

Evidence-Based Surgical Care Quality Improvement Programs and Strategies for Critical Access Hospitals

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This brief is one in a series of policy briefs identifying and assessing evidence-based patient safety and quality improvement interventions appropriate for use by state Flex Programs and Critical Access Hospitals (CAHs).

Introduction

This report focuses on evidence-based surgical care QI programs and strategies that are applicable to inpatient and outpatient surgeries in CAHs. The Flex Monitoring Team prepared this report as part of a larger project, whose purpose is: 1) to identify successful evidence-based QI programs and strategies that could be replicated in CAHs and 2) to disseminate information about these programs and strategies to State Flex Programs.

Background

QI programs can encompass a wide range of strategies, and many QI interventions include multiple strategies, which has made it difficult to evaluate their effectiveness. There is a growing awareness that QI strategies need to rest on a strong evidence base, and that greater attention needs to be paid to understanding why particular interventions work and the factors that affect their success in different settings.¹⁻³

Quality Improvement and the Flex Program

Improving the quality of care provided by CAHs is an important goal of the Medicare Rural Hospital Flexibility (Flex) Program. Throughout the Flex Program, CAHs have implemented a range of QI activities with support from State Flex Programs, as documented by previous Flex Monitoring Team CAH surveys and case studies.⁴⁻⁶ Support for QI in CAHs is a core activity area of focus in the current State Flex Program Grant Guidance. The Federal Office of Rural Health Policy, through the Flex Program, has implemented a new special project, the Medicare Beneficiary Quality Improvement Project (MBQIP). MBQIP is focused on Medicare beneficiary health status improvement, which makes it especially important to identify successful QI programs that can be replicated in CAHs. MBQIP is being

Key Findings

- The peer-reviewed literature on surgical care quality improvement (QI) primarily addresses programs and strategies that were implemented as part of the national Surgical Care Improvement Project (SCIP) and reporting of surgical care quality measures to the Centers for Medicare and Medicaid Services (CMS).
- These QI programs and strategies focus on improving three aspects of surgical care: 1) prevention of surgical infections; 2) prevention of venous thromboembolism; and 3) prevention of adverse cardiac events.
- Although few peer-reviewed articles specifically address implementation of surgical care QI programs and strategies in Critical Access Hospitals (CAHs), several programs and strategies have been found to be effective and could be replicated in CAHs.

implemented in three phases; the quality measures for Phase 2 include the CMS outpatient surgical care improvement measures (Table 1). For 2010 discharges, CAHs that reported to Hospital Compare scored lower overall than other rural and urban hospitals on the two outpatient surgical measures.²¹

Surgery in Rural and Critical Access Hospitals
Surgical case mix varies across urban and rural hospitals, with general surgical procedures accounting for a much higher proportion of inpatient surgery in rural hospitals than in urban hospitals (42% vs. 25%). Rural hospitals also have a higher proportion of obstetric/gynecological surgical procedures (27% vs. 20%) than urban hospitals, and lower proportions of orthopedic, vascular, and cardiothoracic procedures.⁷ American Hospital Association Annual Survey data indicate that about 79% of CAHs provide some type of inpatient surgery, and 88% of CAHs provide outpatient surgical procedures.⁸

Approach

We reviewed and synthesized several types of literature on QI programs and strategies, including articles in peer-reviewed healthcare journals and reports from a variety of public and private organizations working on QI issues in hospitals. The focus of this literature review and synthesis was on initiatives to improve care for surgical patients. We sought to identify programs and strategies that have been successfully implemented in small rural hospitals, as well as other programs and strategies that hold promise for adoption in the small rural hospital environment because the type of resources used to implement them are generally available to CAHs. A SCIP literature review from the Oklahoma Foundation for Medical Quality was particularly helpful.⁹

To help identify additional QI programs and strategies that have not been documented in the literature, we consulted with members of the Flex Monitoring Team Expert Work Group, including State Flex Coordinators and CAH administrators. As needed, we also contacted sponsoring organizations to provide supplemental information

on participant characteristics and QI methods and strategies used.

