provide some insights later in this report.

After participating teams identified local defects through application of CUSP, they used the TRIP model to identify, operationalize, and implement evidence-based practices to address those defects. Participating teams rolled out the AHRQ Safety Program for Surgery across three project phases: Onboarding, Implementation, and Sustainability. See Table 5 for a detailed list of training objectives and content call topics.

The monthly modules within each phase included learning objectives, action items, and deliverables. The NPT developed phase-specific project management guides to communicate module objectives and expectations, and help participating teams anticipate project work.

Table 5. Training Objectives by Program Phase

PHASE	TRAINING OBJECTIVES	CONTENT CALL TOPICS
Onboarding **(Months 0–6)**	*After phase, teams should be able to–* Distinguish between technical and adaptive work Measure perioperative safety culture and surgical site infection (SSI) rates and debrief those data with frontline staff and senior executive Develop a tailored SSI prevention bundle by tapping the wisdom of frontline staff and auditing surgical care processes	0. Kickoff Webinar 1. How to Use the Project Portal: A Training Call for Team Facilitators 2. Educate on the Science of Safety and Identifying Defects 3. Engage Senior Executives in SSI Prevention Work 4. Turning Data into Action: Using HSOPS and SSI Data as Part of Meaningful Change 5. Build an SSI Prevention Bundle 6. Perform an SSI investigation
Implementation **(Months 7–20)**	Develop a strategy to educate key stakeholders, including all frontline staff, about the SSI prevention bundle Evaluate the effectiveness of the SSI prevention bundle Present the SSI prevention bundle process data and SSI outcome data to hospital leadership, frontline staff, and other key stakeholders Implement a plan to assess and improve the quality of briefings and debriefings in their operating room	7. Implement Your SSI Prevention Bundle 8. Program Hospital Team Experiences 9. Learning From Defects Through Sensemaking I 10. Learn From Defects Through Sensemaking II 11. Optimize Briefings and Debriefings 12. Audit Briefings and Debriefings 13. Annual Call 14-20. (Alternating) Program Hospital Team Experiences calls and technical calls on current surgical topics
Sustainability **(Months 21–24)**	Readminister the Hospital Survey on Patient Safety Culture (HSOPS) to team and debrief on the results Prioritize the needs for successful sustainability and spread Continue to use the Learning From Defects tool on a quarterly basis to address local defects in their perioperative area	21. HSOPS Readministration and Culture Debriefing 22. Sustain and Spread Surgical Safety Improvements 23. Learn From Defects for Sustainability 24. Deep-Root Your Data

Instructional Strategies

Content Calls

Content delivery mirrored the approach from the AHRQ national *On the CUSP: Stop BSI* project. Following a kickoff webinar, NPT faculty delivered core content to CEs and perioperative teams during monthly, 60-minute, didactic content calls. Participating hospital teams and surgical quality experts from outside the NPT also delivered presentations on content calls during the Implementation Phase. Program materials were distributed to CEs and hospital teams on a weekly basis.

Program Web Site

The NPT developed the project Web site as a central resource for project content and data, and a link to a project-specific social networking site. The portal included the project database, a central repository of data that the NPT, CEs, and hospital teams used to evaluate the impact of AHRQ Safety Program for Surgery interventions on perioperative safety culture and SSI rates. Since the Web-based portal went live in September 2012, Google Analytics tracking shows that viewers visited its pages more than 65,500 times, or on average of 2,100 times per month.

The five most frequently visited pages after the primary landing page are listed here:

- My Tools;
- CUSP Resources;
- SSI Resources;
- CUSP Sessions; and
- HSOPS (Hospital Survey on Patient Safety Culture) Resources.

Peer-Learning Structures

The culture change literature and our own experience indicate a higher likelihood of acceptance and sustainment when peers drive programs.[10] At the hospital level, the NPT worked to connect perioperative teams that were working on surgical patient populations (e.g., orthopedics, neurosurgery, or obstetrics) or similar evidence based interventions (e.g. in glucose control, operating room traffic, or antibiotic redosing). The NPT developed several structures to facilitate horizontal learning among peers and attempted to answer two key questions:

1. What was the “right” way to define peer groups—by surgical service line, hospital size, provider role, or process measures?
4. In the absence of funding for face-to-face meetings, what was the best venue for connecting peer groups?

The NPT offered four horizontal peer-learning structures at the hospital level: monthly coaching calls, an online social network, affinity groups and email group, and a surgeon leadership course focused on quality improvement.

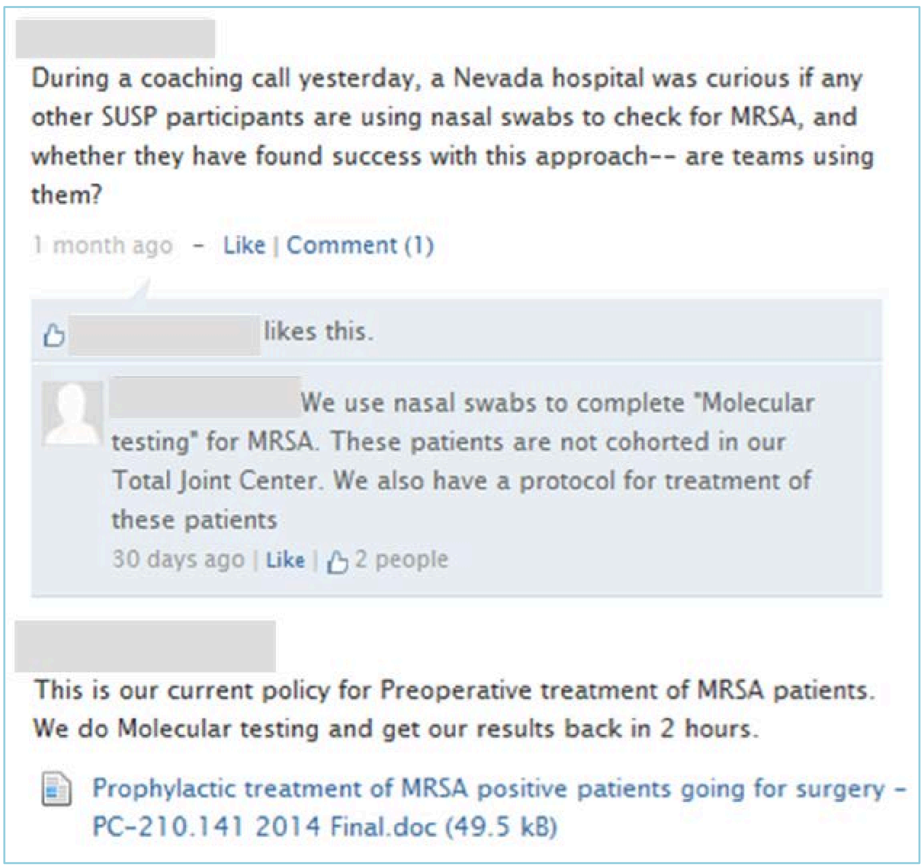
Coaching Calls

Coordinating entity-led coaching calls provided safety program teams with an opportunity to ask questions, share challenges and triumphs, and review SSI data reports aggregated at the CE level. The NPT assigned a coach and coordinator to conduct monthly calls with each CE. During calls, the program faculty-coach reinforced key concepts related to technical and adaptive work, and the research staff-coordinator highlighted project milestones and facilitated action planning. This feedback structure enabled the NPT to make informed adjustments to instructional strategies and standard operating procedures.

Online Social Network

The online social network offered a secure place to post messages, share documents and clinical protocols, and send private messages. Though some perioperative teams used the social network to connect, it did not develop into a self-sufficient platform for learning and sharing. Figure 8 shows a few comments from participants. Many teams and CEs expressed that participation was limited due to many competing priorities.

Figure 8. Posts to the SUSP Social Network



Affinity Groups and Email Distribution List

In 2014, the NPT created four additional series of high-level, technical surgical topics:

- Early recovery,
- Preoperative care,
- Environmental management, and
- Adherence to SCIP measures.

In addition to quarterly calls for each affinity group (with the exception of a bimonthly early recovery call), the NPT registered participating hospitals in an affinity group-specific email distribution list, or listserv. Peer-to-peer communications were more frequent on the listservs than on the online social network, likely because the listserv is embedded into existing email workflow.

Surgeon Leadership Course

As described earlier, qualitative project evaluation included ethnographic interviews at participating hospitals. Those interviews, along with feedback from teams during coaching calls, suggested that surgeon engagement was a barrier to successful implementation. Nevertheless, surgeons may lack relevant knowledge and leadership skills necessary to lead perioperative improvement efforts.

To address this barrier and foster peer learning, the American College of Surgeons (ACS) hosted a surgeon leadership course during the annual ACS Clinical Conference in October 2014. Entitled Surgeons Leading Quality, the course was taught by national leaders in quality improvement. Surgeons affiliated with AHRQ Safety Program for Surgery participating hospitals were invited to attend.

Course objectives applied to surgeons practicing in all types of settings:

- Describe quality in surgery and understand metrics used to assess quality;
- Develop your role as a surgeon leader within your organization's quality improvement infrastructure;
- Evaluate quality improvement resources and needs in your practice environment;
- Apply quality improvement techniques to your practice environment;
- Identify common barriers to quality improvement efforts;
- Develop strategies to improve quality in your work setting; and
- List next steps for your quality improvement efforts.

Course designers limited attendance to 60 surgeons to allow for an interactive learning model and to encourage networking among participants. Once registration exceeded 75 participants, the waiting list was closed despite continuing interest. Course instructors used a range of instructional methods including lecture, panels, small group discussions and hands-on activities.

More than a dozen national surgeon leaders contributed the course content and delivery. The agenda was developed around anticipated common questions a surgeon new to patient safety might ask:

- What is quality in surgery?
- What is safety culture? Does it matter?
- What is the surgeon's role in promoting quality? (Why am I taking this course?)

- What is our hospital's quality improvement infrastructure?
- What should I know about Medicare quality reporting?
- How do I tackle quality improvement challenges? Systems approach
- How do I tackle quality improvement challenges? Engagement and stakeholders
- What are common barriers to quality improvements? How do I overcome those barriers?
- What do I do on Monday morning? Practical tip panel discussion

We used a post-course evaluation to collect immediate reactions to the course. Thirty-seven participants assessed the course. The vast majority of participants indicated that they found value in the course, especially in the examples and case studies provided. Most of the participants anticipated that they would use what they learned in their practice. We had the opportunity to survey course participants again 3 months post-course (January 2015), and received feedback from 18 participants. Although many encountered barriers, the majority of participants continued to find value in the knowledge gained in the course and continued to use quality concepts in their work.

Email Helpdesk

The AHRQ Safety Program for Surgery had many moving parts. The NPT established an email helpdesk to address questions and requests from teams. The NPT used issue-tracking software, connected to the helpdesk email account, to manage technical assistance requests and insure their timely resolution. The email helpdesk was also the primary avenue for communication to CEs and hospital teams. The NPT sent weekly updates and significant ad hoc communications through the helpdesk account.

Implementation Assessment

The NPT sought to systematically assess how (and if) content and instruction led to behavior changes at the hospital level. In August 2014, the NPT launched an intensive assessment of program activities at participating hospitals (i.e., enrolled hospitals, excluding withdrawn hospitals). In each of the five cohorts, the NPT assessed all participating hospitals via a Web-based questionnaire. Additionally, the NPT assessed by telephone about one third of the total number of actively participating hospitals; hospitals contacted via telephone were randomly selected. Table 6 lists the sample size by cohort for the two groups assessed.

Table 6. Hospitals by Cohort Invited To Participate in Implementation Assessment

COHORT	IMPLEMENTATION ASSESSMENT INVITATION (N)	RANDOM ONLINE AND TELEPHONE ASSESSMENT INVITATIONS N (%)	ONLY ONLINE ASSESSMENT INVITATIONS N (%)
1 and 2	60	14 (23.3%)	46 (76.7%)
3	43	11 (25.6%)	32 (74.4%)
4	39	15 (38.5%)	24 (61.5%)
5	51	24 (47.1%)	27 (52.9%)
Total	193	64 (33.2%)	129 (66.8%)

The online assessment consisted primarily of closed-ended questions. There were two versions of it, differing only by a query about scheduling a telephone interview for the randomly selected hospitals. Both versions required the respondent to provide basic demographic data (e.g., name, role on safety team, hospital name, email address, phone number), read the informed consent text presented and input a decision about continuing with the assessment, and included the following sections:

- Respondent's background—profession and role
- Education about science of safety
- Staff Safety Assessment
- Creating and implementing SSI bundle
- CUSP implementation
- Leadership support
- Barriers to SUSP implementation
- Self-assessment of engagement with safety program

The telephone assessment occurred after the online assessment, and probed for details to the responses provided online. This process enabled the NPT to better understand program implementation efforts from the same person who provided the quantitative data.

Table 7 lists response rates and the dates when the NPT assessed each cohort. The assessments began in August 2014 and concluded in August 2015.

