Implementing a Colorectal Bundle in a Multi-Hospital Collaborative

Lessons from the TSQC

Barbara J. Martin RN MBA CCRN
with
William Gibson MD FACS
Chris Clarke RN
Objectives

• Describe development of a set of clinical interventions to reduce surgical site infection
• Review successes, barriers and lessons learned
• Discuss strategies to engage participation of hospitals and clinicians
Tennessee Surgical Quality Collaborative

Tennessee Chapter of American College of Surgeons

Blue Cross Blue Shield of Tennessee

Tennessee Hospital Association through the Tennessee Center for Patient Safety

Hospitals
• Surgeons, Clinical Reviewers, CEOs, Quality Directors
TSQC

Mission
• To improve the care of the surgical patient by supporting an open discussion and transfer of information through a collaborative team effort.

Vision
• To identify best surgical practices, examine how the surgical team obtains best outcomes and teach other surgical teams how to improve outcomes.
TSQC Goals

• Create a consortium of surgeons and hospitals to evaluate and improve surgical care by surgeons in the state of Tennessee

• Active engagement of physicians through the TnACS and collection of quality data effective in driving improvement in surgical outcomes.
Objectives

• Learn from high performers
• Develop best-practice recommendations
• Identify system variables influencing clinical performance
• Non-competitive environment for shared learning
TSQC Member Hospitals

Memphis
Baptist Memorial Hospital
Methodist University Hospital
Saint Francis Hospital

Jackson
Jackson Madison Co General Hospital

Nashville
Vanderbilt University Medical Center
Baptist Hospital
Saint Thomas Hospital
Summit Medical Center

Springfield
NorthCrest Medical Center

Cookeville
Cookeville Regional Medical Center

Crossville
Cumberland Medical Center

Tazewell
Claiborne County Hospital

Bristol
Bristol Regional Medical Center

Johnson City
Johnson City Medical Center

Knoxville
Parkwest Medical Center
University of Tennessee Medical Center
Ft. Sanders Regional Medical Center

Chattanooga
Erlanger Health System
Memorial Health Care System

Columbia
Maury Regional Medical Center
TSQC Demographics

- 21 member hospitals
  - 5 academic medical centers
  - 16 community hospitals
    - 6 rural hospitals

TSQC hospitals perform 49% of the state’s total volume of surgical procedures
## TSQC Patient Pre-operative Risks

<table>
<thead>
<tr>
<th>Preoperative Risk Measure</th>
<th>TSQC (Tennessee)</th>
<th>NSQIP (National)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA class 4/5</td>
<td>11.6% of cases</td>
<td>6.8% of cases</td>
</tr>
<tr>
<td>5+ preoperative risk factors</td>
<td>13.2%</td>
<td>6.8%</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>20.7%</td>
<td>15%</td>
</tr>
<tr>
<td>Total dependence</td>
<td>2.4%</td>
<td>1.2%</td>
</tr>
<tr>
<td>COPD</td>
<td>8.4%</td>
<td>4.9%</td>
</tr>
<tr>
<td>CVA/stroke</td>
<td>6%</td>
<td>3.5%</td>
</tr>
</tbody>
</table>
“Driving Improvement . . .”

• Our maturing group sought a focus for improvement
• The TSQC as a group is not an outlier, but there are variations in outcomes within the group
• Infection-related outcomes were initially attractive
  – Relatively high volume
  – Proven interventions
# 30 Day Postoperative Occurrences

## Comparing Tennessee Outcomes to National Performance

<table>
<thead>
<tr>
<th>Jan – Dec 2010</th>
<th>TSQC</th>
<th>NSQIP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Postop Occurrences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superficial SSI</td>
<td>2.3%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Deep SSI</td>
<td>0.5%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Organ Space SSI</td>
<td>2.1%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1.9%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Urinary Tract Infection</td>
<td>2.0%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Severe Sepsis</td>
<td>0.9%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Mean # of Occurrences</td>
<td>0.2 (± 0.7)</td>
<td>0.2 (± 0.7)</td>
</tr>
</tbody>
</table>
TSQC Opportunities

• Surgical site infections as the first focus

• Rationale:
  – High Volume occurrence in TSQC data
  – 9 of 10 SCNRs identified SSI as opportunity
  – Aligns with hospital current focus on SSI via CMS SCIP public reporting
  – Business case – Length of Stay and Costs significant
Colectomy

• With no obvious outliers in the aggregate data, analysis of specific procedures was indicated.
• Most high-volume procedures were within NSQIP-comparison norms.
• Colectomies were identified as focus for improvement
  – High morbidity
  – High volume
  – Common to all hospitals
# TSQC Volumes