Results

Surgical Care Improvement Project
The Surgical Care Improvement Project (SCIP) is a national quality partnership of organizations interested in improving surgical care by significantly reducing surgical complications. It began as the Surgical Improvement Project (SIP), which was a collaboration between CMS and the Centers for Disease Control (CDC) that focused on post-operative infection prevention in targeted surgical procedures. SIP process measures targeted correct antibiotic selection and timing of administration, appropriate post-operative oxygen use, and appropriate hair removal. SIP outcome measures focused on maintenance of body temperature and glucose levels.¹⁰

In 2003, SIP was renamed SCIP. Its focus expanded beyond infection prevention to target additional preventable surgical complications, including prevention, diagnosis, and appropriate treatment of thromboembolism and cardiac events resulting in postoperative morbidity and mortality. Additional quality measures were adopted to reflect the expanded scope; the SCIP measures were subsequently selected by CMS and the Joint Commission as national reporting measures. SCIP is guided by a national Steering Committee, whose members represent a variety of health care providers, federal agencies and organizations engaged in quality improvement.¹⁰

Many rural hospitals, including CAHs, have actively participated in SCIP-related initiatives. In 2007, for example, 21 rural hospitals, including 19 CAHs, participated in a surgical care improvement collaborative funded by the Wisconsin Flex Program and led by the Wisconsin Hospital Association.¹¹ As of 2011, the Medicare Quality Improvement Community (MedQIC) website listed over 100 rural hospitals from 36 states that have used elements of the SCIP protocol for surgical safety improvement.¹²

Additional Initiatives to Improve Surgical Care
 Multiple national and state quality improvement and patient safety initiatives have included surgical care. The Institute for Healthcare Improvement's 100,000 Lives Campaign addressed prevention of surgical site infections, and the IHI 5 Million Lives Campaign included a focus on reducing surgical complications.¹³ Surgical site infection prevention is a priority focus area for the national Partnership for Patients initiative.¹⁴ The Surgical Care and Outcomes Assessment Program (SCOAP) is a voluntary QI collaborative of hospitals and surgeons in Washington State focused on increasing the use of best practices in surgical care.¹⁵⁻¹⁶

Surgical Care Improvement Quality Measures
 The SCIP quality measures in the CMS Inpatient and Outpatient Quality Reporting Programs/ Hospital Compare are based on a strong body of clinical evidence.^{9,17} They have also met the four criteria for designation as Joint

Commission "accountability" measures: 1) strong scientific evidence exists demonstrating that compliance with a given process of care improves health care; 2) the process being measured is closely connected to the outcome it impacts; 3) the measure accurately assesses whether the evidence-based process has actually been provided; and 4) the measure construct is designed to minimize or eliminate unintended adverse effects.¹⁸

Figure 1 lists the SCIP measures; detailed specifications are available in the inpatient and outpatient specification manuals on the www.qualitynet.org website.¹⁹⁻²⁰ For 2010 discharges, between 418 and 458 CAHs publicly reported data to Hospital Compare on the five surgical infection prevention measures and the two surgical venous thromboembolism prevention measures.²¹ Fewer CAHs reported data on the surgical beta blocker measure (219 CAHs) and the two outpatient surgical measures (154-158

Figure 1: CMS Surgical Care Inpatient and Outpatient Quality Measures

<i>Inpatient Measures</i>	
Surgical Infection Prevention	<ul style="list-style-type: none"> • Prophylactic antibiotic received within one hour prior to surgical incision • Prophylactic antibiotics discontinued within 24 hours after surgery end time • Appropriate prophylactic antibiotic selection • Surgery patients with appropriate hair removal¹ • Inpatients whose urinary catheters were removed within 2 days after surgery to reduce the risk of infection
Prevention of venous thromboembolism (VTE)	<ul style="list-style-type: none"> • Surgery patients with recommended VTE prophylaxis ordered • Surgery patients who received appropriate VTE prophylaxis within 24 hours prior to surgery to 24 hours after surgery
Prevention of adverse cardiac events	<ul style="list-style-type: none"> • Cardiac surgery patients with controlled 6 a.m. postoperative blood glucose • Surgery patients on a beta blocker prior to arrival who received a beta blocker during the perioperative period
Surgical outcomes	<ul style="list-style-type: none"> • Surgical Site Infection rate²
<i>Outpatient Measures</i>	
Surgical Infection Prevention	<ul style="list-style-type: none"> • Prophylactic antibiotic received within one hour prior to surgical incision • Appropriate prophylactic antibiotic selection

¹CMS suspended required data collection for this measure for PPS hospitals as of January 1, 2012; hospitals may voluntarily submit data to CMS and it remains a Joint Commission measure.

²PPS hospitals are required to submit data for this measure to the CDC National Healthcare Safety Network as of January 1, 2012; CDC then transmits the data to CMS. Data will be available on Hospital Compare starting in 2013.

