BEST PRACTICES
CASE STUDIES

VOLUME 8 / JULY 2017

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BEST PRACTICES CASE STUDIES

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ACS QUALITY AND SAFETY CONFERENCE BEST PRACTICES CASE STUDIES

Through the Best Practices Case Studies, hospitals participating in ACS NSQIP, ACS NSQIP Pediatric, and MBSAQIP are provided with an opportunity to share their expertise in implementing surgical quality improvement initiatives within their facilities. The overall goal is to showcase how participating hospitals have utilized programmatic data to improve their performance and outcomes. It is hoped that the Best Practices Case Studies publication will allow program participants to learn from the experience of others and develop similar quality improvement projects within their own organizations.

The idea to publish the Best Practice Case Studies originated through feedback from ACS NSQIP sites via the ACS NSQIP annual conference. Hospitals were looking for information on how to utilize ACS NSQIP data to improve their surgical care and outcomes. Hence, the Best Practices Case Studies initiative was created to provide program participants with examples of quality improvement projects, designed by hospitals and implemented within their own facilities.

The 2017 Best Practices Case Studies were selected from a bank of more than 500 abstracts submitted for the 2017 ACS Quality and Safety Conference. All abstracts were reviewed and vetted by a panel of program experts, and the authors of the studies chosen were asked to further develop their case study and share their accomplishments.

Each case study was developed by quality improvement professionals at participating hospitals (for example, Surgical Clinical Reviewers, Metabolic Surgical Clinical Reviewers, Surgeon Champions, data analysts, program directors, and so on) and describes the objectives and end results of the quality improvement effort, as well as the planning, development, and troubleshooting process.

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Each Best Practices Case Study includes:

- Description of the Problem Addressed
- Context of the Quality Improvement Process
- Planning and Development Process
- Description of the Activity
- Resources Needed
- Results
- Tips for Others

Quality improvement is not an exact science; however, these examples may serve as a starting point to assist others in developing their own quality improvement initiatives, as each case study provides details of the quality improvement effort that hospitals may envision at their own facility.

ACS NSQIP, ACS NSQIP Pediatric, and MBSAQIP are continually looking for participant feedback on making our programs more beneficial to hospitals striving to meet surgical care goals.

Please contact us if you have comments or questions regarding these studies, or if you would like information on how to submit your own Best Practices Case Study for publication in the future.

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GEISINGER MEDICAL CENTER

A Novel Use of the MBSAQIP Data Registry for Analysis of Bariatric Surgical Morbidity and Mortality in Compliance with Standard 2.1

General Information

1. Institution Name: Geisinger Medical Center

2. Submitter Name and Title: Anthony T. Petrick, MD

3. Name of the Case Study:

A Novel Use of the MBSAQIP Data Registry for Analysis of Bariatric Surgical Morbidity and Mortality in Compliance with Standard 2.1

What Was Done?

1. Global Problem Addressed

Morbidity and Mortality (M&M) conferences have long been the mainstay of surgical quality improvement. However, the traditional surgical M&M conference consistently underreports both in-hospital and post-discharge complications and deaths. Hutter reported that approximately one of two deaths and three of four complications were not reported in the M&M conference at Massachusetts General Hospital when compared with a web-based reporting system based on an American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) platform.[1]

Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) Standard 2.1 requires that accredited programs review adverse outcomes at least three times annually and include a review of all bariatric adverse events at these meetings. For programs with high volumes, this format is suboptimal for reporting and affecting quality improvement in a bariatric program. The reports are not timely, and the opportunity for a meaningful review of a significant number of cases utilizing this format is unrealistic.

How Was the Quality Improvement (QI) Activity Put in Place?

1. Context of the QI Activity

Geisinger Medical Center has about 600 inpatient beds and is the referral center for a system of nine hospitals in central Pennsylvania. The hospital is an accredited MBSAQIP center with three accredited bariatric surgeons, one Metabolic and Bariatric Surgery Clinical Reviewer (MBSCR), and one Metabolic and Bariatric Surgery Coordinator (MBS) with two additional bariatric nurse specialists.

Bariatric surgery resides as a section within the department of general surgery, which includes five other specialty sections and a surgical residency graduating four residents per year.

The department of general surgery performs about 4,000 surgical procedures per year, including 350 to 400 bariatric procedures and more than 100 endoscopies on patients who have had a bariatric procedure. As in many academic surgical departments, the surgical M&M conference is the primary collaborative forum for clinical quality improvement.

The MBSAQIP all-occurrence expected morbidity for sleeve gastrectomy is 4.3% at our institution, and the rate for gastric bypass is 9.8%. The expected number of adverse events in patients undergoing primary bariatric procedures is about 40 per year.

The general surgical morbidity and mortality conference met a mean of 17 times per year between 2009 and 2016 with three cases presented at each conference, resulting in only about 10% of bariatric adverse events being reviewed annually (Table 1).

Table 1. Bariatric cases reviewed annually

	General Surgery M&M	Bariatric M&M
2009	5	NA
2010	4	NA
2011	3	NA
2012	3	32
2013	3	38
2014	4	31
2015	2	37
2016	2	35

Table 1 represents the number of bariatric cases reviewed per year in the general surgery department M&M conference compared with the bariatric M&M conference.

2. Planning and Development Process

The limited opportunities for case review in the department M&M conference presented an opportunity to improve our review process for bariatric surgical patients. The MBSAQIP database is populated by an MBSCR and collects all bariatric cases performed in our institution.

Planning was relatively straightforward. All members of the section of bariatric surgery met with 100% consensus that the problem of bariatric quality review needed to be resolved. A staff surgeon was selected to lead the project. The group agreed on a monthly time for the bariatric M&M conference, and schedules were adjusted to accommodate team members.

The group developed a quality improvement (QI) dashboard (Table 2). The dashboard is used to prospectively collect all MBSAQIP data for adverse events within 30 days of discharge, including:

1. Patient demographic information
2. Length of stay
3. Length of stay greater than seven days
4. Emergency department visits
5. Readmission (greater and less than one midnight)
6. Minor reoperations (to include endoscopy)
7. Major reoperations
8. Minor adverse events (classified by Charlson-Dado score)
9. Major adverse events (classified by Charlson-Dado score)
10. Mortality within 90 days of discharge

A departmental data analyst was then engaged to review the MBSAQIP data and format a spreadsheet to provide a snapshot of bariatric patient data. Bariatric surgical fellows were assigned the task of preparing the specific cases to be reviewed monthly.

Table 2. Bariatric QA Dashboard

Approach	(All)
Procedure	(All)
Location	OR GMC

Row Labels	Count of LOG_ID	Females	Mean Age	Mean BMI	Mean Co-Morbid Conditions	Mean Charlson Deyo Comorbidity Index	Mean Meds	Mortality Rate	>1 Midnight Rate	Any Complication
2012	402	79.1%	46.8	48.4	5.1	1.0	5.3	0.0%		48
2013	354	80.8%	46.6	44.9	4.7	1.1	4.4	0.6%		71
2014	331	77.0%	46.7	44.7	5.6	1.2	5.7	0.0%	9.1%	67
2015	378	81.5%	44.9	45.5	4.7	1.0	7.7	0.3%	6.1%	58
2016	285	82.1%	43.7	47.1	3.0	1.1	6.4	0.0%	3.5%	27
Grand Total	1750	80.1%	45.8	46.2	4.7	1.1	5.9	0.2%	6.3%	271

Table 2 represents an abridged snapshot of the Bariatric QA Dashboard. Bariatric QA meetings were held in 25 of 27 months since 2015.

Description of the Quality Improvement Activity

Cases discharged more than 30 days prior to the meeting are selected for review to ensure that all data for 30 days after discharge is available. Mortalities are reviewed at the conference immediately following the mortality and always within 30 days.

The Outcome (Quintiles, Cambridge, MA) download files are then sent to the data analyst two weeks prior to the conference to populate the monthly snapshot. The data analyst then populates the dashboard using a pivot

table in Outlook (Microsoft, Redmond, WA). The lead surgeon reviews the snapshot and meets with the MBSCR one week prior to the conference to identify all adverse events and prioritize them for presentation in the hour-long conference. Fellows are assigned the cases for review one week prior to the conference.

The utilization of the MBSAQIP database to identify bariatric cases for morbidity and mortality conference was initiated in January 2012.

Resources Used and Skills Needed

1. Staff: The project required communication between the center's MBSCR, data analysts, and surgeons. While the data analyst is a valuable team member, the role could be fulfilled by any individual proficient with the use of commercially available spreadsheet software.
2. Costs: The department employed a full-time data analyst who was included in the project and developed the Excel (Microsoft, Redmond, WA) pivot tables.

What Were the Results?

Prior to the bariatric M&M initiative, the mean number of bariatric cases reviewed in M&M was 3.25 per year. This number increased to 34.6 and represented 100% of bariatric patients experiencing adverse events as defined by MBSAQIP (Table 1). Overall attendance at the bariatric M&M conference from 2012 to 2016 was greater than 90% for faculty, fellows, MBSCRs, MBS coordinators, and nurse specialists. All mortalities were identified and reported within 30 days.

1. Setbacks

No barriers to the implementation of this process were encountered.

2. Cost Savings

There were no additional costs associated with this project. The department employed one data analyst from 2012 to 2014 and hired a second data analyst in 2014.

Tips for Others

Previous studies have focused on the limitations of the traditional general surgery M&M conference as the sole means of reviewing adverse events. MBSAQIP accreditation standards require that all bariatric surgical patient records be entered in the MBSAQIP database and that adverse events be reviewed at least three times annually. Adherence to the minimum standard precludes effective review and quality improvement in higher-volume programs. In our experience, group consensus to develop a more effective review of bariatric adverse events was easily attained.