Table 7. Online and Telephone Assessment Response Rates and Schedule by Cohorts

COHORT	ONLINE and TELEPHONE ASSESSMENTS N	TELEPHONE RESPONSE RATE N (%)	ONLINE RESPONSE RATE N (%)	ONLINE ASSESSMENT PERIOD	TELEPHONE ASSESSMENT PERIOD
1 and 2	14	7 (50.0%)	10 (71.4%)	08/26/2014 to 10/31/2014	9/14/2014 to 12/8/2014
3	11	4 (36.4%)	6 (36.4%)	1/5/2015 to 1/23/2015	1/23/2015 to 5/19/2015
4	15	12 (80.0%)	13 (86.7%)	11/12/2014 to 11/26/2014	11/26/2014 to 2/2/2015
5	24	12 (50.0%)	15 (62.5%)	3/2/2015 to 3/20/2015	3/20/2015 to 5/19/2015

Feedback gleaned from online and telephone implementation assessments helped the NPT better understand the hospital-specific barriers that hindered or facilitated safety program implementation. The telephone assessments offered the NPT an opportunity to provide implementation guidance and coaching. Preliminary Web-based and telephone assessment results indicated the following:

- Implementation efforts were often housed in infection prevention and control departments rather than in surgical units. Generally, when these efforts were housed in infection prevention and control departments, safety program team cohesion and engagement levels were low or nonexistent. Typically, the lead safety team member shared data, but the other clinical staff did not engage with the data and the lead team member did not have much influence over team activities.
- The majority of respondents who participated in the online and telephone assessments were clinicians—most predominantly nurses. However, a few physicians did participate, as did infection prevention and perioperative directors.
- Respondents reported having watched the science of safety video. There was variation, however, in how widely this video had become a part of their hospital or unit orientation. Respondents in the earlier cohorts (1, 2, and 3) more frequently reported having incorporated the video in the new employee orientations. Most respondents in cohorts 4 and 5 reported that their hospitals had not included the video as part of orientations, though a greater majority was preparing to do so.
- The majority of the respondents in all five cohorts reported that they had created an SSI bundle. While many hospitals in all five cohorts had implemented an SSI bundle, some common differences included the application of screening for MRSA among colorectal, joint, and cardiac surgery patients; having in place standard bowel prep with oral antibiotics for colorectal surgery; and having a protocol for maintaining sterility of operating room instruments in clean contaminated and contaminated procedures. When respondents were infection prevention personnel and in charge of the Safety Program for Surgery effort, some reported that they did not know what bundles were being implemented in the surgical unit. During the program, the NPT encouraged hospitals to develop SSI bundles, but left the selection of the bundle's component to each hospital. This approach resulted in variations among bundles (Table 8).

Table 8. SSI Bundle Components in Place by Cohort (Online assessment)

BUNDLE COMPONENT IN PLACE	COHORTS 1 and 2 (N=10)	COHORT 3 (N=5)	COHORT 4 (N=13)	COHORT 5 (N=15)
Perform briefings	70.0%	80.0%	53.8%[a]	80.0%
For cleaning contaminated cases, have protocol for separating dirty and clean instruments	90.0%	80.0%	38.5%	71.4%[b]
Have standard alcohol-based skin preparations	90.0%	100.0%	84.6%	80.0%
Have standard bowel preparations with oral antibiotics for colorectal surgery	50.0%	80.0%	23.1%	28.6%[b]
Have standard recommendations for antibiotics based on procedure	100.0%	100.0%	92.3%	100.0%
Recommended redosing of antibiotics	90.0%	100.0%	92.3%	86.7%
Recommended weight-based dosing of cephalosporins	80.0%	80.0%	92.3%	80.0%
Screen for methicillin-resistant *Staphylococcus aureus* (MRSA) colorectal, joints, and cardiac surgery	70.0%	60.0%	53.8%	50.0%[b]
Use forced-air warming devices in operating room for abdominal surgery	100.0%	60.0%	84.6%	92.9%[b]

[a] *N = 12*

[b] *N = 14*

- Respondents in cohorts 1, 2, and 3 reported having received greater leadership support than hospitals in cohorts 4 and 5.
- While SSI data were shared, respondents reported that not all safety teams engaged with the data for the purposes of improving patient safety.
- Perioperative safety teams respondents reported various factors that slowed program implementation across all 5 cohorts (Table 9). Competing priorities and distractions, as well as a lack of leadership support from physicians were the two reasons most cited by hospitals for slowing implementation efforts.

Table 9. Top Contributing Factors to Slow Implementation by Cohort (online assessment)

TYPE OF LEADERSHIP SUPPORT MISSING	COHORTS 1 and 2 (N=9)	COHORT 3 (N=5)	COHORT 4 (N=12)	COHORT 5 (N=14)
Insufficient knowledge of evidence supporting interventions	0 (0%)[a]	0 (0%)	1 (8.3%)	1 (7.1%)
Not enough leadership support from executives	2 (22.2%)	0 (0%)	2 (16.7%)	3 (21.4%)
Not enough leadership support from physicians	3 (33.3%)	2 (50.0%)[b]	5 (41.7%)	6 (42.9%)
Not enough leadership support from nurses	1 (11.1%)	0 (0%)	5 (41.7%)	1 (7.1%)
Insufficient autonomy/authority	2 (22.2%)	0 (0%)	1 (9.1%)[c]	2 (14.3%)
Lack of quality improvement skills	0 (0%)	0 (0%)	6 (50.0%)	1 (7.1%)
Confusion about how to proceed with CUSP activities	1 (11.1%)	1 (20.0%)	7 (58.3%)	3 (21.4%)
Lack of team member consensus regarding goals	0 (0%)	1 (20.0%)	4 (33.3%)	0 (0%)
Inability of team members to work together	0 (0%)	0 (0%)	3 (25.0%)	0 (0%)
Turnover on safety program team	1 (11.1%)	2 (40.0%)	3 (25.0%)	0 (0%)
Not enough buy-in from physician staff	3 (33.3%)	2 (40.0%)	4 (33.3%)	4 (28.6%)
Not enough buy-in from nursing staff	1 (11.1%)	0 (0%)	3 (25.0%)	1 (7.1%)
Not enough buy-in from other staff	1 (11.1%)	0 (0%)[b]	2 (16.7%)	2 (14.3%)
Not enough time	4 (44.4%)	3 (60.0%)	7 (58.3%)	6 (42.9%)
Staff turnover on unit	1 (11.1%)	3 (60.0%)	2 (16.7%)	4 (28.6%)
Data collection burden for staff	2 (22.2%)	2 (50.0%)[b]	3 (25.0%)	4 (28.6%)
Problems with data systems	4 (44.4%)	0 (0%)	4 (33.3%)	4 (28.6%)
Competing priorities or distractions (e.g., new electronic medical record, accreditation visit)	6 (66.7%)	3 (60.0%)	9 (75.0%)	5 (35.7%)

[a] *N = 8*
[b] *N = 4*
[c] *N = 11*

Program Impact

Reductions in Surgical Site Infection Rates

Participating AHRQ Safety Program for Surgery hospitals reported their SSI rates via the transfer of data files into the project database from the ACS NSQIP® and NHSN or both. The NPT completed the data file transfer process for hospitals reporting SSI rates through ACS NSQIP. CE leads transferred hospitals' SSI data from NHSN. Although the SSI definitions are the same for ACS NSQIP and NHSN, the details of the surveillance approach are different. At most hospitals participating in both programs, the ACS NSQIP colectomy SSI rate is almost 50 percent higher than the NHSN colon SSI rate. Therefore, the NPT analyzed NHSN and ACS NSQIP data separately.[15] Furthermore, we separated colon procedures from all other procedures because colon procedures are associated with an inherently higher infection rate.

Methods

This report uses SSI data gathered through August 2, 2015, from all enrolled hospitals; withdrawn hospitals (N=17) are excluded from the analysis (Table 10 and Table 11).

Table 10. Hospital and Perioperative Surgical Units Recruitment Data

	TOTAL HOSPITALS[a]	TOTAL SURGICAL UNITS[a]	NHSN HOSPITALS	NSQIP HOSPITALS
Recruited	220	400	N/A[b]	N/A[b]
Enrolled	197	376	163	55
Withdrawn	17	26	17	0
Included in analysis			146	55

[a]Hospitals could enroll for more than one surgical procedure and database (e.g., Hospital X enrolled its colectomy and obstetrics/gynecology procedures under both NHSN and NSQIP into the project). They are counted under both NSQIP and NHSN enrollment numbers, as well as under colectomy and non-colectomy procedures.
[b]Hospitals identified database type during enrollment.

Table 11. Hospital and Perioperative Surgical Teams Recruitment Data by Procedure

	HOSPITAL NHSN COLON	HOSPITAL NHSN NON-COLON	HOSPITAL NSQIP COLON	HOSPITAL NSQIP NON-COLON	UNIT NHSN	UNIT NSQIP	UNIT NHSN COLON	UNIT NHSN NON-COLON	UNIT NSQIP COLON	UNIT NSQIP NON-COLON
Enrolled	121	67	39	24	295	81	128	167	40	41
Withdrawn	0	0	0	0	25	1	7	18	1	0
Included in analysis	121	67	39	24	270	80	121	149	40	41
Missing data[a]	8	9	2	0	41	0	8	33	3	3
For final analysis[b]	**113**	**58**	**37**	**24**	229	80	**113**	**116**	**37**	**38**

NHSN = National Healthcare Safety Network; NSQIP = National Surgical Quality Improvement Program; SSI = surgical site infection

[a]*Some hospitals did not authorize CEs to transfer NHSN data into the project database, or mistakenly registered in the project (registered a surgical line that they did not report to NHSN).*

[b]*For final analysis figures are reflected in the SSI result tables below.*

The majority of hospitals participated in the AHRQ Safety Program for Surgery to reduce SSI after colon procedures but a subset of hospitals also focused on a variety of non-colon procedures (Table 12).

Table 12. Surgical Procedures Reported by Perioperative Teams and Reflected in Data Analysis

TEAMS	PROCEDURES INCLUDED IN SURVEILLANCE	NHSN SURGICAL TEAMS[a] (N=270)	NSQIP SURGICAL TEAMS[a] (N=80)
COLO	Colectomy	121	39
	NON-COLO TEAMS		
GSUR	Bile duct, liver, or pancreatic; rectal; herniorrhaphy; thyroid and/or parathyroid; appendix; small bowel; spleen; gastric; gallbladder; exploratory laparotomy surgery	34	19
ORTO	Knee and hip prosthesis, open reduction of fracture	39	3
OBGN	Abdominal hysterectomy, cesarean section, ovarian surgery, vaginal hysterectomy	29	3
CARD	Cardiac surgery, coronary artery bypass graft with both chest and donor site incisions, coronary artery bypass graft with chest incision only, pacemaker surgery	8	1
NEURO	Spinal fusion, refusion of spine, laminectomy, craniotomy, ventricular shunt	7	4
BRST	Breast surgery	5	0
NECK	Neck surgery	5	0
UROL	Prostate and kidney surgery	7	3
VASC	Carotid endarterectomy, abdominal aortic aneurysm repair, peripheral vascular bypass surgery, limb amputation, shunt for dialysis	6	4
THOR	Thoracic surgery	5	1
ABTP	Kidney transplant, liver transplant	1	0
PLAS	Flap, breast reduction, breast reconstruction, abdominoplasty	0	3

[a]Hospitals reported the number of SSIs (numerator) and the number of surgical procedures (denominator) on a monthly basis, the ratio of which constitutes the unadjusted SSI rate, defined as number of SSIs per 100 cases

The NPT collected baseline or pre-intervention data from 1 year prior to the start of each cohort. Cohort 1 and 2 post-intervention data collection began in July 2012; cohort 3 in February 2013; cohort 4 in October 2013; and cohort 5 in April 2014. The analysis in this report is a comparison of baseline SSI rates with post-intervention SSI rates for 15 months after implementation. We show the 15-month post-baseline data collection period as 5 consecutive quarters in reference to project timeline, not based on calendar quarters (Table 13).

Table 13. Data Collection Periods by Cohort

COHORT	BASELINE	Q1	Q2	Q3	Q4	Q5
1	July 11–June 12	Jul–Sep 12	Oct–Dec 12	Jan–Mar 13	Apr–Jun 13	July–Sep 13
2	Sep 11–Aug 12	Sep–Nov 12	Dec 12–Feb 13	Mar–May 13	Jun–Aug 13	Sep–Nov 13
3	Feb 12–Jan 13	Feb–Apr 13	May–Jul 13	Aug–Oct 13	Nov 13–Jan 14	Feb–Apr 14
4	Oct 12–Sep 13	Oct–Dec 13	Jan–Mar 14	Apr–Jun 14	July–Sep 14	Oct–Dec 14
5	Apr 11–Mar 14	Apr–Jun 14	July–Sep 14	Oct–Dec 14	Jan–Mar 15	Apr–Jun 15

Brief Commentary on Data Acquisition

In response to the low rate of data submission by CEs by option year 2, the NPT dramatically streamlined the NHSN data transfer process. Briefly, the initial SSI data transfer process included three high-level steps:

1. CE leads returned project registration forms and data use agreement (DUA) to the NPT;
2. Hospital teams registered in the online project database and attached an SSI reporting application to their network; and
3. CE leads downloaded numerator and denominator data files from NHSN and uploaded them into the project database on a monthly basis.

The NPT developed a new data collection standard operating procedure in response to CE leads' concerns about time burden. Research staff streamlined registration and DUA collection as part of the recruitment process. They partnered with the project database vendor to streamline remaining data transfer steps, developing a process to attach the SSI reporting application to hospital networks on behalf of each hospital and creating new functionalities in the database that cut data transfer time from approximately four hours to 30 minutes per month.

Additionally, research staff partnered with each CE lead to shepherd them through the data transfer process. The project team developed data transfer manuals and Webinars to teach data transfer and provided technical assistance to CE leads via the SUSP help desk and routine project calls. Data acquisition rates more than doubled between November 2013 and March 2014.

Analyses

The analysis separates the data into the following categories: NHSN colon versus NHSN non-colon procedures, and NSQIP colon versus NSQIP non-colon procedures. Relative reduction was calculated by subtracting the SSI rate for the last quarter from the baseline SSI rate divided by the baseline SSI rate. The differences between baseline SSI rate and SSI rate in the last quarter are tested by chi-squared tests. All analyses were conducted using STATA version 13.1 (Stata Corporation, TX, USA).