CAHs). No CAHs reported on the cardiac surgery postoperative blood glucose measure.

Literature on QI Programs and Strategies to Improve Surgical Care

The peer-reviewed literature and reports on surgical care quality improvement primarily address initiatives that were implemented as part of national SCIP efforts and reporting of surgical care quality measures to CMS. The vast majority of articles and reports focus on surgical infection prevention in the inpatient setting. However, since the CMS antibiotic timing and selection measures are similar for the inpatient and outpatient settings, many of the QI strategies used for inpatient surgery are likely to be applicable to the hospital outpatient setting as well.²²

The QI strategies that were identified in the peer-reviewed literature and reports are summarized below (the numbers after each program or strategy refer to the references that follow). Table 1 provides additional information about the QI programs and strategies to improve surgical care, their sponsoring organizations, program details and results, and the extent to which they included CAHs and other small rural hospitals.

QI Programs/Strategies focused on surgical infection prevention and other aspects of surgical care improvement, e.g., prevention of venous thromboembolism and cardiac events

- Provision of baseline data on hospital performance (e.g., data on individual hospital-level performance on the surgical care quality measures provided prior to implementation of a QI intervention).^{10,15,16,23,25,26,29,30}
- Data feedback and benchmarking (e.g., performance data provided to hospitals (and, in some cases, surgeons) on surgical quality measures over time and in relation to other hospitals or desired levels of performance).^{10,15-17,23,25,26,28-30}
- Educational sessions/training for surgical staff (e.g., presentation of information by experts to surgeons and perioperative personnel on topics such as the scientific basis for the surgical quality measures as well as peer-to-peer sessions for sharing of surgical care

improvement tools and best practices from other hospitals).^{10,15-17,23,25,26,28}

- Cross-disciplinary teams (e.g., surgeons, anesthesiologists, operating room nurses, infection control, and pharmacy staff) to develop action plans for improving performance on surgical care measures, clearly define responsibilities for specific processes, implement changes and monitor progress.^{17,23,25,29,30}
- Surgical checklists that list step-by-step processes to be completed prior to the start of surgery and during surgery as appropriate, such as administration of antibiotic prophylaxis, having active warming of the patient in place, etc.^{15,16,25,27,28}
- Standardized order forms (e.g., pre-surgical forms that list evidence-based recommendations for antibiotics for specific surgeries; post-surgical forms with automatic stop orders for antibiotics within 24 hours after surgery end and for catheter removal within 2 days).^{22,25,27,30}
- Computerized clinician reminders (e.g., use of electronic medical records, clinical decision support systems, and alerts to identify relevant patients and remind clinicians about the need for antibiotic and VTE prophylaxis orders).²⁷⁻²⁹

Figure 1 contains links to tools and resources to facilitate the use of these strategies.

Conclusions

The peer-reviewed literature on surgical care QI primarily addresses programs and strategies that were implemented as part of the national SCIP and reporting of surgical care quality measures to CMS. Few articles have evaluated the effectiveness of these QI programs specifically for CAHs. However, many QI programs and strategies, including data feedback and benchmarking, educational sessions for surgical staff, cross-disciplinary teams, surgical checklists, standardized order forms, and clinician reminders have been shown to improve surgical care processes and could be replicated in CAHs.

How can State Flex Programs help CAHs Improve Surgical Care?

State Flex programs can assist CAHs in improving outcomes for SCIP measures by:

- Encouraging CAHs to use the evidence-based programs, tools and resources highlighted in this brief;
- Providing technical assistance and support to assist CAHs in implementing evidence-based QI activities related to surgical care improvement;
- Encouraging CAHs to benchmark their performance against other CAHs; participation in MBQIP will allow hospitals to do this for outpatient surgical measures.
- Fostering collaborative relationships between CAHs and QIOs; and
- Encouraging CAHs to participate in MBQIP, Partnerships for Patients, and other quality and patient safety initiatives that address surgical care improvement.

Figure 1. Tools and Resources for Surgical Care Quality Improvement

SCIP Toolkits

This resource document from the Arizona Health Services Advisory Group (the Arizona QIO) includes SCIP tools and step-by-step improvement directions.

www.hsag.com/App_Resources/Documents/SCIP_SpreadToolkit.pdf

This SCIP toolkit from the North Carolina Center for Hospital Quality and Patient Safety provides resources on SCIP project management, the use of teams, performance improvement and measurement. www.ncqualitycenter.org/downloads/NCSCIPtoolkit.pdf

Institute for Healthcare Improvement How-to Guide: Prevent Surgical Site Infections.