MBSAQIP requires all bariatric cases to be entered in the database, and the Outcome download report is an efficient and highly reliable method of utilizing de-identified data to perform bariatric surgical QA and maintain compliance with Standard 2.1. We now can track outcomes trends for the entire program monthly as well as review bariatric adverse outcomes in greater detail, which provides additional opportunities for quality improvement projects in compliance with standard 7.2. Our group introduces the minutes of our monthly bariatric M&M meetings into our quarterly CMBS meeting minutes, freeing more time to discuss program performance improvement projects and administrative issues.

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LANGLEY MEMORIAL HOSPITAL

From Worst to First: How a Small Community Hospital Went from a High to Low Outlier in Urinary Tract Infections

General Information

1. Institution Name: Langley Memorial Hospital (LMH), Langley, BC

2. Submitter Name and Title: Lila Gottenbos, RN, Surgical Clinical Reviewer

3. Name of the Case Study:

From Worst to First: How a Small Community Hospital Went from a High to Low Outlier in Urinary Tract Infections

What Was Done?

1. Global Problem Addressed

Urinary tract infections (UTIs) are a leading cause of nosocomial infections and documented harmful events in hospitalized patients.[1] Catheter-associated urinary tract infections (CAUTIs) account for the majority of health care-associated UTIs and have been associated with increased morbidity, mortality, hospital cost, and length of stay.[2]

2. Identification of Local Problem

LMH joined the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) in July 2011. Since ACS NSQIP Semi-Annual Report data were not immediately available due to our hospital's recent enrollment, raw data was initially used to identify quality improvement opportunities within our patient population. The initial raw data showed that the raw UTI rate at LMH was 3.3%, and this area was chosen as our focus for initial quality improvement efforts. LMH's first SAR, received in July 2012, confirmed the raw data results and identified LMH as a statistically significant high outlier in the 9th decile for all cases UTI.

How Was the Quality Improvement (QI) Activity Put in Place?

1. Context of the QI Activity

- LMH is a 200-bed community hospital located in Langley, BC. The surgical program at LMH is made up of a 25-bed surgical in-patient unit, five operating rooms (ORs), a nine-bed surgical day care (SDC), and a seven-bed post-anesthesia care unit (PACU). The annual surgical volume is approximately 6,000 cases per year.

- LMH joined ACS NSQIP in July 2011, joining four other ACS NSQIP hospitals within the Fraser Health Authority. Since 2011, ACS NSQIP participation within Fraser Health has grown to 11 sites.
- Data on UTI rates were available to hospital administrators prior to LMH joining ACS NSQIP in July 2011, but the data were not risk adjusted, were not discussed at a front-line staff level, and were severely limited by long delays, thus making the data out-of-date by the time received.

2. Planning and Development Process

The work on reducing UTIs at LMH occurred in two phases. Phase 1 ran from April 2012 to June 2014, and Phase 2 ran from October 2014 to March 2016. Phase 1 focused on implementation of best practices and sustainment of those practices, while Phase 2 focused on the use of new technology with the implementation and testing of an all-in-one, closed-system, silver Foley catheter kit.

Phase 1

- Initial data on all surgical outcomes were brought to the site Surgeon Champion (SC) and surgical program leadership, which consisted of directors, managers, patient care coordinators (PCCs), and clinical nurse educators (CNEs). After review, the leadership group decided UTIs were to be the focus for our initial quality improvement work. Initial data presented are shown in Table 1.

Table 1. Initial data

SAR Date	Decile	Odds Ratio	Raw Rate
January 2011–December 2011	9 H	1.66	3.3%
July 2011–June 2012	9 H	1.59	2.8%

- The lead Surgical Clinical Reviewer (SCR) and quality improvement (QI) consultant at LMH formed a frontline action team, which consisted of frontline nurses from the surgical inpatient unit, the OR, PACU, and surgical day care. This frontline action team had the support of the program leadership, and staff members were paid for attending.

- Meetings began in April 2012, with initial meetings of the frontline action team occurring every two weeks. Initial meetings focused on developing a project charter with a clear goal identified. This goal was to reduce UTIs in surgical patients at LMH from 3.3% to 2% by December 2012. Roles and responsibilities of each team member and meeting frequency were discussed and understood before any project work began.
- Initial team work focused on reviewing current recommended best practices and identifying practice gaps that existed between current LMH practice and best practice. The best practice guidelines that were reviewed came from a variety of sources, including ACS NSQIP, the Canadian Patient Safety Institute (CPSI), and the Healthcare Infection Control Practices Advisory Committee (HICPAC).
- Frontline team members also participated in a TRIZ exercise where they were asked how they could ensure that the next patient that came into their care developed a UTI. The results of this exercise allowed the team members to gain a unique perspective on processes that were already in place at LMH that could be contributing to the high UTI rates in our surgical patients.
- Team members also went back to their surgical areas and canvassed their colleagues for a fuller understanding of potential practice gaps that existed.
- Through these strategies, the team identified practice gaps, including indiscriminate use of urinary catheters in some peri-operative and post-operative patients, catheters staying in too long, sterile insertion technique variance, and inadequate insertion kit (lack of good prep coverage).

Phase 2

- Nearing the end and after Phase 1 was completed, multiple audits at varying points in time were used to ensure that practice changes as implemented were being sustained in the practice areas. The results of these audits showed that the practice changes had been sustained and that the UTI rates at LMH stabilized.
- Planning and development for Phase 2 began in October 2014, with an agreement to be the first hospital in Canada to trial a closed-system, all-in-one, silver Foley catheter kit. This trial was designed to last one year, from April 2015 to March 2016. The goal of the trial was to reduce UTI rates by 50% by March 2016. No other practice changes were implemented during this trial.

Description of the Quality Improvement Activity

Phase 1

- A presentation was delivered to OR staff by a urology surgeon from LMH. This presentation covered both catheter insertion technique and the consequences of indiscriminate use of catheters in surgical patients. This presentation inspired the OR nurses working in orthopaedics to stop the routine catheterization of all total joint patients, effective the day of the in-service. This in-service also inspired the nurses in the gynecology service to discuss and implement a "re-prep of the perineum" policy for instances of catheter reinsertion during major gynecology surgery.
- Total joint catheter insertion guidelines were developed to eliminate the routine use of catheters in this patient population. Nursing staff were to follow the guidelines that had been developed through consultation with nursing, anesthesia, orthopaedics, and urology, as well as frontline leadership. It was estimated that these guidelines helped reduce routine catheter use in total joint patients at LMH by approximately 60%.
- In-services on the inpatient unit emphasized proper insertion technique (two-person, sterile technique, and so on). Surgical staff also completed online CAUTI education modules, and this process was monitored by the CNEs in each area. A refresher on urinary retention guidelines and appropriate actions for patients in urinary retention was also completed.
- The staff had identified that the catheter insertion kits they were currently using did not contain a prep product that allowed them to obtain adequate coverage for female patients. The staff researched a new kit that had a product they believed would solve this problem, and this kit was brought in.
- Physician reminder stickers brought attention to catheters still in place. These reminder stickers were placed every night in the physician orders section of the chart to remind the physician that the patient still had a Foley catheter and to give appropriate direction to the staff for its removal.

Phase 2

- The SC and SCR at LMH met with frontline leadership to discuss the possibility of running a trial of the closed-system, all-in-one, silver Foley catheter kit. After discussion with the leadership group, the vendor agreed to a one-year trial, at no additional cost to the site, which was to run from April 2015 to March 2016. No additional cost meant that the catheter kits were sold to the site at the current cost

of a standard catheter insertion. The group and the vendor agreed that the trial would include all surgical areas and all patients in emergency, so as not to miss any potential surgical patients.

- All standard two-way, three-way, and coude catheters in all surgical areas and all of emergency were changed out to all-in-one, silver Foley catheter kits. In cases where there was not a kit available for a specific size or type of catheter, standalone silver-tipped catheters of the appropriate size and type were used.

Resources Used and Skills Needed

1. Eight frontline team members (nurses from the OR, SDC, PACU, and the inpatient unit) formed the frontline action team. Surgeons from varying subspecialties and anesthesiologists formed the team to review and implement the Total Joint Catheter guidelines, as well as the urinary retention algorithm. Other team members included the Surgeon Champion, Surgical Clinical Reviewer, clinical nurse educators, managers, patient care coordinators, and a quality improvement consultant.
2. There was no additional cost for either phase. No additional funding was required.
3. For Phase 2, the SCR managed inventory and distribution for the new all-in-one kits for the duration of the trial.

What Were the Results?

1. Overall Results

ACS NSQIP non-risk-adjusted and SAR data were used to track the results of the two phases.