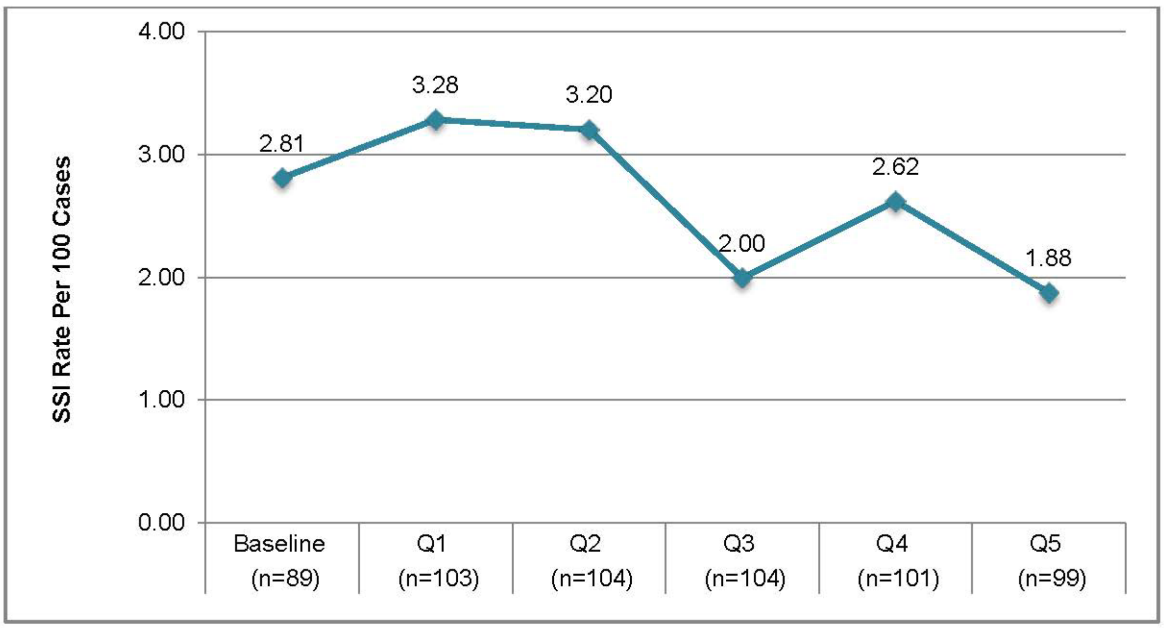
Results

The AHRQ Safety Program for Surgery was associated with a significant reduction in SSIs at participating hospitals. By comparing the fifth-quarter data with those of baseline, hospitals submitting NHSN SSI data observed a 33 percent relative reduction in SSIs for colon procedures and 34 percent reduction for non-colon procedures. Hospitals participating with ACS NSQIP data observed a 25 percent reduction in SSIs for colon procedures and 40 percent for non-colon procedures.

NHSN Colon Procedures and Non-Colon Procedures

SSI rates for the baseline and intervention period for NHSN colon and non-colon procedures can be found in Figure 9, Table 14, and Figure 10.

Figure 9. NHSN Colon Procedures: Perioperative Team-level Unadjusted SSI Rate Over Time[a]



n = number of perioperative teams
Baseline period was 12 months before program implementation.
Quarterly rate represents the average SSI rate across a 3-month project period.
[a]Paired analysis of unadjusted data from perioperative teams reporting baseline and followup data for any project quarter shows similar significant reduction in SSI rates (see Appendix).

Table 14. Summary NHSN Colon and Non-Colon Data Through Quarter 5

	PRE Baseline[a] 12 Months	POST Q1[b] Months 1-3	POST Q2[b] Months 4-6	POST Q3[b] Months 7-9	POST Q4[b] Months 10-12	POST Q5[c] Months 13-15
NHSN COLON PROCEDURES						
Number of Hospitals Reporting (N=113)	89	103	104	104	101	99
Number of Teams Reporting (N=113)	89	103	104	104	101	99
Total Number of Procedures	9,579	2,933	3,053	3,046	2,726	2,337
Total Number of SSIs	277	95	96	62	74	45
SSI Rate: (SSIs/Cases)×100	2.89	3.24	3.14	2.04	2.71	1.93
Relative Reduction (compared with baseline)						-33%
P Value[d]						0.012
NHSN NON-COLON PROCEDURES						
Number of Hospitals Reporting (N=58)	53	47	51	49	48	44
Number of Teams Reporting (N=116)	87	72	78	79	76	71
Total Number of Procedures	24,175	5,826	5,729	5,400	5,882	4,787
Total Number of SSIs	205	35	31	22	35	27
SSI Rate: (SSIs/Cases)×100	0.85	0.60	0.54	0.41	0.60	0.56
Relative Reduction (compared with baseline)						-33%
P Value[d]						0.046

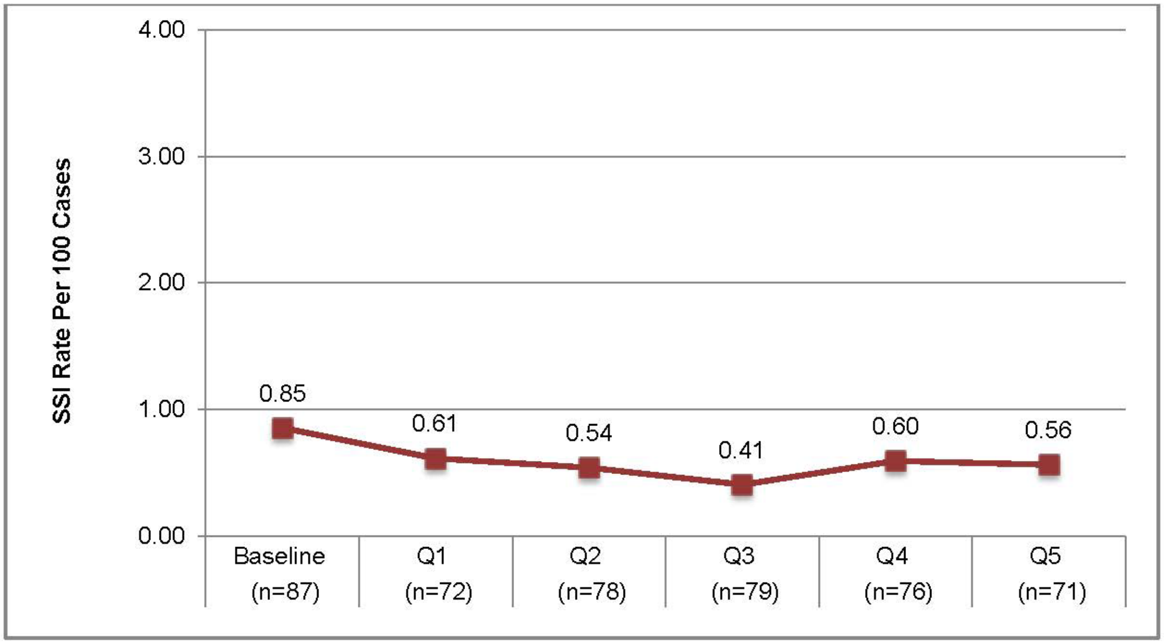
[a] *Actual number of hospitals and surgical teams reporting baseline data do not match the total N because CMS did not require hospitals to submit baseline data (Jul-Dec 2011) to NHSN for that time period.*

[b] *Actual number of hospitals and surgical teams reporting post- intervention quarterly data do not match the total N because if a team performed no procedures during a quarter they were excluded from that time period.*

[c] *Actual number of hospitals and surgical teams reporting post-intervention quarter 5 data does not match the total N because of the SSI surveillance requirements in reporting quarter 5 data for cohort 4 and 5 hospitals; data will be complete by August 2015.*

[d] *From chi-squared tests as compared to baseline*

Figure 10. NHSN Non-Colon Procedures: Perioperative Team-level Unadjusted SSI Rate Over Time



n = number of perioperative teams
Baseline period was 12 months before program implementation.
Quarterly rate represents the average SSI rate across a 3-month project period.

NSQIP Colon and Non-Colon Procedures

SSI rates for the baseline and intervention period for NSQIP colon and non-colon procedures can be found in Table 15, Figure 11, and Figure 12, respectively.

For both NSQIP colon and non-colon procedures, hospital participation in the AHRQ Safety Program for Surgery was associated with reduction in SSI rates. Although there was some rebound found in the third and fourth quarters, the SSI rates continued to drop in the fifth quarter. For participating hospitals, the ACS NSQIP colon procedure SSI rates declined from 12.44 per 100 surgical cases at baseline to 9.35 per 100 cases in the fifth quarter of the program (p=0.014). The overall relative reduction in the SSI rate was 25 percent. Participating hospitals focusing on non-colon procedures also saw a significant reduction—SSI rates declined from 3.83 per 100 surgical cases to 2.3 per 100 cases (p=0.004) with an overall relative reduction of 40 percent.

Table 15. Summary NSQIP Colon and Non-Colon Data Through Quarter 5

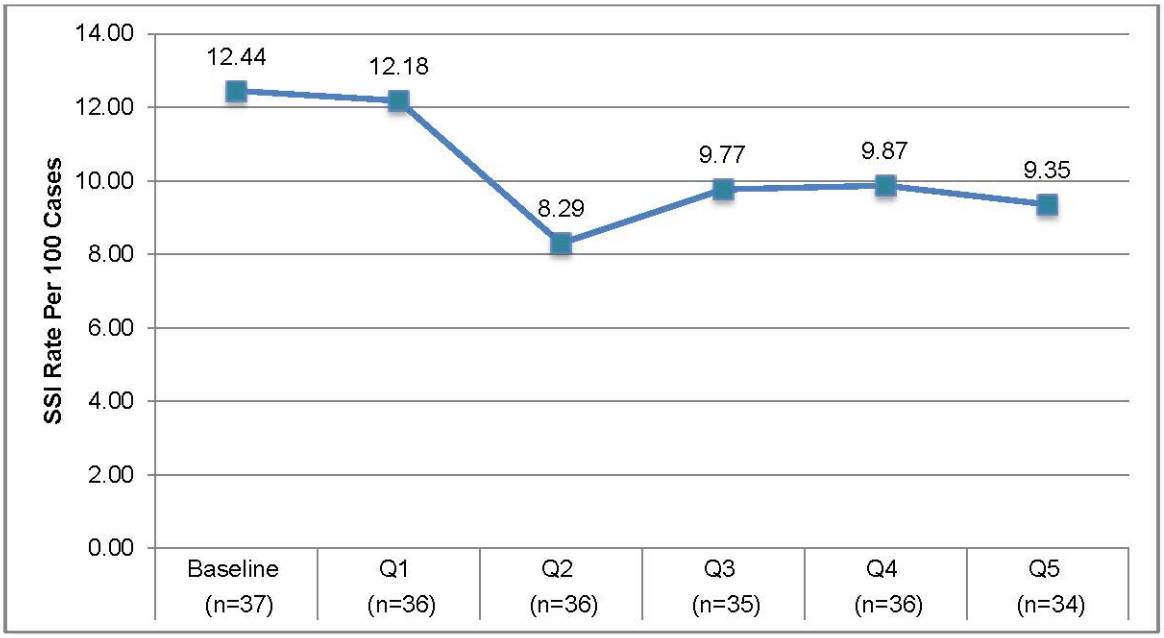
	PRE Baseline[a]	POST Q1[a]	POST Q2[a]	POST Q3[a]	POST Q4[a]	POST Q5[b]
	12 Months	Months 1-3	Months 4-6	Months 7-9	Months 10-12	Months 13-15
NSQIP COLON PROCEDURES						
Number of Hospitals Reporting *(N=37)*	37	36	36	35	36	34
Number of Teams Reporting *(N=37)*	37	36	36	35	36	34
Total Number of Procedures	3,970	1,018	1,025	942	912	802
Total Number of SSIs	494	124	85	92	90	75
SSI Rate: (SSIs/Cases)×100	12.44	12.18	8.29	9.77	9.87	9.35
Relative Reduction (compared with baseline)						-25%
P Value[c]						0.027
NSQIP NON-COLON PROCEDURES						
Number of Hospitals Reporting *(N=24)*	24	24	24	24	23	22
Number of Teams Reporting *(N=38)*	38	38	37	38	37	30
Total Number of Procedures	8,434	2,567	2,565	2,557	2,665	1,435
Total Number of SSIs	323	79	72	95	96	33
SSI Rate: (SSIs/Cases)×100	3.83	3.08	2.81	3.72	3.60	2.30
Relative Reduction (compared with baseline)						-40%
P Value[c]						0.005

[a]*Actual number of hospitals and surgical teams reporting baseline and post- intervention quarterly data do not match the total N because if a team performed no procedures during a quarter they were excluded from that time period.*

[b]*Actual number of hospitals and surgical teams reporting post- intervention quarter 5 data does not match the total N because of a delay in reporting quarter 5 data for cohort 4 and 5 hospitals, which is August 2015.*

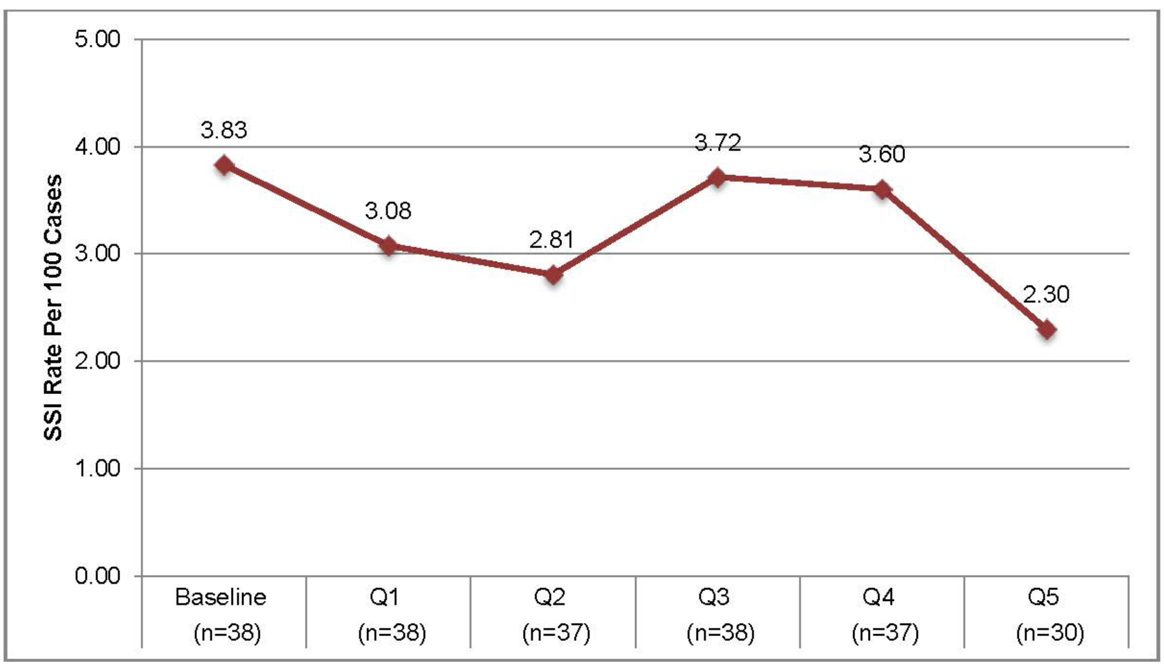
[c]*From chi-squared tests as compared to baseline*

Figure 11. NSQIP Colon Procedures: Perioperative Team-level Unadjusted SSI Rate Over Time



n = number of perioperative teams
Baseline period was 12 months before program implementation.
Quarterly rate represents the average SSI rate across a 3-month project period.