This IHI guide describes key evidence-based care components for preventing surgical site infections, describes how to implement these interventions, and recommends measures to gauge improvement. It was initially developed as part of IHI's 5 Million Lives Campaign. www.ihl.org/knowledge/Pages/Tools/HowtoGuidePreventSurgicalSiteInfection.aspx.

Institute for Healthcare Improvement (IHI) Mentor Hospitals

The IHI website maintains a registry of mentor hospitals that have volunteered to provide support, advice, clinical expertise, and tips to hospitals seeking help with their implementation efforts on surgical care related topics including use of the surgical safety checklist, surgical complications, and venous thromboembolism. The registry includes information on mentor hospital characteristics, such as urban/rural location, teaching status and bed size, to allow hospitals to find mentors with similar demographics. The availability of rural hospital mentors varies by topic; for example, as of May 2012, the surgical safety checklist mentors were all large urban facilities, while four rural hospitals, including one CAH, were among the surgical complications mentors.

www.ihl.org/offering/MembershipsNetworks/MentorHospitalRegistry/Pages/default.

Figure 1. Tools and Resources for Surgical Care Quality Improvement (continued)

Preventing Hospital-Acquired Venous Thromboembolism: A Guide for Effective Quality Improvement. AHRQ Publication No. 08-0075.

This practical guide was prepared for AHRQ by the Society of Hospital Medicine for the purpose of assisting hospital QI staff in implementing efforts to prevent hospital-acquired venous thromboembolism (VTE). Topics covered include assembling an effective team, setting goals and a timeline, constructing a VTE protocol, analyzing care delivery and tracking performance.

www.ahrq.gov/qual/vtguide/

Surgical Care and Outcomes Assessment Program (SCOAP) Surgical Checklists

The SCOAP website includes steps to follow in implementing SCOAP and links to download the surgical checklist, ambulatory surgery checklist and a poster version of the checklist.

www.scoap.org/checklists/implementation

Improving Surgical Care: Stories from the Field

This presentation describes the experiences of two small rural Minnesota hospitals, including one CAH, which worked with Stratis Health, Minnesota's QIO, on SCIP projects.

www.stratishealth.org/documents/ImprovingSurgicalCarePanelPresentation_website.pdf

Partnership for Patients

Surgical Site Infection prevention is one of nine focus areas for the Partnership for Patients initiative. Through the initiative, federal funding has been awarded to 26 Hospital Engagement Networks to develop learning collaboratives for hospitals and provide a wide array of initiatives and activities to improve patient safety. The networks will conduct intensive training programs to support hospitals in making patient care safer, provide technical assistance so that hospitals can achieve quality measurement goals, and establish and implement a system to track and monitor hospital progress in meeting quality improvement goals.

<http://www.healthcare.gov/compare/partnership-for-patients/index.html>

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This policy brief is available at www.flexmonitoring.org. For more information, please contact Jill Klingner at klin0089@d.umn.edu

Table 1. Evidence-Based Surgical Care Improvement Programs/Strategies					
Measures Addressed, Strategies Used	Sponsoring Organizations	Program Description	Results	Inclusion of CAHs/small rural hospitals	Citations
<p><u>Measures addressed:</u></p> <ul style="list-style-type: none"> • Antibiotic timing • Antibiotic selection • Antibiotic duration • Maintenance of normothermia • Avoid shaving surgical site • Oxygenation • Glucose control <p><u>Strategies used:</u></p> <ul style="list-style-type: none"> • Collaborative learning sessions • Teams led by clinical champions, who identified processes that worked best in their local hospital • Reporting of quarterly data on national measures • Support from QIOs • Sharing of tools and processes used by successful hospitals, e.g., preprinted order forms with recommended antibiotics; post-surgical forms with automatic antibiotic stops after 24 hours; pharmacist review of patient charts and one-on-one followup with physicians to address variance from recommendations; and assignment of responsibility for antibiotic administration to anesthesiology. 	<p>The National Surgical Infection Prevention Collaborative was a CMS demonstration project led by Qualis Health, the QIO for WA, ID, and AK.</p>	<ul style="list-style-type: none"> • 43 QIOs and 56 hospitals from all 50 states participated in a 12 month project. • 4 two-day learning sessions for teams of 2-4 persons (surgeon or anesthesiologist, perioperative nurses and infection control professionals) included review of evidence base and methods for implementing and measuring change. • Each team conducted self-assessments and established action plans. Emails, monthly conference calls, and calls with other teams and supporting QIOs were used to share barriers, results and lessons learned. 	<p>Participating teams demonstrated significant improvement in median performance over one year in antibiotic timing (72% to 92%), antibiotic selection (90% to 95%) and discontinuation within 24 hours (67% to 85%); maintenance of temperature (57% to 74%), oxygenation (75% to 94%) and glucose control (46% to 54%); and avoidance of shaving surgical site (59% to 95%). The infection rate decreased 27%, from 2.3% to 1.7%.</p>	<p>Participants included several small and rural hospitals.</p>	<p>Dellinger et al²³</p>