Table 2. Phase 1 SAR data

SAR Date	Decile	Odds Ratio	Raw Rate
January 2012–December 2012	8 H	1.47	2.4%
July 2012–June 2013	8	1.37	2.1%
January 2013–December 2013	7	1.19	1.7%
July 2013–June 2014	8	1.34	1.9%
January 2014–December 2014	8	1.28	1.7%

Figure 1. Phase 1 ACS NSQIP non-risk-adjusted data

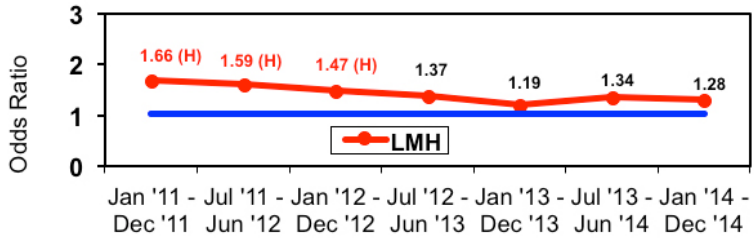
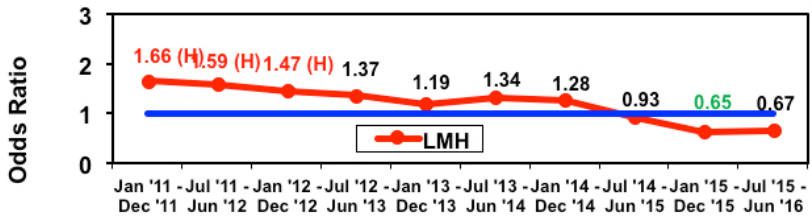


Table 3. Phase 2 SAR data

SAR Date	Decile	Odds Ratio	Raw Rate
July 2014–June 2015	5	0.93	1.3%
January 2015–December 2015	2 L	0.65	0.9%
July 2015–June 2016	2	0.67	0.9%

Figure 2. Phase 2 ACS NSQIP non-risk-adjusted data



After analyzing the results of Phase 2, it was decided to permanently implement the closed-system, all-in-one, silver Foley catheter kit and silver standalone Foley catheters in the surgical program. Furthermore, the site leadership has opted to implement the closed-system, all-in-one, silver Foley catheter kits in all areas of the hospital.

2. Setbacks

During Phase 1, initial barriers encountered were related to staff engagement in the decision-making and implementation process. To overcome this barrier, the team ensured that disciplines that would be affected by practice changes were involved in the decision-making

and implementation process so that their unique perspective could be considered. Also, staff in an area where a practice change was to take place were given ample notice of the change, and a plan for evaluation and feedback was clearly identified so that staff could give feedback on the change once it was implemented. This process allowed the team to quickly identify issues and implement solutions in near-real time so as not to disrupt the change process.

During Phase 2, barriers included supply and distribution of the product and initial cost of the product. The cost of the product was neutralized by the vendor agreeing to supply the product at no additional cost for the duration of the trial.

Since LMH is in a large health authority, much of the ordering and supply and distribution is centralized. Having an item specially brought in for a trial proved to be a challenging proposition. This issue was overcome by holding frequent meetings with involved personnel to come to a solution on how to meet the supply needs of the site while staying within the confines of the distribution framework of the health authority. Eventually, it was agreed that the SCR would manage the supply, distribution, and inventory tracking for the site for the duration of the trial.

3. Cost Savings

For both phases of the work, the approximate amount invested was $0. Total cost avoidance for both phases, from January 2012 to June 2016, based on an internal cost determination of approximately $1920 CDN per UTI occurrence, is approximately $759,400 CDN. As there was no increased cost to LMH during the year-long trial, the net cost avoidance is also $759,000 CDN.

For implementation of the closed-system, all-in-one, silver Foley kit beyond the initial year-long trial, the cost increase was determined based on the increase in the cost of the catheter kits ($8 CDN) multiplied by the approximate number of catheters utilized in the surgical areas and ER per year (2,000), giving us a total cost increase of approximately $16,000 CDN. Yearly cost avoidance in 2015 was $240,000 CDN. The expected increase of $16,000 CDN gives us a total net cost avoidance of $224,000 CDN for the year 2015.

Tips for Others

- Involve key stakeholders early and often. Unexpected barriers can quickly derail a good project. Involving key stakeholders can help identify potential barriers before they are encountered, thus helping to more easily keep a project on track.
- Talk to your frontline staff. These are the people who know how a planned practice change will actually work at the patient care level. Often times, change comes top-down, which disengages frontline staff. Involving these staff members can go a long way to making sure planned changes are successful at the patient care level.
- Look at established best practices first. These are easy wins that can be implemented at little to no extra cost and often with very minor changes to current practice.
- Audit your practice changes. Address gaps quickly and often to ensure that changes are sustained.
- Think outside the box. Once best practices have been implemented and sustained, it's time to look for other unique ways to solve problems at your site. Don't be afraid to delve into areas where the evidence isn't cut and dry. You and the staff at your site know your site best. If it makes sense, it's worth a try.

Acknowledgements

The success of the UTI reduction efforts at LMH was due in large part to the many dedicated frontline nurses and physicians in our surgical program. Many staff members attended meetings and did project work in addition to their normal duties. Their perseverance and willingness to challenge the status quo have ensured the patients at LMH are having fewer complications than ever before.

The executive and frontline leadership teams at LMH also deserve acknowledgement for supporting this work. From encouraging staff and attending meetings to their willingness to take risks to improve care, the unwavering support of the leadership team makes our quality improvement work possible.

Lastly, the LMH Surgeon Champion, ACS NSQIP SCRs, and ACS NSQIP clerk are an amazing team to work with and are integral to the fantastic quality improvement work we do at LMH.

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SAINT JOSEPH HOSPITAL

Implementation of an Enhanced Recovery Pathway for Bariatric Surgery Patients at an MBSAQIP-Accredited Community Hospital

General Information

1. Institution Name: Saint Joseph Hospital (SJH), Denver, CO

2. Submitter Name and Title: Teresa Gross, General Surgery Resident

Authors: Teresa Gross, MD, MSCR; Susan Zabala, RN, CBN; Rhonda Simpson, RN, SCR; John Raheb, MD; and Jason M. Johnson, DO, FACS, FASMBS

3. Name of the Case Study:

Implementation of an Enhanced Recovery Pathway for Bariatric Surgery Patients at an MBSAQIP-Accredited Community Hospital

What Was Done?

1. Global Problem Addressed

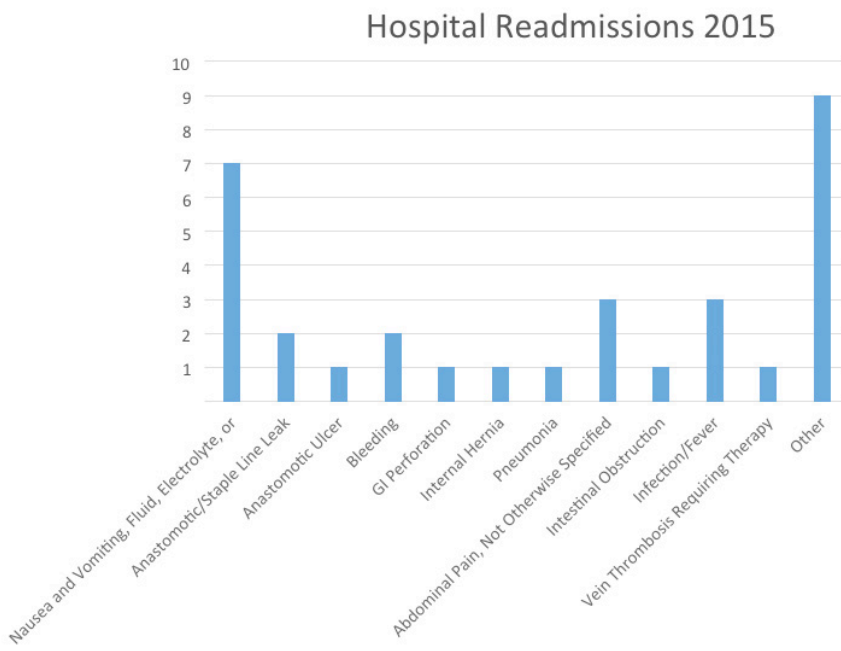
Laparoscopic sleeve gastrectomy (LSG) and laparoscopic roux-en-y gastric bypass (LRYGB) are widely accepted operations for the treatment of morbid obesity. Both procedures are known to have complications of postoperative nausea and dehydration. Bariatric surgery patients occasionally return to the emergency room, and some require readmission. There is limited literature on enhanced recovery protocols tailored to the bariatric surgery procedures. The success of enhanced recovery after surgery (ERAS) in general surgery populations is highlighted by reduced readmission rates and length of stay (LOS).[1,2] Recent meta-analysis data exists confirming the efficiency and safety of such protocols.[3] This manuscript addresses a community hospital-initiated enhanced recovery after bariatric surgery (ERABS) protocol from inception to early implementation and quantifies early results associated with the ERABS process.

2. Identification of Local Problem

In 2015, Saint Joseph Hospital was identified in the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) risk-adjusted Semi Annual Report (SAR) as 9th decile in readmissions and 10th decile in reoperations. This 2015 SAR indicated that our observed rate of readmission for LSG rate was 3.7%, compared with the national benchmark LSG-specific readmission rate of 3%. For LRYGB, our observed rate of readmission for LRYGB-specific risk-adjusted readmission rate was 7.8%, compared with the national benchmark LRYGB-specific readmission rate of 4.9%. Clearly these rates indicated a need for improvement in both categories.

The MBSAQIP report identified that the majority of SJH bariatric readmissions were caused by dehydration and nausea. SJH is not alone in this regard.[4] Prior publications not only cite postoperative nausea and dehydration as the most common cause for re-admission, but also the most common preventable cause of readmission.[5] Abdominal pain that did not require intervention was the cause of approximately one in 10 of these re-admissions (Figure 1).

Figure 1. Saint Joseph Hospital, Denver, CO, bariatric surgical re-admissions 2015



The main focus of the enhanced recovery after bariatric surgery (ERABS) protocol development group was to design an all-encompassing preoperative through postoperative care pathway that could be initially implemented in the outpatient office and continued through the 90-day global coverage period.

How Was the Quality Improvement (QI) Activity Put in Place?