Figure 12. NSQIP Non-Colon Procedures: Perioperative Team-level Unadjusted SSI Rate Over Time



n = number of perioperative teams
Baseline period was 12 months before program implementation.
Quarterly rate represents the average SSI rate across a 3-month project period.

Conclusion and Discussion

The majority of hospitals participated in the AHRQ Safety Program for Surgery to focus on improving performance on colon procedures but a subset of hospitals focused on a variety of other procedures. Most hospitals reported NHSN data for surveillance but a subset did use ACS NSQIP data. Overall, regardless of surveillance program or surgical procedure type, AHRQ Safety Program for Surgery participation was associated with a significant reduction in SSI. In some hospitals, surgical teams performed a small number of surgical procedures during the project quarter (in some cases, zero). This led to "noise" in the data with variability by quarter. Despite this, participating hospitals realized significant improvements, suggesting that the CUSP model is an engaging framework for the implementation of perioperative quality improvement and patient safety programs.

Improvements in Safety Culture

An important early step in the AHRQ Safety Program for Surgery includes systematically measuring frontline care provider perceptions of the culture of safety in which improvement efforts are unfolding. The HSOPS is a reliable and valid survey designed to assess clinician and staff perceptions of the culture of safety within their unit, work setting, and overall hospital.[16] The instrument is designed to measure seven work setting-referenced safety culture dimensions, three hospital-referenced dimensions, and four outcome variables.

Methods

All participating hospitals within each cohort were invited to submit patient safety climate survey data collected with the HSOPS survey at 2 time periods throughout the project:

1. During the kickoff period for their cohort; and
2. During a followup period either 16 months (Cohorts 1-4) or 12 months (Cohort 5) after kickoff.

Each HSOPS data submission period was 8 weeks, with extensions for each cohort afforded as needed based on data submission rates. Teams could request individual team extensions as well, if needed.

Participating hospitals and work settings were invited to submit data to the project portal through one of two methods:

1. Collect new HSOPS data from their participating surgical areas using the online HSOPS survey tool available in the safety program portal, or
2. Upload HSOPS survey data previously collected during annual safety culture assessments conducted by their organizations.

During the kickoff period, teams choosing to upload HSOPS data were asked to upload only data collected in the 12 months prior to project kickoff. During followup, teams were invited to upload data collected in the 6 months (Cohort 5) or 12 months (Cohorts 1-4) prior to the start of the followup data submission period.

Outreach and Approach

In line with the original project management strategy, information concerning the baseline HSOPS data submission periods for Cohorts 1 through 3 was mediated through the participating coordinating entities (CE). The CEs served as the liaison between the AHRQ Safety Program for Surgery NPT and the participating hospitals; the CEs were therefore responsible for communicating project information, including HSOPS data submission periods and reminders, directly with survey coordinators at each participating hospital. This model limited direct contact between the NPT and survey coordinators on each team with the exceptions of content and technical training webinars or hospital team-initiated email or phone communication with the NPT helpdesk. The NPT elected to provide additional support to the hospital teams in order to increase the response rates. With permission from coordinating entities, the NPT moved to a direct outreach approach for cohorts 4 and 5.

For valid inferences from the HSOPS data the NPT sought a minimum response rate of 60 percent for hospital safety culture assessments. The NPT utilized several pathways to increase data submission rates: email helpdesk, email reminders, phone contact, and survey period extensions.

AHRQ Safety Program for Surgery Helpdesk

Hospitals, teams, and survey coordinators could directly contact the NPT via the helpdesk. Helpdesk inquiries included requests for information about the data upload procedure, the process for entering participant email addresses to the Web site, and the HSOPS survey open and close dates.

Email Reminders

Reminder emails were typically sent within the first 4 weeks of the 8-week HSOPS survey administration period to hospitals that had yet to begin survey upload. These hospitals were asked whether they were facing any problems conducting or uploading the surveys. Although few replies were received, those who responded indicated that they were collecting participant emails to upload into the program web portal. The NPT sent reminder emails near the end of the baseline and followup data collection periods with the approaching survey closure dates.

Phone Contact

In the fourth week of each cohort's data collection period, hospitals were contacted by phone and informed of their current HSOPS response rate(s). This call was intended to check in with the hospitals and serve as a reminder to those that had not yet started to begin survey administration or data upload. We prompted several hospitals to begin data collection; some hospital teams forgot about the survey deadline, while others elected not to participate in the HSOPS data collection process. Through this direct contact, we were able to identify barriers to data collection, such as a lack of understanding of how to upload the data to the online Web portal or an inability to find the raw data to upload. Some hospitals used these calls as an opportunity to report difficulties with participants receiving the survey notification emails, resulting in low participation rates. Help was offered to find and upload the raw data and resend survey notification emails. Though time intensive, direct contact helped us understand the issues the hospitals were facing, and we were able to increase hospital participation and individual response rates.

Survey Period Extensions

Extensions were granted to hospitals that needed extra time to complete their HSOPS surveys. For example, Cohort 3's followup data collection was conducted during the Ebola outbreak, which also overlapped with the winter holidays. Because quality control and infectious disease specialists were focused on these external factors, the followup data collection period was extended to January 31, 2015. However, Cohort 3 still failed to meet the desired minimum participation rates, necessitating an additional data collection extension through April 30, 2015.

Analyses

Bivariate correlation analyses were conducted to examine the relationships between hospital response rate, hospital sample size, safety culture outcomes, and the 10 HSOPS dimensions. Mean comparison analyses were also carried out to test change in perceptions of safety culture from baseline to followup. To be included in initial analyses, hospitals were required to have baseline or followup data from more than four respondents (hospital response rate range between 0 and 100 percent). Analyses of baseline-to-followup changes in HSOPS dimension scores were assessed using a two-tailed, independent groups t-test with Bonferroni correction for multiple statistical tests. The Bonferroni correction is a method used to counteract the problem of multiple comparisons wherein it becomes more likely that statistically significant findings will be observed by chance (Type I error) when conventional significance benchmarks (e.g., $p < .05$) are used. The Bonferroni correction thus relies on a more rigorous p-value as the cut-off for statistical significance to reduce the risk of Type I error (i.e., falsely determining the presence of an effect). For most HSOPS analyses the criteria for statistical significance is $p < .003$ or otherwise stated. This cutoff value is determined by dividing the desired cutoff score (*p*=.05) by the number of independent hypotheses (sixteen [16]) within a family of tests.

One-way Analyses of Variance (ANOVAs) were conducted to compare baseline HSOPS scores across cohorts. For these analyses, Cohorts 1 and 2 are collapsed for two reasons: they were combined during the active intervention phase and also to enable adequate sample size to be able to compare between cohorts. As fewer hospitals submitted followup HSOPS data, Kruskal-Wallis tests were used to compare followup HSOPS scores across cohorts in order to account for non-normality and smaller sample sizes at followup.

To capture the cultural changes that occurred from baseline to followup, two-tailed paired samples t-tests with Bonferroni correction were conducted for the subset of 38 participating hospitals that submitted HSOPS data at both baseline and followup with greater than 4 respondents. Finally, we conducted sensitivity analyses to compare these results to additional paired samples t-test analyses with Bonferroni correction of hospitals that submitted both baseline and followup scores with greater than four respondents and had a response rate between 51 percent and 100 percent.

Results

HSOPS Data Submission

Table 16 summarizes HSOPS data submission within and across all project cohorts. Overall, 56 percent of hospitals that registered for the project voluntarily submitted perioperative HSOPS data at baseline (*N*=153) and 16 percent at followup (*N*=44). These data represented 344 perioperative work settings at baseline and 101 work settings at followup. Table 2 shows the hospital characteristic data. The majority of the data was submitted by community hospitals (*N*=112 at baseline and *N*=35 at followup) and tertiary hospitals (*N*=34 at baseline, and *N*=8 at followup). The sample represented hospitals of various sizes (most commonly 100-199 or 200-399 beds) and submission did not differ by developed environment (e.g., urban, rural). Most hospitals that submitted HSOPS data were nonteaching (*N*=97 at baseline and *N*=28 at followup). Survey response rates ranged from 5.7 percent to 100 percent at baseline (*M* = 68.5%, *SD* = 26.5%) and 8.5 percent to 100 percent at followup (*M* = 55.0%, *SD* = 29.5%).

Table 16. HSOPS Survey Submission Rates by Cohort at Baseline and Followup

COHORT	DATA COLLECTION PERIOD	HOSPITALS SUBMITTING PERIOPERATIVE HSOPS DATA	TOTAL HOSPITALS REGISTERED	% OF REGISTERED HOSPITALS THAT SUBMITTED HSOPS DATA	NUMBER OF PERIOPERATIVE WORK SETTINGS (PREOP, OR, PACU)	INDIVIDUAL RESPONDENTS
1	Baseline Oct 15–Dec 1, 2012	9	15	60%	16	337
1	Followup July 3–Nov 3, 2014	3	15	20%	7	63
2	Baseline Jan 18–Mar 18, 2013	32	104	31%	71	3,357
2	Followup July 11–Sep 3, 2014	17	104	16%	40	1,015
3	Baseline Apr 9–June 8, 2013	34	50	70%	89	2,325
3	Followup Oct 11, 2014–Apr 3, 2015	8	50	12%	16	167
4	Baseline Oct 28–Dec 16, 2013	35	43	81%	77	5,841
4	Followup Apr 8–June 15, 2015	7	43	12%	14	4,705
5	Baseline May 14–July 15, 2014	43	61	70%	91	3,016
5	Followup May 20–July 31, 2015	9	61	15%	24	636
Total	Baseline	153	273	56%	344	14,876
Total	Followup	44	273	16%	101	6,586

HSOPS = Hospital Survey On Patient Safety Culture; PREOP = preoperative area; OR = operating room; PACU = Post-anesthesia care unit