<table>
<thead>
<tr>
<th>Year</th>
<th>Colectomies</th>
<th>Total Cases</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1,194</td>
<td>13,510</td>
<td>8.8%</td>
</tr>
<tr>
<td>2010</td>
<td>1,227</td>
<td>14,933</td>
<td>8.2%</td>
</tr>
<tr>
<td>2011</td>
<td>1,342</td>
<td>14,682</td>
<td>9.1%</td>
</tr>
<tr>
<td>Total</td>
<td>3,763</td>
<td>43,125</td>
<td>8.7%</td>
</tr>
</tbody>
</table>
30 Day Outcomes: Colectomy

<table>
<thead>
<tr>
<th></th>
<th>TSQC</th>
<th>NSQIP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Superficial Incisional SSI</strong></td>
<td>7.2%</td>
<td>6.5%</td>
</tr>
<tr>
<td><strong>Organ/Space SSI</strong></td>
<td>4.5%</td>
<td>3.7%</td>
</tr>
<tr>
<td><strong>Deep Incisional SSI</strong></td>
<td>0.9%</td>
<td>1.3%</td>
</tr>
</tbody>
</table>
Risk Adjusted Site Comparison Superficial SSI
12 Months Ended June 30, 2011
Justification for Colectomy Focus

- High volume in all hospitals
  - 8-9% of total TSQC cases
  - 1250 colon cases annually
- Performed by nearly 200 surgeons
- Practice recommendations available
- Established outcomes rates
  - NSQIP
  - NHSN
Costs of Surgical Site Infections

- Literature review
  - LOS increases 7-10 days
  - Additional cost $20,000
- THA hospital billing data
  - TSQC Patients with wound occurrence
    - Average length of stay 7.2 extra days
    - Additional costs $25,546 per case
ACS NSQIP Best Practices

• Policies in place, compliance measured
  – SCIP Measures
    • Blood glucose control
    • Normothermia
  – Asepsis/Cleaning
  – OR Provider (nails, scrub, attire)

• Limited implementation
  – Drain placement/management
  – Antibiotics adjusted for morbid obesity
  – Antibiotics re-dosed if extended OR time
  – Supplemental oxygen for colorectal surgery
## SCIP Performance Antibiotic Measures

<table>
<thead>
<tr>
<th>CMS Calculated Performance Measures</th>
<th>SCIP Abx within 1 hour</th>
<th>SCIP Abx Selection</th>
<th>SCIP Abx Discontinuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 10% Performance Level for All United States Hospitals</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Average Performance Level for All United States Hospitals</td>
<td>98%</td>
<td>98%</td>
<td>96%</td>
</tr>
<tr>
<td>Average Performance Level for All Tennessee Hospitals</td>
<td>98%</td>
<td>98%</td>
<td>96%</td>
</tr>
<tr>
<td>Average Performance Level for TSQC Hospitals</td>
<td>97%</td>
<td>98%</td>
<td>95%</td>
</tr>
<tr>
<td>TSQC range</td>
<td>95-99</td>
<td>95-99</td>
<td>87-99</td>
</tr>
</tbody>
</table>

CMS Hospital Compare Data updated May 2012
Distribution of Operative Time for Colectomy 2009-1 thru 2011-1

- Mode = 1.7 hours
- Median = 2.1 hours
- Mean = 2.42 hours
- Standard Deviation = 1.31 hours
- Total Cases = 2,794
- 5th percentile = 0.9 hours
- 25th percentile = 1.5 hours
- 50th percentile = 2.1 hours
- 75th percentile = 3.0 hours
- 95th percentile = 4.9 hours
- Number of Cases > 3 hours = 678
# Colectomy Operative Time v. All SSI Rate

<table>
<thead>
<tr>
<th>Decile Rank of Operative Time</th>
<th>Cases</th>
<th>Operative Time (Hours)</th>
<th>Total SSI Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>427</td>
<td>0.91</td>
<td>8.4%</td>
</tr>
<tr>
<td>2</td>
<td>410</td>
<td>1.34</td>
<td>10.0%</td>
</tr>
<tr>
<td>3</td>
<td>440</td>
<td>1.63</td>
<td>12.1%</td>
</tr>
<tr>
<td>4</td>
<td>417</td>
<td>1.91</td>
<td>11.5%</td>
</tr>
<tr>
<td>5</td>
<td>420</td>
<td>2.16</td>
<td>12.1%</td>
</tr>
<tr>
<td>6</td>
<td>419</td>
<td>2.46</td>
<td>15.3%</td>
</tr>
<tr>
<td>7</td>
<td>429</td>
<td>2.82</td>
<td>17.7%</td>
</tr>
<tr>
<td>8</td>
<td>425</td>
<td>3.12</td>
<td>16.5%</td>
</tr>
<tr>
<td>9</td>
<td>425</td>
<td>3.87</td>
<td>20.7%</td>
</tr>
<tr>
<td>10</td>
<td>420</td>
<td>5.60</td>
<td>29.1%</td>
</tr>
</tbody>
</table>