1. Context of the QI Activity

This project was performed at a 400-bed community teaching hospital where both vertical sleeve gastrectomy (n=229) and roux-en-y gastric bypass (n=205) operations were performed during the prior calendar year. SJH participates in MBSAQIP and its associated decreasing re-admissions through opportunities provided (DROP) initiative, which provided the framework and facilitated creation of an appropriate interdisciplinary team of clinicians, clinic staff, support staff, and surgeons to review re-admissions.

An ERAS protocol had recently been implemented by the colorectal surgery team at SJH, and the operating room (OR) staff and nursing personnel required for effective implementation of that care pathway were in place and expanded to include ERABS-trained personnel. After the DROP initiative had been implemented, attention was then focused on development of an ERABS protocol designed to decrease returns to the operating room and hospital readmissions for obese patients undergoing weight-loss procedures.

2. Planning and Development Process

As the ERAS and ERABS protocols evolved, common themes from both cohorts emerged, which included:

- Patient education, multimodal pain control
- Early ambulation
- Minimization of intraoperative fluid administration as deemed appropriate by the attending anesthesiologists[2]

Patient education

There is no consensus on the best method of preoperative patient education. The Saint Joseph Hospital ERABS protocol included standardized written materials provided to each patient outlining the procedure and expectations and included frequently asked questions (FAQs). To date, published analysis of preoperative education has not affected rates of readmission, phone calls to the office, or return to the operating room.[6]

Multimodal pain control

Current published data from ERAS protocols have demonstrated the effectiveness of multimodal pain control.[7] There is, currently, a concerted effort to decrease prescription opioid use on a global scale.

- Topical injection of lipophilic analagesics and liberal use of nonsteroidal anti-inflammatory drugs (NSAIDS) can minimize the need for prescription opioids in the bariatric surgery population.
- Engage in early consultation with the anesthesia service to facilitate effective ERABS pain modulation.

Hydration

- Use a low-calorie option with electrolyte composition similar to G2 Gatorade for preoperative hydration in obese patients.
- The focus on preoperative hydration was prompted by an internal review of our institutional readmission causes and emergency department (ED) visits, in conjunction with current bariatric surgery reviews.
- A retrospective review of more than 1,200 consecutive RYGB by Kellog e.t. al, demonstrated that 21% of patients had an ED visit, readmission, or reoperation within 90 days of the primary bariatric procedure. Of these readmissions, 26% were for dehydration, nausea, and vomiting, while 20% were for abdominal pain.[8]
- Macht et al, noted that ED visits that did not result in re-admission comprised 14.6% of the 36,673 bariatric patients reviewed in their database. These visits were primarily for abdominal pain (24%) and dehydration, nausea, and vomiting (21%). They concluded that most of those admission were preventable.[9]

Assessment of suitability for discharge on POD1

Length of stay (LOS) after bariatric surgery has decreased in recent years, and studies now examine if discharge at less than 24 hours is safe and feasible. ERAS protocols that shorten LOS in bariatric patients consistently show a cost reduction, as reducing LOS has not been associated with increase in readmission.[3,10] Observational studies have noted that complications tend to happen within the first 24 hours or after POD5. The studies point out that there is little need to keep a patient for two or three days if the patient met discharge criteria on POD1.[11] Even just actively choosing to have a goal of discharge within 23 hours if discharge criteria are met allowed decreased LOS without increasing readmissions.[12]

Description of the Quality Improvement Activity

QI Study Design: Using a Historic Control

Most ERAS studies are either observation or utilize a historic control group.[13-14]

Observational studies are limited because they demonstrate only correlation and not causation. Studies with a historic control group are logistically the most simple, as outcomes of a new protocol can be compared with baseline data prior to implementation. However, historic controls are confounded by advances in technique over time. Therefore, the desire to attribute improved outcomes to a new ERAS protocol is confounded by the natural advances in technique and surgeon skill that improve outcomes. Prospective randomized controlled trials are expensive and pose ethical dilemmas. The SJH design group opted for a project using historical controls. Bariatric surgeons and bariatric-trained nurses were used to address modifications stratified by phase of care.

Date when the QI activity was first implemented: August 2016

Resources Used and Skills Needed

- Monthly meetings were held in the same location, on the same weekday, and at the same time. Reminder e-mails were sent one week prior to the meeting. At these meetings, the prior month's readmissions, reoperations, and complications were reviewed and tracked to document progress. Any logistic issues with protocol implementation were discussed. Participants included:
  - A nurse coordinator, mindful of all component groups and meeting agendas, was appointed secretary and mediator of discussion
  - An acting data reviewer for data review and analysis
  - A representative of each division (see below)
- A representative was appointed for each division, including pharmacy, anesthesiology, surgeon, resident, floor nurse, preop/pacu nurse, OR staff, clinic nurse, and clinic staff.
- Pharmacy oversight was critical, especially as postoperative bariatric patients have difficulty swallowing pills, and we needed options for elixir and liquid forms of medications, which are not commonly stocked.
- Dietary education and implementation was provided for each patient.

Table 1.
Pre-Hospitalization • Education class and pamphlet about process, expectations, diet, and FAQs • Liver shrinking diet for 13 days, than one day of a sugar-free, clear liquid diet before surgery • Hydration: G2 Gatorade, 12 ounces the night before and the morning of surgery
Preoperative • Multimodal pain: Liquid gabapentin, ibuprofen suspension, liquid acetaminophen
Intraoperative • Fentanyl induction and maintenance • Multimodal pain: Ketamine, ketorolac at the end of the case, liposomal bupivacaine • Antiemetic: Ondansetron, dexamethasone
Postoperative Unit • PRN multimodal pain: IV lidocaine drip 1 mg/kg/hr (ideal body weight) as first choice analgesic, oral hydromorphone, then IV hydromorphone or fentanyl for breakthrough pain • Hydration: Encourage patient to start clear fluids postoperatively • PRN antiemetic: Ondansetron, diphenhydramine, promethazine, lorazepam, haloperidol
Floor Care • Multimodal pain: Scheduled liquid acetaminophen, liquid gabapentin, ketorolac for 24 hours, then ibuprofen suspension • PRN Multimodal pain: Oral hydromorphone • VTE PPX: Enoxaparin or heparin • Early mobilization: Ambulate within two to four hours of surgery, then every four hours
Discharge Criteria • Assess for discharge starting POD1 • Tolerate postoperative liquids at a rate proportional to 1.5 L liquid per day • Pain controlled with PO medications • Ambulate with minimal assistance
Post-Hospitalization • Diet in stages: Sugar-free clear liquid, full liquids, soft foods, then solid foods (outlined in pamphlets) • Close follow-up: Phone call by a bariatric nurse within one week of surgery

Standard order sets for all of the above with an opt-out approach to deviate from the ERABS protocol.

Anesthesia staff, OR staff, nursing staff, and resident staff all educated on these order sets and standards.

What Were the Results?

1. Setbacks

Difficulty providing multimodal pain control for patients who cannot take PO tablets.

- Pharmacy involvement was critical for procurement of liquid forms of multimodal pain control.
- The preoperative education was originally a one-on-one format in the clinic setting. This was format transitioned to a group class format to streamline the process at the hospital.

Difficulty was identified when conveying large amounts of information. A pamphlet covering all common questions, diets, and review of the information covered in the class was included for all patients.

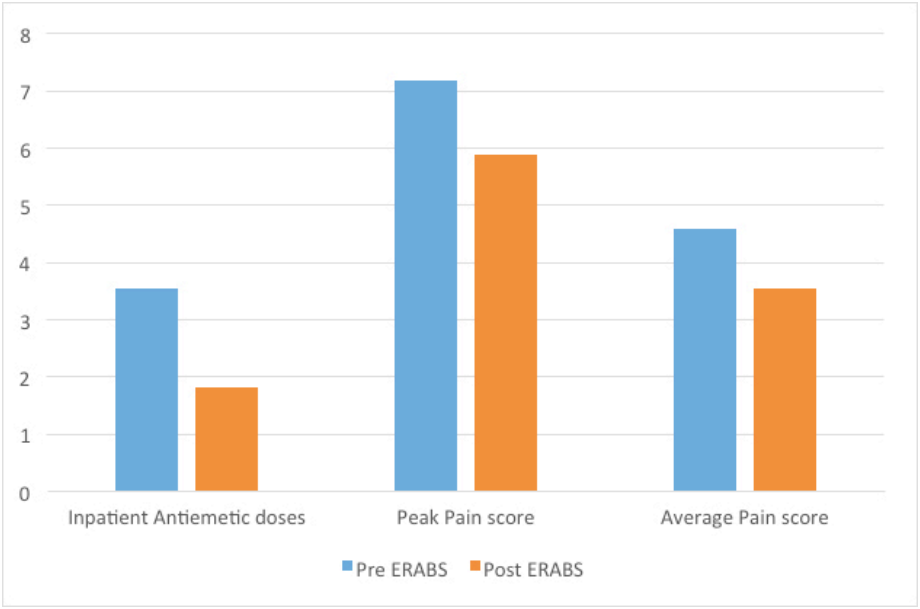
Difficulties were noted with patient compliance with preoperative hydration requirements. It was decided that the Gatorade product would be distributed at the education class.

Compliance with administration of appropriate preop medications was difficult. Working closely with our electronic medical record (EMR) technical staff was essential in creating order sets that allowed the protocol to be followed with minimal effort of nursing staff, anesthesia, and residents with each transfer.

2. Preliminary Results

Patient accrual continues, and it is too early to predict final outcomes in an interim analysis. Staff is encouraged by the results so far and has seen a decrease in postoperative nausea represented by a decrease in the number of requested antiemetic doses and a decrease in reported peak and mean pain. There was a significant reduction in both peak and mean pain scores out of 10 (7.2 to 5.9 $p<0.01$ and 4.6 to 3.6 $p<0.01$, respectively) and number of antiemetic doses inpatient from pre-ERABS to post-ERABS (3.5 to 1.8 $p<0.01$).