HSOPS: Independent Groups Pre–Post Analyses

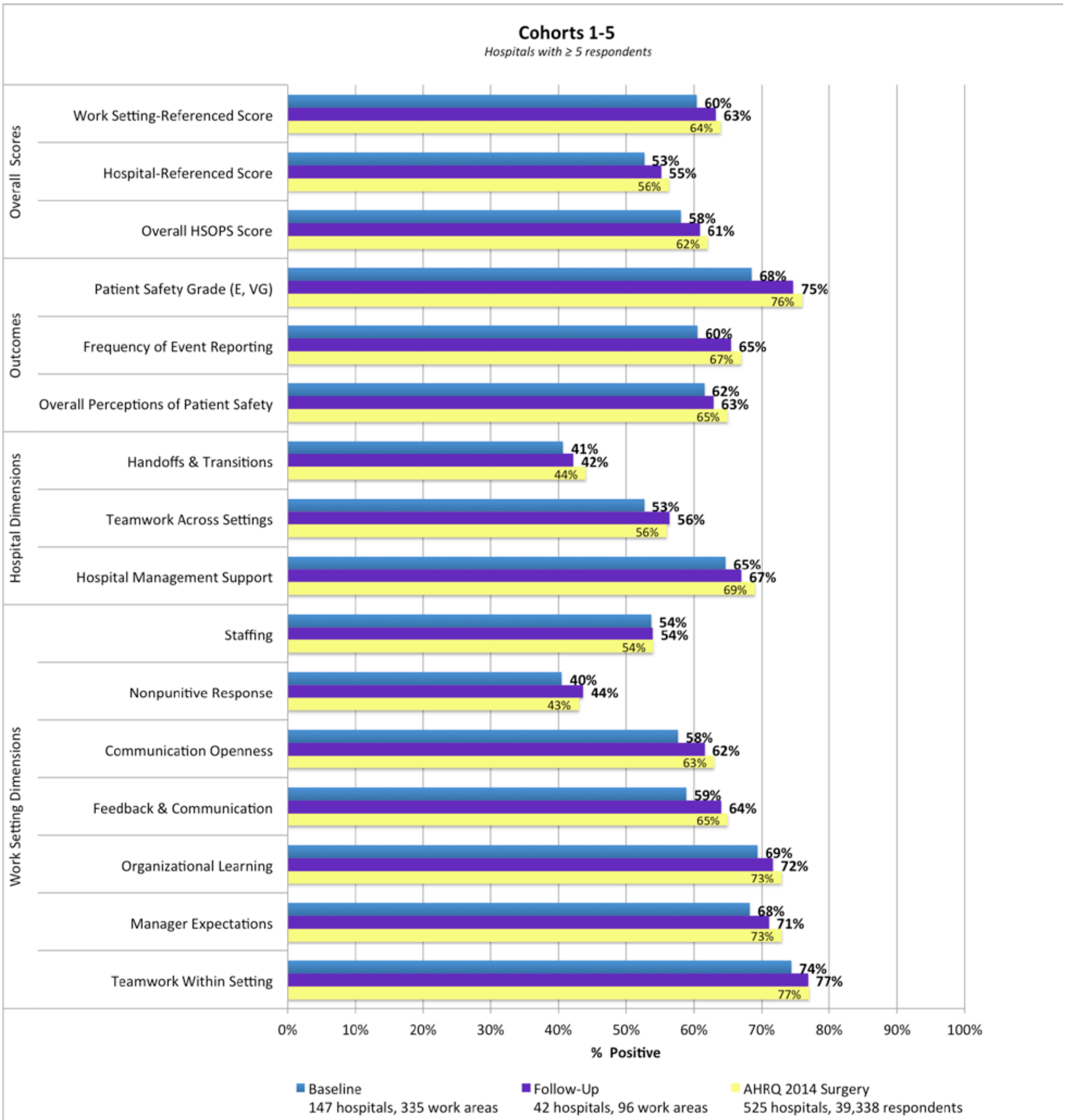
Results among hospitals with more than four respondents and response rates between zero and 100 percent at baseline (*N*=147) and followup (*N*=42) can be found in Figure 13 and Table 17.

Figure 13 presents the percent positive dimension scores for seven work setting-referenced dimensions, three hospital-referenced dimensions, three outcome dimensions, and three overall summary scores. These results are compared to aggregate surgery data from AHRQ's *Hospital Survey on Patient Safety Culture Comparative Database*, a central repository for survey data from hospitals that have administered HSOPS. The database serves as a resource for comparing patient safety culture survey results to those of other hospitals in support of patient safety culture improvement. The 2014 user comparative database report displays results from 653 hospitals and 405,281 hospital staff respondents. To present a relevant comparator for the surgical data collected, the AHRQ benchmark data presented in this report are from a subsample of 39,338 hospital staff respondents in 525 hospitals who indicated surgery as their primary work setting.

Results of the independent groups t-test analysis are presented in Table 16. The largest mean gains were observed in the following dimensions:

- Patient safety grade (+6.2%)
- Feedback and communication about error (+5.2%)
- Frequency of event reporting (+5.0%)

Figure 13. Independent Groups Comparison of Hospital Baseline and Followup HSOPS Dimension Scores



E = excellent; VG = very good

Table 17. Independent Groups Comparison of Hospital Baseline and Followup HSOPS Dimension Scores

DIMENSIONS	% MEAN BASELINE (N=147)	% MEAN FOLLOWUP (N=42)	% MEAN DIFFERENCE	STANDARD ERROR DIFFERENCE	P-VALUE
OUTCOMES					
Overall perceptions of safety	61.55	62.90	+1.35	2.34	0.56
Frequency of event reporting	60.49	65.48	+4.98	2.12	0.02
Grade (excellent-very good)	68.50	74.68	+6.18	3.23	0.06
HSOPS SUMMARY SCORES					
Overall average score	58.07	60.83	+2.76	1.65	0.10
Hospital-referenced composite average score	52.67	55.18	+2.51	1.96	0.20
Work setting-referenced composite average score	60.39	63.25	+2.87	1.69	0.09
HOSPITAL-REFERENCED DIMENSIONS					
Hospital management support	64.69	66.99	+2.30	2.41	0.34
Teamwork across settings	52.66	56.42	+3.75	2.14	0.08
Handoffs and transitions	40.65	42.13	+1.49	2.06	0.47
WORK SETTING-REFERENCED DIMENSIONS					
Teamwork within settings	74.40	76.83	+2.44	1.79	0.18
Supervisor expectations	68.23	71.10	+2.87	2.15	0.18
Organizational learning	69.37	71.70	+2.33	1.96	0.24
Communication openness	57.65	61.56	+3.92	1.90	0.04
Feedback and communication	58.86	64.04	+5.18	2.22	0.02
Nonpunitive response	40.46	43.59	+3.13	2.33	0.18
Staffing	53.74	53.96	+0.21	2.54	0.93

After correcting for multiple tests, a statistically significant improvement was not found for any of the HSOPS dimensions. Improvement trends that did not meet adjusted statistical criteria ($p < .003$) were observed in one patient safety outcome, *frequency of event reporting* (+5.0%), and two HSOPS dimensions, *feedback and communication about error* (+5.2%), and *communication openness* (+4.0%).

Comparisons Between Cohorts

At baseline, hospitals demonstrated relatively similar *overall HSOPS scores*: 58 percent for Cohorts 1-2, 59 percent for Cohort 3, 58 percent for Cohort 4, and 58 percent for Cohort 5), *work setting-referenced scores* (60% for Cohorts 1-2, 62 percent for Cohort 3, 61 percent for Cohort 4, and 60 percent for Cohort 5), and *hospital-referenced scores* (52 percent for Cohorts 1-2, 54 percent for Cohort 3, 52 percent for Cohort 4, and 53 percent for Cohort 5) across cohorts. Cohorts demonstrated slightly more variability at followup; however, no statistically significant differences between cohorts were detected with one-way ANOVAs at baseline or followup.

HSOPS: Paired Pre–Post Analyses

Results among hospitals (*N*=38) that submitted data at both baseline and followup with greater than four respondents and response rates between 0 and 100 percent at baseline and followup are presented in Figure 14 and Table 18. Figure 14 shows the average percent positive scores for seven work setting-referenced dimensions, three hospital-referenced dimensions, three outcome dimensions, and three overall summary scores. Baseline and followup scores for each of these dimensions are compared to the 2014 AHRQ surgery benchmark data.

Figure 14. Paired Groups Sample Comparison of Hospital Baseline and Followup HSOPS Dimension Scores

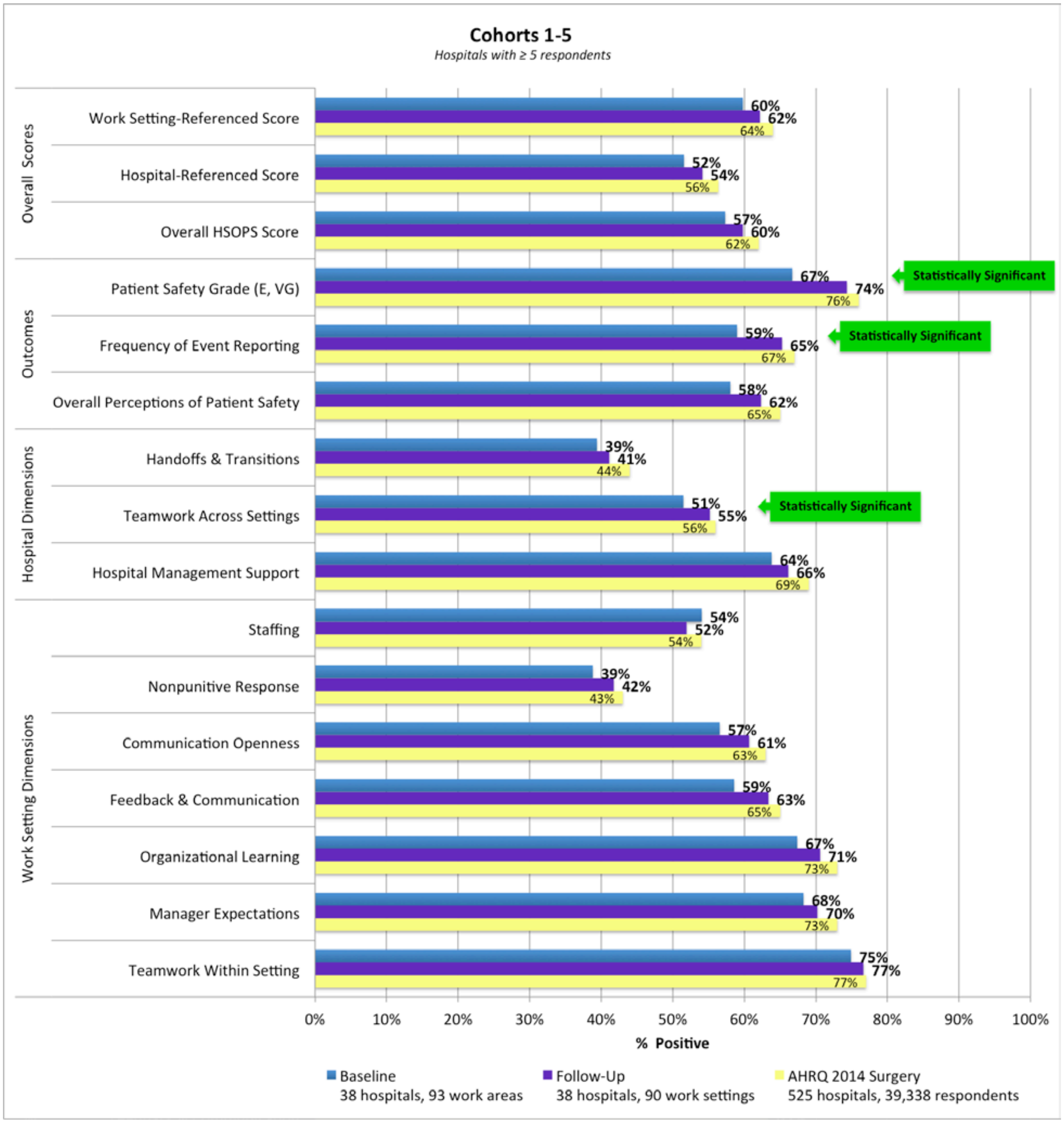


Table 18. Paired Groups Sample Comparison of Hospital Baseline and Followup HSOPS Dimension Scores

DIMENSIONS	% MEAN BASELINE (N=38)	% MEAN FOLLOWUP (N=38)	% MEAN DIFFERENCE	STANDARD ERROR DIFFERENCE	P-VALUE
OUTCOMES					
Overall perceptions of safety	58.04	62.32	+4.28	1.74	0.02
Frequency of event reporting	58.98	65.26	+6.27	1.76	0.00[a]
Grade (excellent-very good)	66.70	74.33	+7.64	2.42	0.00[a]
HSOPS SUMMARY SCORES					
Overall average score	57.32	59.76	+2.44	0.96	0.02
Hospital-referenced composite average score	51.56	54.14	+2.57	1.16	0.03
Work setting-referenced composite average score	59.79	62.17	+2.38	1.04	0.03
HOSPITAL-REFERENCED DIMENSIONS					
Hospital management support	63.81	66.12	+2.30	2.14	0.29
Teamwork across settings	51.48	55.18	+3.70	1.12	0.00[a]
Handoffs and transitions	39.40	41.11	+1.72	1.25	0.18
WORK SETTING-REFERENCED DIMENSIONS					
Teamwork within settings	74.90	76.67	+1.77	1.47	0.24
Supervisor expectations	68.27	70.23	+1.96	1.65	0.24
Organizational learning	67.39	70.57	+3.18	1.70	0.07
Communication openness	56.55	60.70	+4.14	1.39	0.01
Feedback and communication	58.57	63.36	+4.79	1.59	0.01
Nonpunitive response	38.81	41.73	+2.91	1.63	0.08
Staffing	54.05	51.93	-2.11	2.06	0.31

[a]*Significant with Bonferroni correction p<0.003*

Table 18 presents the results of the t-tests conducted using the paired subsample. Identical to the unpaired sample, the largest mean gains were observed in the following areas:

- Patient safety grade (+7.6%);
- Frequency of event reporting (+6.3%); and
- Feedback and communication about error (+4.8%).