![Graph showing the relationship between Colectomy Operative Time and Total SSI Rate]

The graph shows a linear relationship between operative time and SSI rate, with an equation of $y = 0.0439x + 0.0398$ and an $R^2$ value of 0.9779.
Highest Preoperative Glucose v. All SSI Rate (%)

\[ y = 0.0535 \ln(x) - 0.1933 \]

\[ R^2 = 0.7438 \]
Identifying a “bundle”

• No structured, recognized group of strategies to reduce risk of SSI

• Some data for specific interventions and practices, none for a group of practices. Some approaches have generated controversy
  - SCIP
  - Mechanical and antibiotic bowel preparation
  - Hyperoxygenation
Identifying a “bundle”

- Level 1 or 2 data
- Not controversial
- Consider elements already in place (e.g., SCIP)
- Easily implemented case by case
- Able to be abstracted from the medical record
- Not mutually dependent: hospitals and surgeons can choose to participate in any or all of the elements
- Cheap
Bundle Options

• Oral Antibiotics
• Glycemic Control
• Parenteral Antibiotics
• Mechanical Bowel Prep
• Perioperative Oxygenation
• Wound closure

• Anastomosis Technique
• Skin preparation prior to admission
• Skin preparation prior to incision
• Normothermia
• Wound protection
The TSQC Colorectal Bundle

- Maintenance of normothermia
- Glycemic control
- Appropriate antibiotic use
- Perioperative hyperoxygenation
# Colectomy Bundle Recommendation

## Evidence Summary

<table>
<thead>
<tr>
<th>Resource</th>
<th>Summary</th>
<th>Findings</th>
<th>Comments</th>
</tr>
</thead>
</table>
| A bundle of interventions to reduce colorectal surgical infections Bull A, et al | Implementation of:  
- Normothermia  
- Normoglycemia  
- Oxygen delivery  
- Appropriate antibiotics | Colorectal surgical site infection 15% > 7% (not statistically significant) | Small sample size  
Difficulty to implement and maintain; low compliance with individual components  
Infection rates fell over the subsequent 12 months. |
| Perioperative supplemental oxygen therapy and surgical site infection: a meta-analysis of randomized controlled trials Qadan M et al | Meta-analysis of 5 RCTs, Control FiO2 .30 - .35, Study FiO2 .80 for 2-6 hours postoperatively, 30 day follow up  
3 studies colorectal; 2 studies multispecialty | Surgical site infection rates 12% control; 9% hyperoxic.  
Relative risk reduction  
Greater benefit in colorectal procedures | Variable use of abx, blood loss among studies  
No standard definition of infection  
Significant improvement in all but one study, where SSI rate increased. |
| Perioperative Normothermia to reduce the incidence of surgical wound infection and shorten hospitalization Kurz et al | Double-blind RCT demonstrating triple the incidence of SSI and pronged hospitalization in patients undergoing colectomy with intraoperative hypothermia | Surgical site infection in 19% of patients with intraoperative hypothermia and 6% of patients with intraoperative normothermia. | Standard preoperative prep; cases risk-adjusted for smoking, BMI, cases risk-adjusted for smoking, BMI, length of surgery. Clinical diagnosis of SSI. |
| Scientific Principles and Clinical Implications of Perioperative Glucose regulation and control Akhtar, S et al | Review article evaluating glucose control in the preoperative, intraoperative, and postoperative periods | Though there are unresolved questions regarding appropriate control it is prudent to maintain glucose levels < 180 mg / dL | The authors site heterogeneity in many of the included studies as a limitation to the analysis; postoperative control appears to have the most significant effect on postoperative complications |
| Antimicrobial prophylaxis: an advisory statement from the National Surgical Infection Prevention Project Bratzler DW et al | Consensus position statement from the Surgical Infection Prevention Guidelines Writers Group | Optimal prophylaxis ensures that adequate concentrations of an appropriate antimicrobial are present in the serum, tissue, and wound during the entire time that the incision is open and at risk for bacterial contamination. | This article is a primary source document for SCIP guidelines |
### Clinical Application and Review