Table 2. Comparing antiemetic doses and pain before and after ERABS protocol at a community hospital



*Pre-ERABS : All patients who received a RNYGB or VSG at our hospital in a three-month period before ERABS implementation, March–May 2016 (n=91).

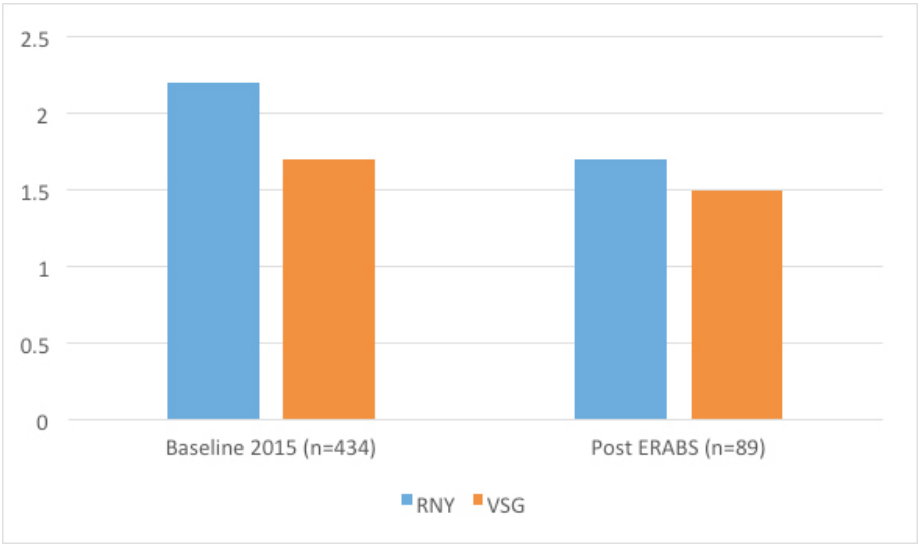
*Post-ERABS: All patients who received a RNYGB or VSG at our hospital in a three-month period after ERABS implementation, September–November 2016 (n=89).

*Antiemetic doses were PRN orders that the patient requested from their nurse.

*Pain scores were part of routine charting, and are out of a 10 point scale with 10 being the most severe pain.

Implementation of this pathway has resuled in a decrease in LOS for our patients. We plan to check for statistical signficance when we have a larger patient base in the post-ERABS group.

Table 3. Length of stay before and after ERABS implementation



*Baseline 2015: All patients who received RNYGB or VSG at our hospital in 2015 (n=434)

*Post-ERABS: All patients who received a RNYGB or VSG at our hospital in a three- month period after ERABS implementation

*Length of stay in days from admission on the day of surgery to the confirmed discharge order

3. Cost Savings

Between a decrease in the primary symptoms causing readmission and a decrease in hospital LOS, we anticipate that we will have decreased the cost associated with bariatric surgery in our patient population. Our final cost analysis is still underway.

Tips for Others

One protocol is unlikely to address the needs of all programs. The process of self-review to identify the most common avoidable readmissions is important and is significantly aided by MBSAQIP reports and data. Although SJH and the national MBSAQIP data show nearly a third of readmissions related to N/V, a similar review in Ontario had only 10% of readmissions attributed to N/V and more attributed to infection (25%).[5] The iterative process of self-review with multidisciplinary round table discussions may be the most flexible way to tackle bariatric surgery quality improvement, as it is a burgeoning field with a great deal of variety in practice.

Round table debriefing with selective providers in each phase of care is essential for long-term success of this pathway. Regularly scheduled discussions appear to be the more effective method of information dissemination. These meetings are supervised by the ERAS nurse coordinator, with data supplied by our MBSAQIP abstractor.

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SEATTLE CHILDREN'S HOSPITAL

Improving High-Value Care of Ileocolic Intussusception in a Pediatric Emergency Department

General Information

1. Institution Name: Seattle Children's Hospital

2. Submitter Name and Title: Rebekah A. Burns, MD

3. Name of the Case Study:

Improving High-value Care of Ileocolic Intussusception in a Pediatric Emergency Department

What Was Done?

1. Global Problem Addressed

Ileocolic intussusception is one of the most common causes of intestinal obstruction in young children. Presenting symptoms often include episodic abdominal pain, fussiness, and emesis. These, unfortunately, are common and nonspecific complaints. The "classic triad" of abdominal pain, palpable mass, and bloody stool is present in less than 40% of cases.[1] The management of intussusception for hemodynamically stable patients without evidence of perforation includes attempted reduction with an air or liquid contrast enema. Wide practice variation, however, exists across the U.S. regarding practices such as diagnostic imaging, prophylactic antibiotic administration, and hospitalization.

Prior to the development of the clinical standard work pathway, our hospital had a guideline for diagnosis and management of ileocolic intussusception in the emergency department. Components of the guidelines were used with varying consistency amongst emergency medicine and surgical providers. Abdominal radiographs were recommended as the initial screening step for intussusception. However, numerous studies have demonstrated a far superior sensitivity and specificity of ultrasound (US) in the diagnosis of intussusception.[2] We found that many children were undergoing radiography only to then have an ultrasound done regardless of the results of the X ray. It was also standard practice to administer cefoxitin to all patients diagnosed with intussusception prior to enema reduction. This step was consistently practiced in our institution, but wide practice variation exists across the country. Also, all patients with intussusception were admitted to the surgical service regardless of whether reduction was achieved with enema. Many institutions in the U.S. routinely discharge patients after successful reduction, although variation exists.

How Was the Quality Improvement (QI) Activity Put in Place?

1. Context of the QI Activity

Seattle Children's Hospital is the tertiary care referral center for Washington, Idaho, Montana, and Alaska. There are approximately 75,000 visits annually to the urgent care clinics and emergency department (ED). The hospital has pediatric specialists on staff in nearly every subspecialty.

This project was developed as part of the Clinical Standard Work (CSW) process that is utilized at our site to address a wide variety of clinical practices. CSW is a documented approach to management and treatment of particular population or diagnosis that Children's providers and staff are expected to follow. The approach is rooted in evidence when available, and when evidence is not available, it is determined by team consensus. The management approach is supported by some method or standardized tool(s) that is integrated into the work flow such as an order set, checklist, or algorithm. There are identified process and outcome measures specific to the condition that are tracked, evaluated, and followed by a designated pathway owner to ensure the continual improvement of the care for this condition.

If a project is approved for CSW consideration, the guidelines below are used to inform prioritization and resourcing:

- Does this project improve value of care to patient?
- Does the patient population represent a significantly growing volume?
- Does the current situation have highly variable practice?
- Is there an imminent patient safety concern?
- Does division/department leadership support this standardization?
- Is there anticipated large effect as a result of this project?

2. Planning and Development Process

Working Group Established

- Representatives from pediatric surgery and anesthesia were recruited to join a working team lead by a pediatric emergency medicine (PEM) physician. A clinical nurse specialist, clinical standard work consultant, clinical effectiveness project manager, librarian, clinical informatician, ultrasound technician, pharmacist, and clinical effectiveness analyst were also recruited.

Stages of Planning and Implementation

Determination of project scope and clinical questions: April 2016

Current state mapping by key stakeholders: May 2016

Literature review and revision of clinical questions: June 2016

Review of key studies and consensus building with key stake holders: July 2016

Simulation of proposed pathway: August 2016

Revisions and production of order sets: August–September 2016

Go-live date: October 10, 2016

Clinical Questions

Clinical questions were developed by the PEM project leader with a focus on quality of care within the emergency department. Therapeutic measures such as enema and surgery were deemed to be outside the scope of this project. Questions were refined using input from other team members.

1. What is the best initial radiologic diagnostic modality for intussusception? What is the role of radiography, if any?
2. What clinical features can be used to assess a risk level for intussusception?
3. What is the optimal antibiotic management of these patients?
4. Does a surgery consultation need to be obtained prior to enema reduction?
5. Is there need for lab evaluation after confirmation of intussusception?
6. What is the optimal sedation and/or analgesia for these patients?
7. What is the appropriate disposition for patients with intussusception post-reduction (admission versus discharge home)?

Current State Mapping

Charts of patients with intussusception were reviewed in order to understand the current process and flow, including time to diagnostic and therapeutic measures. Data from patients evaluated for intussusception were also reviewed to determine current practice variation in evaluation.

Literature Review and Pathway Development

Studies were identified by searching electronic databases using search strategies developed and executed by a medical librarian. The searches for all aspects of intussusception were performed in June 2016. The following databases were searched: on the Ovid platform, Medline and the Cochrane Database of Systematic Reviews; elsewhere, Embase, National Guideline Clearinghouse, TRIP, and Cincinnati Children's Evidence-Based Care Guidelines. Clinical questions regarding intussusception were searched from 2006 to date. A search with no evidence categories, study, or publication type limitations was conducted for pediatrics ages 0 to 18 years. A second search limited to certain evidence categories, such as relevant publication types, clinical queries filters for diagnosis and therapy, index terms for study types, and other similar limits was conducted with no age specifications. All retrieval was limited to the English language. In Medline and Embase, appropriate Medical Subject Headings (MeSH) and Emtree headings were used respectively, along with text words, and the search strategy was adapted for other databases using their controlled vocabularies, where available, along with text words.