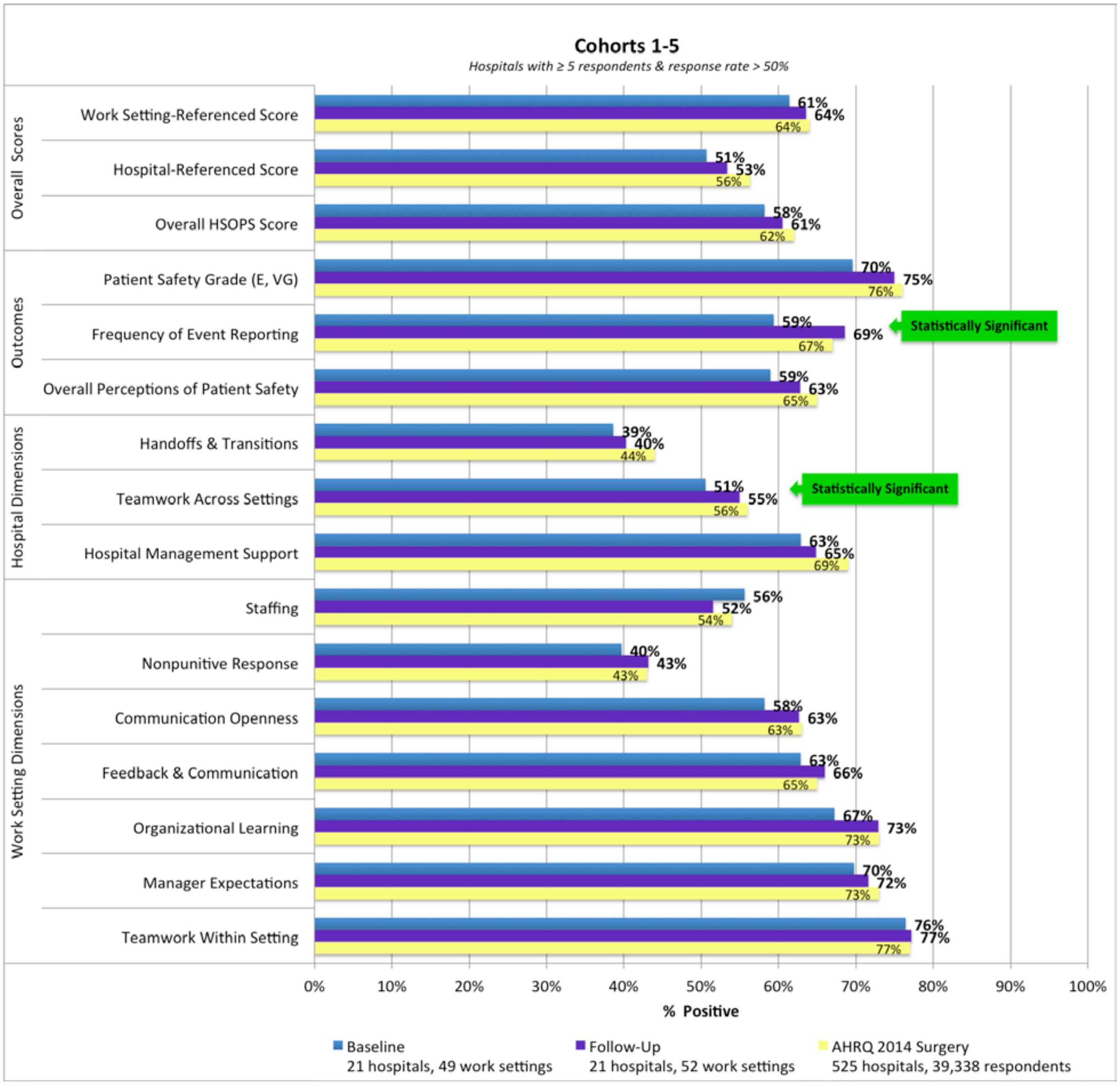
After correction for multiple statistical tests, a statistically significant improvement was found for two outcomes, *frequency of event reporting* (59.0% at baseline versus 65.3% at followup) and *patient safety grade* (66.7% at baseline versus 74.3% at followup), and one dimension, *teamwork across work settings* (51.5% at baseline versus 55.2% at followup). Improvement trends that did not meet adjusted statistical criteria ($p < .003$) were observed in three summary scores, *overall climate score* (+2.4%), *average hospital-referenced climate score* (+2.6%), and average *work setting-referenced score* (+2.4%), one patient safety outcome, *overall perceptions of patient safety* (+4.3%), and two dimensions, *communication openness* (+4.1%) and *feedback and communication* (+4.8%).

HSOPS: Sensitivity Analyses

Results among hospitals that submitted data at both baseline and followup with greater than four respondents and response rates between 51 and 100 percent at baseline and followup (termed *high performers*, N=21) were analyzed. Figure 15 presents baseline and followup dimension scores for this sample in comparison to the 2014 AHRQ surgery benchmark scores. As expected, scores from the 21 high performing hospitals tended to be slightly higher at baseline and followup as compared to the scores from the 38 hospitals in the paired sample.

Running t-test analyses to compare the baseline and followup means for each dimension within this sample of high performers moderately altered results (Table 19). Similar to findings from t-test analyses conducted on the paired sample, after correcting for multiple tests a statistically significant improvement was found for *frequency of event reporting* (+ 9.2%, $p < .003$) and *teamwork across work settings* (+4.4%, $p < .003$). Unlike in the paired sample, the increase in the *patient safety grade* score (+5.4%, p=.13) was not statistically significant. Improvements in mean scores that did not meet adjusted statistical criteria ($p < .003$) were different from those observed in the paired sample and included *organizational learning* (+5.7%) and *communication openness* (+4.5%).

Figure 15. High Performer Paired Groups Sample Comparison of Hospital Baseline and Followup HSOPS Dimension Scores



E = excellent; VG = very good

High performer indicates a response rate of > 50 percent.

Table 19. High Performer Paired Samples Comparison of Hospital Baseline and Followup HSOPS Dimension Scores

DIMENSIONS	% MEAN BASELINE (N=21)	% MEAN FOLLOWUP (N=21)	% MEAN DIFFERENCE	STANDARD ERROR DIFFERENCE	P-VALUE
OUTCOMES					
Overall perceptions of safety	58.95	62.78	+3.83	2.39	0.12
Frequency of event reporting	59.37	68.58	+9.21	2.39	0.00[a]
Grade (excellent-very good)	69.58	74.98	+5.41	3.40	0.13
HSOPS SUMMARY SCORES					
Overall average score	58.19	60.51	+2.33	1.43	0.12
Hospital-referenced composite average score	50.69	53.36	+2.67	1.52	0.09
Work setting-referenced composite average score	61.40	63.57	+2.18	1.61	0.19
HOSPITAL-REFERENCED DIMENSIONS					
Hospital management support	62.88	64.84	+1.96	2.69	0.48
Teamwork across settings	50.56	54.96	+4.40	1.30	0.00[a]
Handoffs and transitions	38.63	40.28	+1.66	1.68	0.34
WORK SETTING-REFERENCED DIMENSIONS					
Teamwork within settings	76.44	77.19	+0.75	2.03	0.71
Supervisor expectations	69.76	71.58	+1.82	2.26	0.43
Organizational learning	67.23	72.90	+5.67	2.47	0.03
Communication openness	58.19	62.67	+4.47	1.93	0.03
Feedback and communication	62.86	65.96	+3.10	2.00	0.14
Nonpunitive response	39.70	43.17	+3.47	1.76	0.06
Staffing	55.61	51.55	-4.06	2.84	0.17

High performer indicates a response rate of > 50 percent.

[a] Significant with Bonferroni correction p<0.003

Discussion

This project represents one of the largest, multicenter attempts to evaluate the impact of a targeted intervention designed to reduce preventable harm and patient safety culture in perioperative care areas. 197 hospitals enrolled in the AHRQ Safety Program for Surgery project. Of these, 153 hospitals voluntarily submitted patient safety culture survey data for their participating perioperative work settings at baseline and 44 submitted data at followup. Independent groups analysis of these data were conducted on hospitals with 0 to 100 percent response rate and five or more respondents at baseline (N=147) and followup (N=42). Across these hospitals, small improvements were observed within all of the 10 HSOPS dimensions, 3 outcomes, and 3 summary scores. Among the highest scoring HSOPS dimensions were *teamwork within settings* (74.4% at baseline to 76.8% at followup), *organizational learning* (69.4% at baseline to 71.7% at followup), and *patient safety grade* (74.7% at baseline). *Non-punitive response to error* (40.5% at baseline to 43.6% at followup) and *handoffs and transitions* (40.7% at baseline to 42.1% at followup) were among the lowest scoring dimensions. Independent groups t-test analyses with Bonferroni correction for multiple statistical tests were conducted to assess the statistical significance of these changes. None of the changes from baseline to followup demonstrated statistical significance when employing Bonferroni correction for multiple tests. Improvement trends that were significant at conventional cut-off levels (i.e., $p \le .05$) included *frequency of event reporting* (+5.0%, p=.02), *feedback and communication about error* (+5.2%, p=.02), and *communication openness* (+4.0%, p=.04).

The unequal sample sizes in the independent groups analysis do not allow us to make meaningful comparisons of baseline and followup data. Therefore, to make stronger inferences from our findings, we conducted additional analyses of the 38 hospitals that provided HSOPS data at both baseline and followup. These analyses revealed statistically significant improvements in *patient safety grade* (+7.6%, $p < .003$). That is, following implementation, perioperative employee perceptions of the safety of their hospital increased nearly 8 percent. We also found statistically significant improvements in *frequency of event reporting* (+6.3%, $p < .003$) and *teamwork across settings* (+3.7%, $p < .003$). Additionally, scores did not differ significantly by data submission method or cohort.

Since scores for *frequency of event reporting* and *teamwork across settings* are each composited from multiple items, we considered the individual items composing each dimension to gain greater insight into what particular attitudes or behaviors are driving these findings. Results indicated that a single item, "hospital units work well together to provide the best care for patients," from the teamwork across settings dimension was statistically significant after correction for multiple tests (+6.0%, $p < .003$). This result may indicate that the safety program has positive benefits for providers' cross-setting professional relationships. However, it is important to consider this finding within context. Other dimensions that also provide insight into cross-setting working relationships (e.g., *handoffs and transitions*) did not demonstrate statistically significant improvement.

All 3 items that compose the dimension *frequency of event reporting* improved significantly. The item demonstrating the greatest increase was "When a mistake is made, but is caught and corrected before affecting the patient, how often is this reported?" (+9,0%, p<.003). This result is particularly encouraging as barriers to reporting near misses (i.e., instances where the patient could have been harmed but was not) include additional workload burdens, lack of confidence that positive change will result, psychological barriers to admitting mistakes, and concern over punitive action.[17,18] Our results indicate that the safety program may help to reduce some of these barriers and empower clinicians to transparently discuss and actively learn from error.

Sensitivity Analysis

We conducted sensitivity analyses to assess the robustness of our findings. As expected, the 21 hospitals that we identified as high performers (i.e., hospitals with more than 5 respondents and response rates between 51 and 100%) demonstrated slightly higher HSOPS scores overall when compared with the 38 hospitals in our paired sample. We found that changes in *frequency of event reporting* and *teamwork across settings* remained statistically significant after correcting for multiple tests. Changes in *patient safety grade*, however, were not significant in this high performer sample. These findings indicate moderate robustness of our findings and give us further confidence that meaningful changes were observed for *frequency of event reporting* and *teamwork across settings*. However, they limit our ability to draw a definitive conclusion about *patient safety grade*.

Comparison to AHRQ Benchmarks and Other National Implementation Projects

Hospitals that submitted HSOPS data to the project tended to have lower scores than the surgery benchmark scores reported in the 2014 AHRQ HSOPS User Comparative Database, particularly at baseline. Although we cannot be certain as to why this is, two explanations are possible. First, participation was optional and it may be that hospitals with below-benchmark patient safety culture wanted to participate in an effort to improve perioperative safety climate while those closer to or above benchmark scores did not sense a great need to adopt the safety program in their organizations. Second, submission of HSOPS data to the AHRQ comparative database is also optional and it may be that high performers are more likely to share their success in a national database than lower performers.

It is also important to compare and contrast these findings with previous national safety improvement evaluations. Evaluations of national efforts to reduce bloodstream infections in the ICU found significant improvements in two unit-referenced HSOPS dimensions among Adult ICUs (*feedback and communication about error* and *teamwork within unit*).[19] In comparison, our current results in the perioperative environment point to significant improvements in cross-area teamwork and error reporting behavior. This may reflect the implementation approach in surgery that was adopted for this project and the high degrees of coordination required between preoperative, operating room, and postoperative care areas and care providers. These findings are also augmented by ethnographic results highlighted in the next section of this report.

Limitations

Our findings must be interpreted in light of several limitations. These include the voluntary nature of safety culture survey data submission and attrition over the course of the implementation period. Just over 50 percent of participating hospitals voluntarily submitted data at baseline (some used other survey tools [e.g., the Safety Attitudes Questionnaire[20]] to conduct their hospitalwide culture assessments, some could not get access to their individual level HSOPS data) and there was limited HSOPS data submission across all five cohorts at followup. Despite multiple outreach attempts to hospitals and CEs, reasons cited for this attrition included failure to remember the hospital was enrolled in the project or turnover of key project leaders, lack of understanding how to upload the data to the online Web portal, and lack of access to raw survey data collected as part of hospitalwide safety culture assessments. The NPT made all reasonable efforts to assist hospitals with overcoming these barriers. These efforts had some success as suggested by the fact that some hospitals submitted followup data despite not having submitted baseline data.

As a result of attrition, pre–post evaluation analyses represent a subset of hospitals that participated in the project. The unequal sample size between baseline and followup introduces potential confounding that limits interpretation of results. Therefore, we conducted analyses on a subset of 38 hospitals that submitted data at both baseline and followup. Although limiting the sample in this way may reduce power of our analyses, it also reduces noise and enables us to make stronger inferences regarding the improvement trends observed.

Conclusion

In a multicenter evaluation of perioperative work settings, perceptions of cross-setting teamwork and event reporting behavior significantly improved following implementation of a surgical safety improvement intervention program. The data collected in this project provide the potential for exploring contextual factors that moderate safety culture improvement.

Ethnographic Interviews

Purpose

Improvement work in the perioperative settings can be hindered by the extended lag between quality improvement efforts, the availability of intervention data, and analysis of the results. This lag complicates the prevention of HAIs in the delivery of surgical services and requires a different approach from the prevention of HAIs in intensive care units. The ethnographic team was tasked with determining how CUSP would work in the perioperative setting and supporting project implementation with real-time feedback from observations of the NPT, CEs, and hospital teams.

Ethnography and its associated qualitative research components provide a method for studying group life that is particularly suited for addressing the tension between a plan and its implementation. Qualitative methods, such as observational studies and semi-structured interviews, yield ground-level, experiential data discovered in face-to-face interactions. Capturing multiple narratives from frontline providers, the ethnography team recorded the successes and setbacks of perioperative quality improvement efforts. The ethnographic or qualitative research team (QRT) studied how frontline workers make sense of their everyday world of work and how everyday sense making creates the patterns found in statistical analysis of aggregated quantitative data sets.