<table>
<thead>
<tr>
<th>Measure</th>
<th>Recommendation</th>
<th>Clinical Application</th>
<th>NSQIP Abstraction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normothermia</strong></td>
<td>Maintain core temperature $&gt; 36^\circ$ during the perioperative period</td>
<td>Check temperature prior to entering the operating room. Check every 15 minutes intraoperatively. Check immediately upon arrival in PACU and every 30 minutes until discharge from PACU. Active warming (e.g., Bair hugger) for patients with temp $&lt; 36^\circ$.</td>
<td>Abstract lowest intraoperative temperature.</td>
</tr>
<tr>
<td><strong>Normoglycemia</strong></td>
<td>Maintain blood glucose level $&lt; 200$ mg/dl on the day of surgery and through the postoperative period</td>
<td>Check blood glucose (all patients) prior to entering the operating room, and in the PACU. Institute sliding scale insulin coverage for blood glucose $&gt; 200$, or per hospital protocol.</td>
<td>Abstract the highest glucose on the day of surgery.</td>
</tr>
<tr>
<td><strong>Antibiotic use</strong></td>
<td>Appropriate antibiotic selection and timing per SCIP guidelines</td>
<td>Administer antibiotics within 1 hour prior to surgical incision. Redose antibiotics if appropriate for operations lasting 3 hours or more.</td>
<td>No abstraction; hospital will report SCIP Inf 1f, 2f, and 3f performance.</td>
</tr>
<tr>
<td><strong>Supplemental Oxygen</strong></td>
<td>Administer supplemental oxygen at 80% intraoperatively and postoperatively for 6 hours by non-rebreather.</td>
<td>Deliver $\text{FiO}_2 .80$ through the anesthesia circuit and postoperatively.</td>
<td>Review anesthesia record, postoperative order set, PACU record for intraop and postop delivery. Answer “yes” if the order is for $\text{FiO}_2 .80$.</td>
</tr>
</tbody>
</table>
Collaborative Implementation

Fall 2011
- Baseline data analysis
- Literature review and development of recommendations
- Leadership Committee review and approval
- Consensus approval from collaborative membership

Winter 2011-2012
- Collaborative implementation target: January 1
- Trial implementation by Dr. Gibson
- SCR review and refinement of custom fields
Collaborative Implementation

Spring 2012
- Review of implementation progress: limited to individual surgeon preference in 6 of 10 hospitals
- Evaluation of support needs from members
- 11 Tennessee hospitals join NSQIP and TSQC

Summer 2012
- Status review with each hospital
  - Limited implementation
  - Opportunity for cultural shift
- Early analysis of custom field utilization
Collaborative Implementation

• Participation is voluntary
• Reporting practice change is voluntary
• Surgeons as leaders have varying roles within hospital implementation strategies
• Surgical Clinical Reviewers report through different departments
• TSQC initiative competes with other initiatives
Barriers

• Individual surgeon practice can be influenced; hospitals and systems are more difficult to change
• Some hospitals required multidisciplinary committee review and approval; others can change one surgeon at a time
• Changes to order sets may be difficult
• Indirect costs to implementation (e.g., glucometers)
How will we know the change is an improvement?

• Initiatives in place to reduce colorectal SSI
  – Joint Commission
  – Hospital Engagement Networks
  – SUSP Johns Hopkins
  – Local process improvement

• Evaluate process
  – Temperature regulation
  – SCIP compliance
  – Glucose regulation

Participation in a multi-hospital collaboration to reduce patient complications is a measure of success
Lessons Learned

• Surgeon Champions must believe, support, and proselytize.
• Supporting the program in the hospital and in the state requires multidisciplinary engagement
  – Surgeons Quality
  – Clinical leaders Infection Control
  – Anesthesiology Administration
• Improved patient outcomes will not be the first measure of success.
• NSQIP can be a stand-alone program—but collaboration will improve results.
Next Steps

• Engage newly-joined hospitals in the work of the collaborative
• Determine implementation status in member hospitals
• Share strategies for implementation among hospitals
• Evaluate process changes through analysis of aggregate data
Limited Bibliography


• Akhtar, S; Barash, PG; Inzucchi, SE Scientific Principles and Clinical Implications of Perioperative Glucose Regulation and Control. *Anesthesia and Analgesia, 110(2)*: 478-497. 10.1213/ANE.0b013e3181c6be63.

Thanks to

TSQC Surgical Clinical Reviewers
TSQC Surgeon Champions
TSQC Leadership Committee
Tennessee Chapter – American College of Surgeons
Blue Cross / Blue Shield of Tennessee
Tennessee Hospital Association / Tennessee Center for Patient Safety
William T. Cecil, MBA

For more information contact

Barbara J Martin RN MBA CCRN
Quality Consultant
Vanderbilt University Medical Center
Barbara.j.martin@Vanderbilt.edu

William C. Gibson MD FACS
Premier Surgical Associates
wgibson@premiersurgical.com

Chris Clarke RN
Senior Vice President, Clinical Services
Tennessee Hospital Association
cclarke@tha.com