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<p><u>Measures addressed:</u></p> <ul style="list-style-type: none"> • Outcome and process measures for appendectomies, colorectal procedures, and bariatric surgeries. <p><u>Strategies used:</u></p> <ul style="list-style-type: none"> • Data reporting and feedback • Peer-to-peer educational interventions • Use of standardized orders and operating room checklists 	The Surgical Care and Outcomes Assessment Program (SCOAP) is a QI collaborative. It is a program of the Foundation for Health Care Quality in Seattle, WA.	SCOAP was established in 2006. It consists of 2 components: 1) a surveillance system that gathers data on risk-adjusted outcomes and over 50 processes of care and 2) a “correction” function that engages surgeons to address lapses in care delivery. It encourages use of educational interventions, preprinted orders and an operating room checklist. The initial set of surgeries includes appendectomies, colorectal procedures, and bariatric surgeries.	All participating hospitals in Washington State use standardized orders/templates and SCOAP OR checklists, which address processes such as administration of antibiotics within 60 minutes, active warming of patient, VTE prophylaxis and glucose control.	Sixty hospitals in Washington State participate, including CAHs and rural hospitals	Flum et al, 2005 ¹⁵ Kwon et al, 2012 ¹⁶
<p><u>Measures addressed:</u></p> <ul style="list-style-type: none"> • Antibiotic timing • Antibiotic selection • Antibiotic duration <p><u>Strategies used:</u></p> <ul style="list-style-type: none"> • Data surveillance • Encouraging hospitals to participate in QI activities 	CMS, CDC and the SCIP Steering Committee	Ongoing national surveillance and encouraging hospitals to participate in QI activities to reduce surgical complications	National surveillance data for 2002-2004 showed improvement in all three antibiotic measures	Many rural hospitals, including CAHs, have participated in SCIP activities.	Bratzler and Hunt, 2006 ¹⁰ Free full text is available at: http://cid.oxfordjournals.org/content/43/3/322.long

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<u>Measures addressed:</u> <ul style="list-style-type: none"> • Antibiotic timing • Antibiotic selection • Antibiotic duration • Avoidance of shaving • Perioperative glucose control <u>Strategies used:</u> <ul style="list-style-type: none"> • Clinician reminders • Educational interventions • Automatic stop orders 	AHRQ	This critical analysis examined the research on QI interventions related to preventing surgical site infections and reduction of catheter-associated urinary tract infections.	<ul style="list-style-type: none"> • Clinician reminders and educational interventions with audit and feedback were effective at improving appropriate prophylaxis. • The effectiveness of QI strategies promoting perioperative glucose control or normothermia, or decreasing operative site shaving could not be determined as very few studies reported data on these measures. • Physician reminders coupled with automatic stop orders were effective at reducing duration of urethral catheterization. 	Multiple studies of different types of hospitals were examined; with the exception of one study involving 6 rural hospitals in Australia, no information was included on rural or urban location.	Ranji et al, 2007 ²⁷
<u>Measures addressed:</u> <ul style="list-style-type: none"> • Antibiotic timing • Antibiotic selection • Antibiotic duration • Maintenance of normothermia • Maintenance of normoglycemia in diabetic patients • Surgical site infection rates 	University of Virginia Health System	This 547 bed hospital implemented a multidisciplinary wound-management protocol that included: designation of responsibility for preoperative antibiotic administration and thermoregulation; standardized processes for delivery of preoperative antibiotics and use of warming devices;	Compliance with administration of prophylactic antibiotics increased from 68% to 91% ($p \leq 0.0001$), and compliance with cessation within 24 hours increased from 71% to 93% ($p \leq 0.0001$). Compliance with normothermia increased from 64% to 71% ($p = 0.25$). Inci-	The study hospital is a large urban facility, but the basic strategies used to implement the protocol (e.g., standardized pro	Hedrick 2007 ²⁷