The qualitative component of the AHRQ Safety Program for Surgery was aimed at gaining insight into how frontline providers interpret and implement the project "in situ." Then, as part of "ethnography in action," the QRT team provided feedback to the NPT and the hospital sites in support of the various challenges and obstacles encountered while implementing the safety program. Feedback from the QRT to the NPT contributed to changes in content delivery and adaptions in CUSP for the surgical setting. The ethnography in action component of the AHRQ Safety Program for Surgery concentrated on maximizing "observer effect," leveraging the Hawthorne effect, to improve program performance and stimulate change.

Methods

Data Collection

The QRT collected data from two sources: NPT meetings and hospital visits**.**

Workgroup Meetings

First, QRT members attended, observed, and participated in the regular meetings of the AHRQ Safety Program for Surgery work group and subgroups. These meetings covered all aspects of project management, such as delivering content materials to both CEs and participating sites; creating a user-friendly Web site; and streamlining the data collection process. As opposed to being mere passive participants, the team made significant suggestions based on past experience or, more commonly, feedback from the hospital sites. For example, CEs indicated during ethnography interviews that they wanted a "more personal" relationship with the NPT and to foster horizontal learning within their state hospital teams. QRT brought this feedback to the NPT; as a result, the coaching call format was adjusted to reflect state-centric calls.

Hospital Site Visits

Coordinating entities recruited hospitals for site visits. After conducting observations and interviews in 17 volunteer hospitals in 5 States, the QRT collected more than 300 interviews and 30 focus group interviews. We visited 3 States twice, conducting a second round of interviews at 11 of the 17 sites. Repeat visits provided an impactful opportunity to observe change over time.

A site visit typically lasted 1 to 5 days per hospital, depending on the size of the hospital. Team members conducted observations in the operating room, preoperative units, the post-anesthesia care unit, and observed hospital safety program meetings. Interviews were conducted with the safety program team, clinicians, administrators, and frontline staff. State leads were interviewed twice in 3 of the 5 states.

Interviews were open-ended. Hospital staff walked interviewers through a typical day and shared many perceptions:

- How comfortable they felt speaking up about concerns;
- How involved they were with the safety program or other quality improvement initiatives;
- How adverse events were handled; and
- Where improvements were needed.

Analytic Approach

All interviews were digitally recorded, transcribed, made anonymous, and uploaded to qualitative software for coding (Dedoose). The QRT developed a codebook for organizing the data. Four members of the qualitative research team read and reread interviews to derive codes from the data. Each member performed multiple rounds of coding to validate the interview coding process and refine the codebook. Not surprisingly, the empirically derived codes have a significant overlap with themes that implementation science suggests are important for successful implementation of quality improvement programs.

We have assembled the most robust, comprehensive and granular qualitative data asset to analyze how federally financed, national quality improvement efforts operate both in theory and practice.

Our first task was to understand how the NPT, CEs, and program sites determined if their efforts were successful. This proved to be a surprisingly complex task; the theoretical definitions and empirical indicators of success and failure are multifactorial, change over time, and are not easily captured by any single outcome measure. In addition, the various stakeholders often define success and failure in differential and sometimes conflicting terms. In a four-year program with multiple cohorts, CEs, and a NPT, definitions of success and failure evolve over time and at each level of analysis.

A Narrative Chronology

The ethnographic section is organized in two sections. The first section of the narrative chronology highlights how the impression of critical themes emerged over time. The second section is data-driven and organized around 3 recurring themes relevant to assessing a quality improvement project: engagement, turnover, and achieving a non-punitive reporting environment.

First Round of Visits–Reasons for Optimism

On the first round of visits, safety program team members showed an eagerness to reduce SSI rates and other complications of surgery, such as wrong-site surgery, dosage, and pharmaceutical errors. Hospital team members were also eager to use CUSP tools, such as the Perioperative Staff Safety Assessment or the “two questions,” to identify and help solve local issues. In the interviews, quality improvement personnel and surgeons indicated appreciation for the science of safety and the evidence-based intervention to improve surgical practice. Additionally, team members indicated that the tools were useful in improving communication in surgical teams and between departments.

However, the expressed enthusiasm for the project tools exceeded their actual use. Effective CUSP implementation requires that frontline workers feel comfortable speaking up about patient safety concerns. A surprising number of frontline clinicians did not feel comfortable doing so; they feared retribution if they pointed out systemic defects that led to complications. Interview respondents recited examples that reinforced the lack of anonymity in a small work group. They also believed that retribution for reporting the failure of others to follow procedures was natural and hard to avoid.

Forming a CUSP team allows frontline providers in surgical services to meet and become comfortable discussing how the next patient will be harmed and what can be done to prevent it. Teams that once had no forum for discussing probable sources of harm developed and continued to meet after their involvement in the safety program formally ended. The CUSP team added to the organization’s capacity to engage in future quality improvement projects.

Hospital teams described the relationship to the national project as productive; coaching and content calls built connections between local hospital settings and national policy platforms. Many teams expressed a desire to run with the “big dogs” – the “big dogs” here being the Armstrong Institute. Teams indicated that the Armstrong Institute linked their efforts to the cutting edge of quality improvement initiatives. This feeling was strongest in smaller hospitals or those hospitals farther from urban centers.

Prior CUSP involvement was a phenomenal motivator to site participation. Hospitals that had previously participated in CUSP initiatives, like Stop BSI or Stop CAUTI projects, used their positive experience in HAI reduction to join the AHRQ Safety Program for Surgery. Experience with the CUSP model allowed teams to initiate surgical quality improvement work faster. In the first year of implementation for the first two cohorts, hospital teams with previous CUSP training experienced a disconnect between expectations and what the NPT was providing. However as the science on improving SSIs matured, as the NPT enhanced the project materials, and as the ethnographic team reported qualitative data from the field, this disconnect was mitigated for cohorts 3, 4, and 5.

Participating hospitals vary greatly as to type: critical access; free standing, community hospital; religiously-affiliated community hospital; public hospital; hospital connected to a networked system; or tertiary care center. In addition, there is an array of financial and organizational agreements that exists among individual surgeons or groups of surgeons and individual hospitals. Some sites employed nursing and other health care staff members in unions; others did not. These variations in organizational characteristics led to significant variation in local implementation of the safety program.

First Round of Visits–Reasons for Tempering Optimism

During the first round of visits, the hospital teams shared the most formidable challenges to implementation. A significant disconnect exists between the organization of perioperative services, which are designed to transition patients through the various phases of either ambulatory or inpatient procedures, and surgical product lines that are organized by surgical specialty. The differences between surgical services and surgical product lines affect communication from safety program champions to frontline staff not personally engaged in the program.

Structural barriers, such as staff shortages and the lack of dedicated time, hamper project implementation. These two constraints influence the progress each hospital team can realize during the program. Changes in personnel, particularly among team leadership roles, create instability and inertia in the safety program rollout. In addition, other priorities compete for staff attention. The introduction of new electronic medical record systems stalled program momentum at a number of hospitals. Economic uncertainty in a reorganizing health marketplace also inhibits efforts in quality improvement, as available resources are often redirected toward pressing issues.

Some hospitals undertaking multiple quality improvement projects have demonstrated some synergy between the different initiatives, but this practice runs the risk of competition for scarce resources and overburdened staff. Several frontline staff members were initially skeptical of attending safety program meetings or participating in the surgical safety project due to dissatisfaction with the previous initiatives. Several sites encountered success because of the phenomenon of the "Sunday Worker," a person so dedicated to the project that they use personal time to attend meetings, enter data, send out newsletters, and advocate for surgical safety initiatives.

Second Round of Visits–Four Questions

Faculty leads from the NPT asked us to concentrate on four questions during our second round of visits, which occurred a year after the first round of visits:

1. What should hospitals/management do to be successful?
2. What should NPT and CEs do to be successful?
3. How have hospitals successfully addressed barriers to success?
4. Among hospitals that have achieved SSI reduction, do they sustain improvements? If so, how?

During the second round of visits, no single trajectory of change was found. Sites that were struggling on the first visit were now making tremendous headway with changes in department heads and new executive leadership. Sites progressing well at the first visit had stalled due to changes in leadership and staff reductions. Very few hospital sites sustained executive engagement in the program. Rather, executive leadership typically delegated and defined the safety program as a partnership between the surgical department and the hospital quality Improvement and patient safety department. As a result, a strong surgical champion paired with either a strong nursing champion or a forceful quality improvement advocate was necessary to implement the program. Forceful quality improvement advocates typically had experience as surgical nurses.

There was a high burnout rate of quality improvement staff. This professional group tends to provide the vision and commitment to fuel the social change that drives quality improvement projects. Yet many quality improvement staff members felt that their efforts to promote patient safety were met with indifference by management and frontline staff alike. Between the first and second round of site visits, quality improvement staff from several hospitals in the sample resigned because they felt their efforts had been futile.

In the second-round visits, the burnout of quality improvement personnel had taken a toll on local progress. The loss of this role led to frequent leadership turnover in the surgical safety program team and the subsequent loss of the original mission and commitment.

Many of the sites that have enrolled in the project did not cite reducing SSIs as an explicit goal. This is particularly true in sites reporting NHSN data where baseline rates were initially low. These sites were more interested in leveraging the CUSP training to build the capacity to solve local problems than reducing surgical site infections.

At multiple sites, staff members expressed a desire to visit and learn from sites that had been successful at lowering their SSI rates. Additional requests to engage in horizontal learning were particularly strong in states that lack surgical collaboratives.

Several sites told tales of failure. These narratives had a "first this, then that" quality as our interviewees described multiple barriers to success. Finding a standard time to meet, then not meeting when unexpected medical crises arose, staffing changes, unexpected staff illness and death, fires, floods, and blizzards—all were cited in different combinations as reasons for stalled progress implementing the AHRQ Safety Program for Surgery. Narratives of success are more contingent and less varied than narratives of failure. Narratives of success all had a similar nondramatic quality in their retelling. No matter how much teams struggled to get there, successful teams described a process in which things came together. Eager to move forward, these teams were less likely to dwell on the process, finding it harder to summarize what worked compared with what did not.

Themes

The first two factors affected implementation at every level of organization: the NPT, coordinating entities, and individual program sites. The last theme—nonpunitive environment—operated forcefully and affected program implementation at the level of the local project site.

For the remainder of the final report, we summarize three broad themes that have emerged as critical for a qualitative analysis of the AHRQ Safety Program for Surgery:

- Engagement,
- Turnover as impediment and opportunity, and
- Nonpunitive environment.

Engagement

Engagement refers to the level of involvement on the part of frontline staff and the executive tier. As with many quality improvement programs, engagement is necessary in achieving success. When team members reflect on how they would judge program success, they indicated transforming the surgical culture in their unit. By the same token, when team members were asked what failure would look like, they said a "failure to change the culture of the organization." Team members repeatedly stated that the key to success was engagement.

Engagement can be thwarted at multiple levels within organizations and systems. These levels are analytically separate, but empirically intermixed. When hospitals and management fail to secure engagement, it filters down to all levels of the organization and impacts frontline staff.

Enrollment at the organizational level begins with hospital leadership signing a nonbinding agreement with the NPT. If executive leadership then passed project management to subordinates and provided no evidence that leadership was invested in program success, a strong organizational signal was sent that the project had a low place in the complex hierarchy of competing priorities. Hospital executives that delegated projects to less empowered subordinates without resources communicated a lack of real commitment to the effort.

A lack of executive involvement was not necessarily fatal in hospitals with a robust organizational structure for quality improvement. But even with strong quality improvement, barriers still inhibited engagement. Failure to engage often occurred in organizations in which a strong working relationship failed to exist or evolve between a surgical champion and a quality improvement leader.

One pattern from a few sites was indicative of a lack of engagement. In simple terms, the executive leadership informed the chair of surgery of the hospital's participation in the project; the chair agreed with chief executive that no harm could come from participation. However, neither the executive nor the chair was enthusiastic about participation. Even if one or both were enthusiastic, they failed to commit resources to the project.

In this case a junior surgeon, typically the most recent addition to the surgical staff, was "voluntold" that they would lead the effort. The new recruit neither commanded the respect of surgical colleagues nor possessed the requisite relational experience with frontline staff to create engagement. The project would then limp along until a new surgeon was hired. At this point, the first surgical leader would inform the chair that leading the safety program and building a practice are too overwhelming and that regrettably he or she needed to resign the position. Predictably, the chair would then appoint the least senior surgeon as lead and the cycle repeated.

Yet, even with a committed surgical champion and team leader, engagement is not guaranteed. In hospitals that lacked a staff model for organizing the surgical department, the buy in from surgeons, who spread their patients across several hospitals, is difficult to obtain. Frontline staff often felt overburdened with multiple quality improvement initiatives. Finally, the AHRQ Safety Program for Surgery spanned several units in the hospital and coordination of various aspects of the intervention posed a problem for many teams. It is worth exploring whether an intense identification with preoperative, operating room, or post-anesthesia care unit nursing impacts communication and coordination across units.

Stories of successful engagement all seemed both to be alike and devoid of drama. Executives and frontline workers recognized that there was a problem. The organization and its members were determined to "do something about it." Effective leadership emerged. Things "just seemed to come together." The story of success is, of course, never that simple. In some cases, the dramatic overnight success described in the narrative above was achieved after years of effort, changes in leadership, and many frustrating false starts. Nonetheless, narratives of success have an "everything just came together" quality about them. However, the findings also suggest that seamless uptakes of the surgical safety program may also be radically overturned with staff turnover.