Studies were evaluated by two independent reviewers for quality and ability to address our clinical questions. Selected studies were then evaluated for quality using the GRADE method of rating evidence quality. Evidence is first assessed as to whether it is from randomized trial or cohort studies. The rating is then adjusted in the following manner (Guyatt G, et al. *J Clin Epidemiol*. 2011;4:383-494.):

Quality ratings are downgraded if studies:

- Have serious limitations
- Have inconsistent results
- If evidence does not directly address clinical questions
- If estimates are imprecise
- If it is felt that there is substantial publication bias

Quality ratings can be upgraded if it is felt that:

- The effect size is large
- If studies are designed in a way that confounding would likely underreport the magnitude of the effect
- If a dose-response gradient is evident

Guideline: Recommendation is from a published guideline that used methodology deemed acceptable by the team.

Expert opinion: Our expert opinion is based on available evidence that does not meet GRADE criteria (for example, case-control studies).

Quality of Evidence:

✪✪✪✪ High quality

✪✪✪○ Moderate quality

✪✪○○ Low quality

✪✪○○ Very low quality

Based on our literature review and/or consensus amongst pediatric emergency medicine, radiology, and surgery experts, the following recommendations were made.[3-6]

1. What is the best initial radiologic diagnostic modality for intussusception? What is the role of radiography, if any?
   - Order ultrasound for the diagnostic evaluation of intussusception.
   - Do not order X ray for diagnostic evaluation for the concern of intussusception for patients who are hemodynamically stable with non-acute abdomen due to low sensitivity and specificity.
   - Consult surgery and order two-view abdominal X ray if concern for perforation in patients who are hemodynamically unstable and with peritoneal signs.
2. What clinical features can be used to assess a risk level for intussusception?
   - There is not enough evidence to address.
3. What is the optimal antibiotic management of these patients?
   - Antibiotics are not recommended for routine treatment of intussusception in a patient who is hemodynamically stable and without peritoneal signs.
4. Does surgery need to be consulted prior to enema?
   - Consult surgery for patients who are diagnosed with intussusception prior to enema reduction. The surgery resident will evaluate the patient prior to enema and verbally staff with their fellow/attending. (Expert opinion)
5. Is there need for lab evaluation after confirmation of intussusception?
   - Do not obtain routine labs if not clinically indicated. (Expert opinion)

6. What is the optimal sedation and/or analgesia for these patients?
    - Consider oral acetaminophen for pain.
    - Consider oral oxycodone for moderate to severe pain for confirmed intussusception.
    - Consider IV analgesia in patients who have an IV and moderate to severe pain.
7. What is the appropriate disposition for patients with intussusception post-reduction (admission versus discharge home)?
    - Do not admit children (who are hemodynamically stable and without peritoneal signs, with reliable caregivers, and access to medical care) after intussusception that has been successfully reduced on the first attempt. The patient must, however, successfully tolerate oral challenge with clear liquids prior to discharge.
    - Admit patients to general surgery after successful reduction if unable to tolerate oral intake or have no reliable follow-up.
    - Admit patients to general surgery if first attempt at reduction is unsuccessful or a complication occurs.

Simulation of Proposed Pathway

Using a low-fidelity simulator, we simulated the steps in evaluation and management of a patient with intussusception through arrival the emergency department through discharge to home. This process included completed key components of work flow such as patient transport between the ED and the radiology suites, communication between physicians (PEM, radiology and surgery residents, and attendings), nurses, and radiology technicians. Clarifications and revisions to work-flow protocols were made during this time.

Revisions to Pathway

Modifications to the pathway were made after careful review of results of simulation. Leadership from the three specialties also provided feedback for incorporation into the protocols. See Appendix A for the final pathway.

Description of the Quality Improvement Activity

Education was rolled out one month prior to the implementation of CSW pathway. Policy changes, changes to electronic order sets, and new information for education of families and outside providers were all developed prior to implementation but did not go live until the start date of the pathway, October 10, 2016.

Education

- Learning Center Module consisting of online didactic presentation followed by multiple choice questions related to content created for attending physicians in PEM, pediatric surgery, and radiology.
- Learning modules released one week prior to project go-live date.
- Physician members of project team presented new pathway at PEM, pediatric surgery, and radiology faculty meetings.

Changes in Orders

- PowerPlans in Cerner changed included:
  - US Abdomen Intussusception added to ED Abdominal Pain PowerPlan.
  - ED Confirmed Intussusception PowerPlan created.

Changes in Policy

- Surgical Unit Guideline of Care on Intussusception updated.

Changes in Patient and Outside Provider Resources

- Intussusception Discharge Instructions updated to reflect new care pathway.
- Changes made to *seattlechildrens.org*, a resource for families and medical care providers outside of our institution.

Resources Used and Skills Needed

The core members of our team included:

- PEM physician (project leader)
- Pediatric surgeon
- Pediatric radiologist
- Clinical nurse specialist
- Ultrasound technician manager
- CSW consultant
- Clinical effectiveness project manager
- Clinical informatician
- Librarian
- Pharmacist
- Clinical effectiveness data analyst
- Three additional physicians assisted our team by reviewing the literature from the original search

There were no additional costs beyond normal hospital operations to implement and maintain the project beyond routine funding of the Clinical Effectiveness Program. There was no additional funding for this project.

What Were the Results?

To date there have been 31 cases of intussusception since implementation of the pathway. Two patients were excluded from management per pathway due to clinical concerns for hemodynamic instability and possible perforation. The remaining 29 cases represent 25 patients. Four patients have had recurrence within 48 hours of their initial presentation. Three patients were admitted to the general surgery service because the initial enema was unsuccessful for reduction. An additional three patients were admitted either because the child was presenting with recurrent intussusception that was successfully reduced (n=1) or because the family traveled from a great distance and discharge home from the ED might impact their ability to access medical care if symptoms returned (n=2).

Prior to pathway implementation, 100% of patients with intussusception received antibiotics before enema reduction. No patients treated per the pathway recommendations received antibiotics prior to their first enema

reduction. One patient did, however, receive cefoxitin after reduction during their admission. A second patient received antibiotics after the initial enema reduction failed but was considered off-pathway at that time given failed treatment.

In the year prior to implementation, 69.5% of patients being evaluated for intussusception had an US as the first diagnostic test. Since implementation 91.1% have US as the initial study. In the three years prior to implementation 65.2% of patients with negative evaluations for intussusception had an X ray performed at some point in their ED visit. After implementation only 11% of these patients have had a radiograph.

Median cost per encounter for patients diagnosed with intussusception had decreased from $7,037 pre-implementation to $3,958 post-implementation. Median cost per encounter for patients evaluated for negative evaluation for intussusception decreased from $9,113 to $5,558.

Tips for Others

Project design and implementation requires buy-in from key stakeholders including emergency medicine, surgery, and radiology. We found that reviewing the literature and coming to a consensus was best achieved during in-person meetings. Having adequate support of project managers, librarians, and data managers allowed for timely progress with pathway development and implementation.

We are currently monitoring the effects of our project implementation as well as searching for new clinical data that may warrant changes to our current pathway. We review new literature every four months. The core team members also meet quarterly to review core metrics, including:

- % of patients with intussusception who receive antibiotics
- % of patients with intussusception who have laboratory evaluation
- % of patients with intussusception reduced on first enema attempt who are discharged home from the emergency department within four hours of reduction
- % of patients who have US rather than radiograph for the evaluation of suspected intussusception

Our clinical nurse specialist monitors the electronic feedback system for any reports pertaining to patients with intussusception. Timely reminders of the pathway are provided to clinicians, nursing staff, and radiology technicians when deviations from protocols are observed. Pathway revisions are scheduled for five-year cycles but may occur more frequently if new evidence for practice changes emerges or deficiencies in current practices are identified.

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Reducing Surgical Site Infection Infections (SSI) by Almost 70 Percent in Colorectal Patients with Implementation of the Global SSI Bundle

General Information

1. Institution Name: Surrey Memorial Hospital (SMH)

2. Submitter Name and Title: Pawan Sindhar, RN, MSc, Surgical Clinical Reviewer

3. Name of the Case Study:

Reducing Surgical Site Infection Infections (SSI) by Almost 70 Percent in Colorectal Patients with Implementation of the Global SSI Bundle

What Was Done?

1. Global Problem Addressed

Surgical site infection (SSI) is the most common and potentially preventable complication following surgery. SSI adversely affects patient outcomes and health care costs. Many health care institutions use it as an important quality indicator for patient care and safety.[1]

2. Identification of Local Problem

Procedure-targeted data from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) highlighted our site as a high outlier with higher than expected colorectal SSI. The On-Demand Risk-Adjusted and Smoothed Rates Report indicated the SSI rate to be at 22% in the nonemergent colorectal population.

How Was the Quality Improvement (QI) Activity Put in Place?

1. Context of the QI Activity

SMH is an academic teaching hospital with more than 600 beds. It is a Level III trauma center. SMH is the second largest hospital in British Columbia and has the busiest emergency department, providing service to more than 93,000 emergency room patients per year. We joined the Enhanced Recovery After Surgery (ERAS) program implemented by ACS NSQIP with a focus on nonemergent colorectal surgery, which then led to participation in a provincial initiative to reduce SSIs. Our ERAS team set a target to work on reducing SSIs in elective colorectal surgery by 33% over a 12-month period.

2. Planning and Development Process

- Our site ERAS team was established in December, 2014. Key stake holders invited to be part of the team included surgeons, anesthesia, administration, surgical unit leads and educators, dietetics, physiotherapy, wound care specialist nursing, and ACS NSQIP.
- At monthly meetings, the surgical clinical reviewer presented ACS NSQIP data to drive the actions of the ERAS team to reduce all postoperative complications by adhering to best practice and evidence-based interventions for improved patient outcomes.
- General surgeons performing colorectal surgeries reviewed the ACS NSQIP-based SSI rates in colorectal surgery as a group and recommended improvement interventions based on evidence-based best practices to reduce SSI using the World Health Organization (WHO) global guidelines for prevention of SSI.[4]
- Anesthesia identified gaps in practice around intraoperative normothermia documentation and implemented perioperative blood glucose monitoring for all nonemergent colorectal surgeries.
- The ERAS team used a phased approach to implement the multi-intervention process and determined the appropriate use of ACS NSQIP custom fields to obtain benchmark data.
- Process initiation started with staff education and subsequent implementation of quality improvement activities to reduce SSIs.