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<p><u>Strategies Used:</u> Implementation of a multidisciplinary wound-management protocol</p>		standing orders and reminders; education of OR staff; monthly feedback on compliance and infection rates; involvement of pharmacy staff; and design and use of a protocol for intra-operative and post-operative glucose monitoring	Prevalence of SSI fell from 25.6% to 15.9% ($p \leq 0.05$).	feedback, etc.) could be replicated in smaller rural hospitals.	
<p><u>Measures addressed:</u></p> <ul style="list-style-type: none"> • Antibiotic timing • Antibiotic selection • Antibiotic duration <p><u>Strategies used:</u></p> <ul style="list-style-type: none"> • Comparative feedback reports • Collaborative meetings and materials • Development/revision of policies, pathways, forms • Feedback to relevant staff (e.g. surgeons, quality, infection control teams) • Educational interventions • Modification or standardization of processes • Clinician reminders 	Study was a collaboration of the Society for Healthcare Epidemiology of America, Joint Commission, and CDC.	44 hospitals volunteered for a randomized trial and were assigned to 1 of 2 groups: 1) comparative feedback reports only and 2) feedback plus a QI collaborative that included in-person meetings, teleconferences and supplementary materials.	Both groups implemented a median of 8 QI strategies. Both groups improved performance on the measures. Differences between the groups were not significant.	33 of 44 hospitals were teaching hospitals; no information on rural or urban location. Strategies used could be replicated in smaller rural hospitals.	Kritchevsky et al., 2008 ²⁸

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<p><u>Measures addressed:</u></p> <ul style="list-style-type: none"> • Antibiotic timing • Antibiotic selection • Antibiotic duration • VTE prophylaxis ordered • Maintenance of normothermia • Maintenance of normoglycemia • Administration of beta blockers <p><u>Strategies Used:</u></p> <ul style="list-style-type: none"> • Multi-disciplinary SCIP team • Education of surgeons through multiple venues • Modification of forms to serve as prompts for staff • Preoperative checklist • chart review • Standardized preoperative order sets • Laminated cards with antibiotic choices. • All operating rooms have prophylactic antibiotic listings by surgical specialty for quick reference • Monthly 	The University of California San Diego Medical Center	This 325-bed teaching institution implemented multiple strategies to improve performance on the SCIP measures over a 2 year time period.	Antibiotic timing improved to more than 90%. Appropriate antibiotic choice improved to 100%. The hospital had more difficulty with cessation of antibiotics postoperatively within 24 hours, VTE prophylaxis and administration of beta blockers.	The study hospital is a large urban facility, but strategies used (e.g., multi-disciplinary education, checklists etc.) could be replicated in smaller rural hospitals.	Potenza et al, 2009 ²⁵

Table 1. Evidence-Based Surgical Care Improvement Programs/Strategies					
Measures Addressed, Strategies Used	Sponsoring Organizations	Program Description	Results	Inclusion of CAHs/small rural hospitals	Citations
<p><u>Measures addressed:</u></p> <ul style="list-style-type: none"> • VTE prophylaxis ordered • Receipt of appropriate VTE prophylaxis <p><u>Strategies used:</u></p> <ul style="list-style-type: none"> • Formal SCIP teams • Reviews of measure • failures, including surgical patient readmissions • Tools including a communication log, pocket card and quick reference nursing education materials. • Medical and nursing staff symposia • One-on-one discussions of missed SCIP care opportunities with involved medical, anesthesia, and nursing staff 	Fletcher Allen Health Care, Vermont	A multidisciplinary committee was convened to improve compliance with measures. Guidelines were developed and communicated. Monthly audits of surgical services were conducted, with detailed failure analysis. Small teams were convened for 1-3 months to correct common failures and implement new hospital processes.	<ul style="list-style-type: none"> • The initial antibiotic timing measure improved from 72% at baseline to 84%. • The appropriate antibiotic selection measure was high to start (98%) and remained steady. • The antibiotic duration measure improved significantly from 55% to 87%. 	The study hospital is a large teaching facility, but strategies could be replicated in smaller rural hospitals.	Wilson and Merli, 2011 ²⁹