Turnover as Impediment and Opportunity

During the second round of visits, significant staffing changes had occurred since the first site visit. This turnover was almost always an impediment to progress. One safety program team experienced four new project leaders in a single year. Each time the lead changed, the project restarted at the beginning. Staff leads changed at three additional revisited sites. At other sites, highly engaged staff had moved on to other institutions. We were unable to revisit a hospital due to so much change in hospital leadership that executives felt "it would not serve a useful purpose" to have us return. Staff at that particular institution indicated via telephone a strong desire to share their experience surrounding the safety program. But staff turnover is not always a negative. In two instances, new department chairs reinvigorated what had been struggling programs.

Hospital staff represents a mobile work force. They change positions within organizations and as well as change organizations. In addition, hospitals operate in a dynamic organizational field. Some of the hospitals in the sample had been acquired by larger health systems, while others had banded into a more comprehensive network. Every quality improvement effort needs to plan for turnover to sustain organizational gains.

Nonpunitive Environment

Quality improvement and patient safety advocates both cite a workplace where workers feel free to raise questions and concerns without fear of retribution as the central component of cultural change. A profound disconnect between what administrators believe and what workers experience impacts culture. Administrators point to anonymous incident reporting systems as evidence that they have achieved a nonpunitive reporting system. Staff members report reprisals from coworkers and surgeons to indicate that they felt that their work environment was too small to be nonpunitive. Frontline clinicians stress their small teams where anonymity is not a realistic expectation. Frontline staff also drew a sharp distinction between formal sanctions as reflected in a personnel file and the informal interactions with coworkers.

Conclusion

The purpose of having a QRT as part of the AHRQ Safety Program for Surgery was to support the NPT to meet the challenge of implementing the CUSP methodology in the perioperative setting. Unlike much ethnographic research, leveraging the Hawthorne Effect to improve program delivery and outcomes maximized observer effects.

The NPT was observed as it planned the various details for translating the theory of change behind the AHRQ Safety Program for Surgery into practice for all 5 cohorts. The QRT occasionally advocated for changes in the delivery of the safety program. Second, we conducted more than 300 interview and 30 focus groups from 17 program sites in 5 States. We visited 11 programs twice to get a better sense of how individual sites evolve over time. We created a codebook for the interviews and have finished the open coding off all interview materials. The resource created through this project has potential for triangulation with project data from other sources, such as HSOPS, NHSN, or NSQIP.

Organizational change is complex, occurs for multiple reasons, and is rarely linear. Ethnography in action provides a useful component to a national quality improvement program. It provides a framework to share information that allows real time response to challenges. Quality improvement projects unfold over time in a resource-constrained environment with competing priorities in a dynamic health care marketplace. Change at every level of social organization is the only constant in the delivery of health care. Having a team of researchers capable of reporting on how workers are experiencing changes in this dynamic workspace puts collaborative members in a better position to understand and respond to challenges.

What We Learned

The *On the CUSP: Stop BSI* final report provides five key lessons learned in the conduct of a national collaborative project:

1. Have well-defined, evidence-based interventions
2. Build a solid implementation structure
3. Collect and use timely, accurate, and actionable data to improve performance
4. Tailor the national program for local and unit audiences
5. Evolve project strategies and emphases over time

Certainly the NPT would echo those conclusions with little tailoring. We have an opportunity, though, to share lessons learned not only in the conduct of a national collaborative, but also in the application of the CUSP model to surgery. We focus on three lessons here.

SSI Data Is Not Very Actionable and Lacks a Focus on Patient-Provider Partnerships

Patient safety collaborative projects in the ICU setting clearly demonstrated that data feedback is a strong motivator for behavior change.[10] Crucially, frontline clinicians, the target of behavior change interventions, must believe the reported data are "valid." In surgery, "valid" SSI rates are risk-adjusted, for example by patient acuity, and available from NHSN or ACS NSQIP after a 6-month reporting lag. Participants across all levels of the AHRQ Safety Program for Surgery (e.g., the NPT, CEs and hospital teams) struggled to establish a data feedback mechanism in the absence of timely risk-adjusted data. Moreover, for some surgical procedures (e.g., colon procedures) frontline clinicians and patient safety experts alike do not share an expectation that SSIs will "get to zero." SSIs are also a remote event–the nurses, surgeons, and anesthesiologists performing surgery likely never *see* the SSI, and by the time they *hear* about it they likely do not remember the patient. Other metrics (e.g., length of stay, indicators of patient experience, variable direct costs) may engage relevant stakeholders in quality and patient safety work that ultimately also reduces SSIs. SSI reduction may be a target that we can better hit indirectly.

Sustainable Improvement in Surgical Care Requires Cohesion Across the Continuum Of Care

Surgical teams often self-identify and organize by surgical specialty, for example, a "colorectal team" or "ortho team." Hospitals organize surgical care, though, across a continuum of unique ambulatory and inpatient work settings–the surgical clinic, preoperative area, operating room, PACU, and ICU or floor. Perioperative quality improvement is challenging, because frontline staff are closely associated with their surgical specialty and/or their work setting. But interventions often require standardization across surgical specialties or coordination across settings.[21] Quality improvement and patient safety programs in surgery should be prescriptive about the involvement of frontline staff from across the perioperative care continuum.

Inconsistent Local Levels of "Readiness" for Surgical Collaborative Projects

Although overall, participation in the AHRQ Safety Program for Surgery was associated with significant reductions in SSI rates, success at the hospital level was variable. We believe that the variability seen in hospitals' ability to improve SSI outcomes through project participation is, in part, related to the underlying “readiness” of the hospital to contribute to and benefit from being a part of a clinical community focused on perioperative outcomes.

“Readiness,” or the existence of established hospital-level quality improvement infrastructure and resources, can be a strength or weakness. Structural characteristics (e.g., hospital size, location, affiliations), existing investments in quality improvement programs (registries, national collaborative participation), and a strong baseline safety culture may improve the likelihood that a hospital will realize meaningful reduction in a preventable harm like SSI through collaborative participation. However, perioperative teams were less likely to be successful if the program “lived” with established infection control or quality improvement departments instead of frontline staff. The CUSP intervention required perhaps too significant a shift in the way those hospitals performed quality improvement work.

Lessons on How To Improve Future Surgical Collaboratives

If the SUSP project began today, the NPT would continue to build on the fractal-based quality management infrastructure and clinical communities model that was successfully used in the AHRQ Safety Program for Surgery. In this report we have described our centralized improvement core to support participating teams and horizontal-learning structures to connect participating teams. In this section we build on lessons learned and provide several recommendations for future surgical collaboratives.

Create an Enabling Infrastructure Within Participating Organizations

An enabling infrastructure includes training and support for physicians, nurses, and other QI professionals at each level of an organization as well as a central core within each organization that provides project management, data feedback and improvement science. Future surgical collaboratives should explore opportunities to align efforts across diverse stakeholders to minimize competing priorities for participating organizations and provide additional training and support. For example, future surgical collaborative projects should begin with training sessions on quality improvement and patient safety methods for hospital-level collaborative leaders to foster a common understanding of key concepts and foster the development of appropriate skills.

Engage Clinicians and Connect Them in Peer Learning Communities

CUSP provides a robust strategy to engage clinicians and create a foundation for peer learning communities. Nevertheless, in addition to training, clinicians leading these improvement efforts must have the time and resources necessary to improve. In addition to creating an enabling infrastructure within an organization, future surgical collaboratives should explore opportunities to provide funding for CE efforts, especially face-to-face hospital meetings. Face-to-face meetings promote engagement and the establishment of peer norms that are a critical component of the clinical community.

Transparently Report and Create Accountability

Key stakeholders need timely and valid data on performance and shared leadership accountability. Senior leadership cannot simply delegate surgical collaborative work to the quality improvement or patient safety department staff. Frontline staff should own surgical harm; senior leaders should clearly communicate hospital goals, ensure that sufficient resources are allocated to achieve those goals, and monitor results based on a predetermined timeline.

Meaningful Involvement of Patient Representatives Within the Fractal Structure

Future surgical collaboratives should focus on a strategy that requires patient involvement and multidisciplinary collaboration across the perioperative care continuum. For example, a colorectal team at The Johns Hopkins Hospital implemented an Early Recovery After Surgery pathway that unified all phases of colorectal surgery patients' care from preoperative evaluation in the office to the hospitalization and on to the post-discharge followup visit (Table 20). A major focus of the pathway was to engage patients and their friends and family through education and shared responsibility for recovery. This initiative resulted in a rapid improvement in patient outcomes (SSI, urinary tract infections and venous thromboembolic events), patient experience, and cost.[22]

Table 20. Early Recovery After Surgery Pathway

BEFORE SURGERY	DAY OF SURGERY	INPATIENT RECOVERY	OUTPATIENT RECOVERY
Preoperative counseling about surgery, anesthesia, pain management, and recovery plan	Preoperative multimodal analgesia and postoperative nausea and vomiting prevention	Early ambulation protocol	Phone call from hospital nurse to review discharge instructions 2 days after hospital discharge
Facilitate smoking cessation if appropriate (SSI prevention)	Preoperative VTE prophylaxis before incision or 1 hour after epidural placement, if applicable (VTE prevention)	Remove urinary catheter on postoperative day 1 if no epidural; removal on day 2 if epidural or pelvic procedure (CAUTI prevention)	Referral to home health care agency for transition to home if new ostomy
Pre-operative visiting with enterostomal therapist if ostomy planned for procedure	Maintenance of normothermia by pre-operative and intraoperative forced air warming devices (SSI prevention)	Discontinue intravenous fluids	Return office visit in 10–14 days with surgeon and enterostomal therapist, if applicable
Mechanical bowel preparation with oral antibiotics (SSI prevention)	Prophylactic antibiotic administration (Cefotetan or Clindamycin and Gentamicin) before incision and redosed per recommendations during procedure (SSI prevention)	Rapid resumption of regular oral intake	
Chlorhexidine bathing (SSI prevention)	Intraoperative anesthesia management protocol (epidural anesthesia, total intravenous anesthesia, colloid and crystalloid protocol to reduce total intravenous fluids, avoid immunosuppressive agents)	Multimodal analgesia with or without epidural analgesia delivered by acute pain team (physicians and nurses)	
Continue oral intake until 2 hours before surgery (anesthesia guidelines)	Avoid urinary catheter placement for procedures less than 2 hours (CAUTI prevention)	Risk-stratified VTE prophylaxis (VTE prevention)	
	Mobilize to a chair	Education by enterostomal therapist about ostomy, if applicable	
	Resume small amounts of oral intake		

SSI = surgical site infection; VTE = venous thromboembolism; CAUTI = catheter-associated urinary tract infections

Conclusion

Overall, regardless of surveillance program or surgical procedure type, participation in the AHRQ Safety Program for Surgery was associated with a significant reduction in SSI rates, suggesting that the CUSP model is an engaging framework for the implementation of perioperative quality improvement and patient safety programs. SSIs are complex—procedure, patient, bacteria, and environmental factors all likely impact their development. The NPT needed to develop a program to achieve the following goals:

- Meet hospitals where they are in the SSI prevention journey;
- Teach improvement teams to identify local defects leading to SSIs across a variety of hospital and surgical patient populations;
- Reengage clinicians to lead efforts to improve care for surgical patients; and
- Ensure that all patients received evidence-based care.

Prior CUSP involvement was a great motivator to site participation: Hospitals that had initiated Stop BSI or Stop CAUTI projects used their positive experience in HAI reduction to convince administrators and frontline staff to join and prioritize participation in the AHRQ Safety Program for Surgery. Experience with the CUSP model allowed teams to ramp up faster and begin implementing surgical quality improvement initiatives. In addition to the development and demonstration of a scalable, effective change package for SSI reduction, the AHRQ Safety Program for Surgery enabled CEs and hospital teams to create a sustainable infrastructure for future surgical safety projects.

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Appendix: Supplemental Analyses

Table 1. Summary NHSN Colon and Non-Colon Data, Paired Comparison of Baseline and Quarter 5

	Pre-Intervention	Post-Intervention
	Baseline	Q5
	12 Months	Months 13-15
NHSN Colon Procedures		
Number of Hospitals Reporting	81	81
Number of Teams Reporting	81	81
Total Number of Surgical Cases	7614	1959
Total Number of SSIs	258	45
SSI Rate: (SSIs/Cases)×100	3.39	2.30
Relative Reduction (compared with baseline)		-32%
P Value*		0.027
NHSN Non-Colon Procedures		
Number of Hospitals Reporting	43	
Number of Teams Reporting	68	68
Total Number of Surgical Cases	22717	4764
Total Number of SSIs	178	27
SSI Rate: (SSIs/Cases)×100	0.78	0.57
Relative Reduction (compared with baseline)		-28%
P Value*		0.016

*Wilcoxon sign rank test

Table 2. Summary NSQIP Colon and Non-Colon Data, Paired Comparison of Baseline and Quarter 5

	Pre-Intervention	Post-Intervention
	Baseline	Q5
	12 Months	Months 13-15
NSQIP Colon Procedures		
Number of Hospitals Reporting	34	34
Number of Teams Reporting	34	34
Total Number of Surgical Cases	3757	802
Total Number of SSIs	471	75
SSI Rate: (SSIs/Cases)×100	12.54	9.35
Relative Reduction (compared with baseline)		-25%
P Value*		0.040
NSQIP Non-Colon Procedures		
Number of Hospitals Reporting	22	22
Number of Teams Reporting	30	30
Total Number of Surgical Cases	7596	1435
Total Number of SSIs	313	33
SSI Rate: (SSIs/Cases)×100	4.12	2.30
Relative Reduction (compared with baseline)		-44%
P Value*		0.009

*Wilcoxon sign rank test