Description of the Quality Improvement Activity

Preliminary data from ACS NSQIP was used as a baseline to determine what improvements were needed. Semiannual reports and data drill-down showed our site to be a high outlier for SSI occurrences in colorectal surgery, with a 22% SSI rate in nonemergent colorectal surgery. Based on this information, SSI reduction in nonemergent colorectal surgical patients was selected as our focus group for this initiative.

A multidisciplinary ERAS team was established and World Health Organization (WHO) guidelines for SSI prevention were reviewed.[4]

In discussion with the general surgeons and anesthesia, three interventions were identified as a priority to be implemented at our hospital for nonemergent colorectal patients:

1. Normothermia (accurate documentation)
2. Glycemic control (preoperative, intraoperative, and postoperative)
3. Preoperative oral antibiotic administration (for example, Neomycin)

Staff education around these variables was carried out by the clinical nurse educators on the surgery wards, including surgical day care/admissions, operating room, post-anesthetic care unit, and inpatient surgery wards.

Glucometers, for checking blood glucose, were made available for anesthesia in the operating rooms.

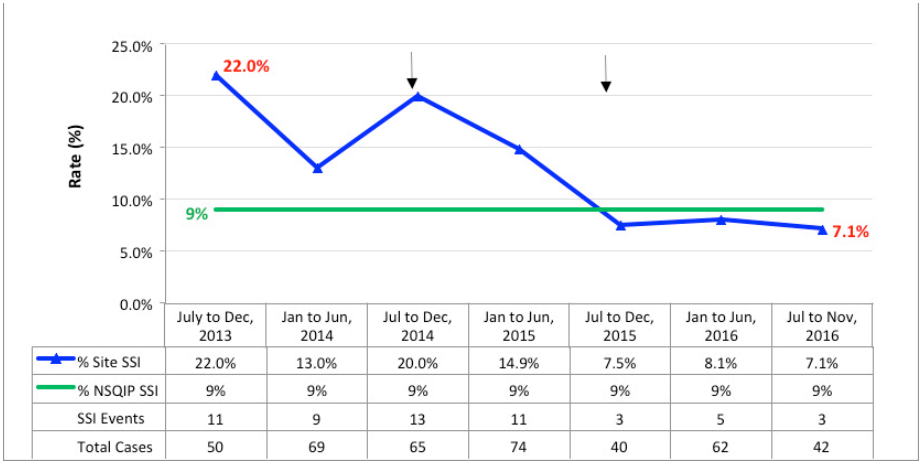
ERAS team members negotiated availability of the preoperative oral antibiotic in the local pharmacies.

Custom fields in the ACS NSQIP workstation were used to document the interventions and enable data surveillance for SSI occurrences.

Resources Used and Skills Needed

1. Participation and engagement from all perioperative team members was paramount for successful implementation of the multiple interventions. Education was provided to all staff, including medical office assistants at surgeons' offices (first contact for patient encounter), preadmission clinic (patient assessment and education), surgical admissions, surgical day care, operating room, post-anesthesia care, and surgical inpatient wards.
2. No additional costs were incurred.

Figure 1. SSI rate in nonemergent colorectal populations from July 2013 to November 2016



	July to Dec, 2013	Jan to Jun, 2014	Jul to Dec, 2014	Jan to Jun, 2015	Jul to Dec, 2015	Jan to Jun, 2016	Jul to Nov, 2016
% Site SSI	22.0%	13.0%	20.0%	14.9%	7.5%	8.1%	7.1%
% NSQIP SSI	9%	9%	9%	9%	9%	9%	9%
SSI Events	11	9	13	11	3	5	3
Total Cases	50	69	65	74	40	62	42

What Were the Results?

1. Results

A 68% reduction in SSI occurrence for nonemergent colorectal surgery. The SSI rate decreased from 22% in mid-2013 to 7.1% by the end of 2016.

2. Setbacks

- Barriers
  - Learning curve included accurate documentation for normothermia during surgery times, and use of new tools, such as glucometers, for anesthesia.
  - Time needed for complete change over to new practice by staff, including the phase-out of older forms, which kept showing up in patient records without the new information needed for data collection.
- Solutions to barriers
  - Implementation of interventions was continuously monitored and frequent reminders provided to staff by the local ERAS team members.
  - ACS NSQIP data were shared at regular intervals with all staff. The data included percentages of interventions being implemented/documented for data extraction.
  - ACS NSQIP data on the effects of these interventions were also shared with staff. For example, decreases in SSI occurrences at monthly intervals.
- Revisions to original plan
  - Initial set of interventions included improving the preoperative intravenous antibiotic timing before surgery start time. However, baseline data collected in the ACS NSQIP custom field indicated that this process was being done appropriately and hence was removed from the list of interventions.
  - Surgeons had chosen to initiate a change in closure sets for all colorectal surgery. However, this step did not have any substantial impact in the SSI occurrences and was deemed to be inconsequential.

3. Cost Savings

- Investment incurred was time spent by the ERAS team members as well as staff education events. No additional monetary costs were involved.
- Safer health care now! estimates the average cost per case of surgical site infections after colorectal surgery to be approximately $16,560 CAN.[3] From July 1, 2013, to December 1, 2016, we prevented 32 additional SSIs for a total savings of approximately $529,920 CAN over that time period.

Tips for Others

1. Staff education is supremely important because a gap exists between the best evidence and practice with regards to SSI prevention.[2] Awareness of evidence is the first step in knowledge translation.[2]
2. Appropriate drill down of ACS NSQIP data is crucial so that information is clearly evident for teams/staff to identify the quality improvement opportunity.
3. Provision of ACS NSQIP data updates at regular intervals to surgical staff/teams helps them focus on the predetermined goals.
4. Including key stakeholders in the decision-making process for all quality improvement interventions is critical to successful implementation and sustainment. These stakeholders include surgeons, anesthetists, management, and frontline staff. A multidisciplinary team such as this one helps foster global participation within the organization and garners support for the initiative and its subsequent success.

Acknowledgements

Surrey Memorial Hospital ERAS Team

Surrey Memorial Hospital ACS NSQIP Team

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TEXAS CHILDREN'S HOSPITAL

A Standardized Protocol to Reduce Pediatric Baclofen Pump Infections: A Quality Improvement Initiativee

General Information

1. Institution Name: Texas Children's Hospital

2. Submitter Names and Titles: Sandi Lam, MD, MBA; JoWinsyl Montojo, RN; Valentina Briceno, RN; Virendra R. Desai, MD; Jeffrey S. Raskin, MD, MS; and, Daniel J. Curry, MD

3. Name of the Case Study:

A Standardized Protocol to Reduce Pediatric Baclofen Pump Infections: A Quality Improvement Initiative

What Was Done?

1. Global Problem Addressed

Intrathecal baclofen pumps are placed for movement disorders such as dystonia and spasticity. Surgical site infections (SSIs) and deep infections related to implant surgery are a problem in this challenging patient population. Known risk factors and special considerations include low body mass index (BMI), presence of percutaneous gastrointestinal access, and scoliosis, among others. A majority of infections occur within 60 days of surgery, reported at a rate of 4% in the first 60 days and 1% per year thereafter.

2. Identification of Local Problem

Using national benchmarks, we found our institution had an unacceptably high rate of infection (23%) compared with other hospitals. We aimed to address implant-related infections. We conducted a quality improvement initiative, following an infection prevention bundle with evidence-based best practice, and examined the pre- and post-protocol-implementation outcomes of perioperative infection and postoperative complications.

How Was the Quality Improvement (QI) Activity Put in Place?

1. Context of the QI Activity

Texas Children's Hospital is a free-standing metropolitan quaternary referral and teaching hospital with more than 650 beds. Advanced quality improvement is valued in the organization. In addition, the neurosurgery division runs a data-driven research program, which further motivated this QI activity.

2. Planning and Development Process

In weekly ongoing quality assurance conferences, we reviewed American College of Surgeons National Surgical Quality Improvement Program-Pediatric (ACS NSQIP-P) metrics and ongoing occurrences. The need for quality improvement was recognized by all stakeholders over the course of information dissemination. We designed an intervention for quality improvement using a Plan-Do-Study-Act (PDSA) model. The treating physicians conducted a literature review of best practices; the pediatric neurosurgery team reached consensus for steps in the perioperative treatment pathway where there was no recommendation in the literature. This process resulted in development of and implementation of an infection prevention bundle, which included preoperative, intraoperative and postoperative steps. We modeled our process after the Hydrocephalus Clinical Research Network shunt infection protocol, which is a successful example of quality improvement in pediatric neurosurgery.

Description of the Quality Improvement Activity

The implementation was pushed forward with team effort from surgery, perioperative nursing, and acute care nursing "micro-team" fronts. Each micro-team had a point person in charge of peer education and compliance with steps of the protocol pertaining to his or her field. We found that with a surgical schedule and team members on different working schedules, it was difficult to carve out in-person meeting times. It was reassuring to find over time that the contemporaneous efforts of different micro-teams worked well, with monthly check-ins via e-mail reporting. Weekly Surgical Quality Assurance case conferences also provided a forum for adjustments in workflow and for addressing any problems or concerns that arose.

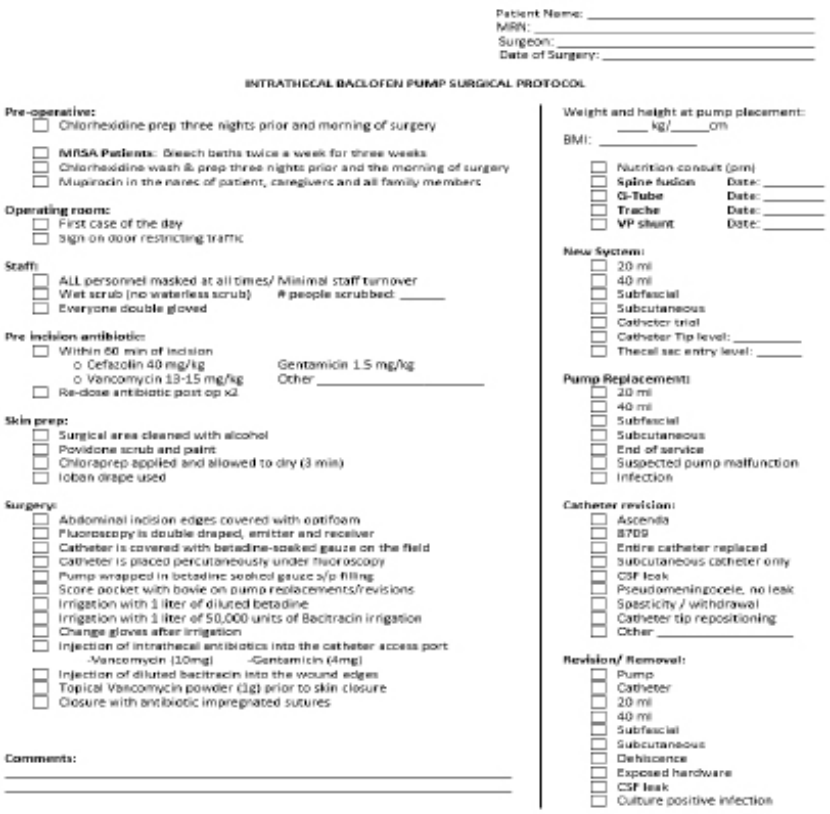
The protocol was implemented starting in August 2014 (Figure 1).

Resources Used and Skills Needed

Our QI effort received no funding and had no additional staff support beyond our usual clinical care efforts. We restructured our workflow and clinical care process according to an agreed-upon protocol, and in doing so allowed for standardization of workflow. The goal was to reduce variation in care, which in turn produced improved clinical results.

The implementation depended on efforts from surgery, perioperative nursing, and acute care nursing "micro-team" fronts. The lead surgeon knew the protocol (and provided education to other surgeons) and asked for

Figure 1. Protocol sheet



Patient Name: _____
MRN: _____
Surgeon: _____
Date of Surgery: _____

INTRATHECAL BACLOFEN PUMP SURGICAL PROTOCOL

Pre-operative:
- ☐ Chlorhexidine prep three nights prior and morning of surgery
- ☐ **MRSA Patients:** Bleach baths twice a week for three weeks
- ☐ Chlorhexidine wash & prep three nights prior and the morning of surgery
- ☐ Mupirocin in the nares of patient, caregivers and all family members

Operating room:
- ☐ First case of the day
- ☐ Sign on door restricting traffic

Staff:
- ☐ ALL personnel masked at all times/ Minimal staff turnover
- ☐ Wet scrub (no waterless scrub) # people scrubbed: _____
- ☐ Everyone double gloved

Pre incision antibiotic:
- ☐ Within 60 min of incision
  - ○ Cefazolin 40 mg/kg — Gentamicin 1.5 mg/kg
  - ○ Vancomycin 13-15 mg/kg — Other _____
- ☐ Re-dose antibiotic post op x2

Skin prep:
- ☐ Surgical area cleaned with alcohol
- ☐ Povidone scrub and paint
- ☐ Chloraprep applied and allowed to dry (3 min)
- ☐ Ioban drape used

Surgery:
- ☐ Abdominal incision edges covered with optifoam
- ☐ Fluoroscopy is double draped, emitter and receiver
- ☐ Catheter is covered with betadine-soaked gauze on the field
- ☐ Catheter is placed percutaneously under fluoroscopy
- ☐ Pump wrapped in betadine soaked gauze x/p filling
- ☐ Score pocket with bovie on pump replacements/revisions
- ☐ Irrigation with 1 liter of diluted betadine
- ☐ Irrigation with 1 liter of 50,000 units of Bacitracin irrigation
- ☐ Change gloves after irrigation
- ☐ Injection of intrathecal antibiotics into the catheter access port
  - -Vancomycin (10mg) -Gentamicin (4mg)
- ☐ Injection of diluted bacitracin into the wound edges
- ☐ Topical Vancomycin powder (1g) prior to skin closure
- ☐ Closure with antibiotic impregnated sutures

Comments:
_____
_____

Weight and height at pump placement:
____ kg/____cm
BMI: _____

- ☐ Nutrition consult (pm)
- ☐ **Spine fusion** Date: _____
- ☐ **G-Tube** Date: _____
- ☐ **Trache** Date: _____
- ☐ **VP shunt** Date: _____

New System:
- ☐ 20 ml
- ☐ 40 ml
- ☐ Subfascial
- ☐ Subcutaneous
- ☐ Catheter trial
- ☐ Catheter Tip level: _____
- ☐ Thecal sac entry level: _____

Pump Replacement:
- ☐ 20 ml
- ☐ 40 ml
- ☐ Subfascial
- ☐ Subcutaneous
- ☐ End of service
- ☐ Suspected pump malfunction
- ☐ Infection

Catheter revision:
- ☐ Ascenda
- ☐ 8709
- ☐ Entire catheter replaced
- ☐ Subcutaneous catheter only
- ☐ CSF leak
- ☐ Pseudomeningocele, no leak
- ☐ Spasticity / withdrawal
- ☐ Catheter tip repositioning
- ☐ Other _____

Revision/ Removal:
- ☐ Pump
- ☐ Catheter
- ☐ 20 ml
- ☐ 40 ml
- ☐ Subfascial
- ☐ Subcutaneous
- ☐ Dehiscence
- ☐ Exposed hardware
- ☐ CSF leak
- ☐ Culture positive infection

the protocol form and help in adherence to the steps during surgeries. The lead operating room nurse educated the rest of the perioperative nursing team, filled out the protocol forms, ensured adherence to the protocol steps by providing supplies and reminders, and made enhancements in operative workflow to make the protocol the "default" behavior. The lead acute care nurse educated peers, ensured adherence to the protocol steps, and activated enhancements in workflow to make the protocol the "default" behavior in the postoperative phase.

What Were the Results?

1. Overall Results

There were a total of 128 cases included for study: 64 cases in each of the pre-implementation and post-implementation groups. In the pre-implementation group, there were 15 total complications (23.4%) and eight infections (12.5%) with Clavien Dindo grade II or higher. After protocol implementation, there were six total complications (9.4%) with four (6.3%) infections. The total complication rate was significantly reduced after protocol implementation (p=0.032), with absolute and relative risk reductions of 14.1% [95% CI: 1.5% - 26.7%] and 60%, respectively.

The infection rate was essentially cut in half, from 12.5% to 6.3%. The infection rate was not a statistically significant reduction (p=0.225), with absolute and relative risk reductions of 6.3% [95% CI: -3.8% - 16.3%] and 50%, respectively. Relatively small sample size to date may contribute to limited ability in achieving statistical significance.

2. Setbacks

Compliance to every step of the protocol was 88%.

Barriers included personnel turnover. Education of all perioperative and acute care nursing members took some time, and new nursing staff were continually coming on board. The surgical team also had rotating trainees who switched on and off service every four months. There was no hard stop mechanism to ensure full compliance in every surgery, so implementation depended on people and people's behaviors. The 88% compliance rate is viewed favorably and is higher over time given penetration of educational efforts across the entire surgical and nursing team.

The protocol was reviewed monthly, and steps of the protocol were discussed regularly, seeking to enhance workflow to prepare for and ensure proper execution of each step at the right time. For instance, storage places of specific dressings were relocated to allow for easier access.

3. Cost Savings

Given that there was no budget for this project and no additional personnel for this project, the amount invested is not quantifiable in financial terms. The team ultimately believes that quality improvement initiatives are the right thing to do for patient care. The key to physician-led and provider-led QI without additional financial support is designing a clinical workflow that can be incorporated into daily practice. We did not receive any project management support.

Savings per case have not been fully quantified in our patient population. Extrapolating from comparative literature of spinal surgery infections, which have reported incrementally increased treatment costs (compared to non-infection controls) of $12,619 to $38,701, total savings in the reduction of complications would total in a range of $113,571 to $348,309 in inpatient hospital costs alone.

Implications on quality of life of the patient and family are targets for future study.

Tips for Others

The key to physician-led and provider-led QI without additional financial support is designing a clinical workflow that can be incorporated into daily practice.

In a surgical team setting, implementation did not require multiple meetings that would take away from clinical care or require cancellation of scheduled surgeries. Once motivated stakeholders were on board, feedback continued regularly with updates and scorecards on compliance and complications. Existing in-person clinical quality assurance conferences provided a forum for weekly check-ins as needed.

Data and feedback are important. Providing meaning to daily work is also important. Positive feedback functions as a great motivator. On the other hand, setbacks such as infection events provide extra incentive to do better. A shared value of striving to improve for patients really provided the best reason to come together as a team and do our best. Strong leadership is thus important.

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