Pediatric Surgery Quality Collaborative

Our First In Person Meeting!
May 11, 2022
MY DOCTOR SAID AT MY AGE I SHOULD REALLY INSTALL A BAR IN THE SHOWER. SO I DID.
Agenda

- State of the Collaborative
- Retreat summary/progress since
- Current status with the ACS
- Project Review
  - Project 1 – Andrew Hu
  - Project 2 – Derek Wakeman/Monica Lopez
  - Project 3 – Shawn Rangel
  - Project 4 – TBD
- Implementation Science
- July Meeting (with SCRs)
PSQC Overview

The PSQC is a partnership of Children’s hospitals and the American College of Surgeons who share the mission of delivering high quality, cost effective, patient-centered surgical care.
PSQC Overview

- Collaborative of NSQIP-P hospitals
- 85 Members with signed DUA
- All but one of the CSV Level 1 hospitals
- National in scope by design
Improving Outcomes Requires Measurement

LOW OUTLIER: If the O/E ratio and the higher range of the confidence interval are < 1.0, the hospital’s outcomes are statistically better than expected. Thus, your hospital’s outcomes are “Exemplary.”

HIGH OUTLIER: If the O/E ratio and the lower range of the confidence interval are > 1.0, the hospital’s outcomes are statistically worse than expected. Thus, your hospital’s outcomes “Need Improvement.”

- 82% of hospitals decreased complications*
- 66% of hospitals decreased mortality*
- 250-500 fewer complications per hospital per year*
Reducing preventable complications improves care and reduces costs:

- Reduction in complications: **250-500***
- Average cost per complication: **$11,626**
- Average savings per hospital: **$2,906,500 - $5,813,000**
- Potential yearly savings across 4,500 hospitals: **$13 - $26 billion**
- Estimated total savings over a decade**: **$130 - $260 billion**


**Length of time used for health reform calculations
The Triad of Surgical Quality Improvement

Improving Surgical Care for Children

CSV

NSQIP-P

PSQC
PSQC Overview
What we are not

• Not a disease specific registry (Anorectal, CDHSG, …)
• Not federally funded (COG, NRN)
• Not a regional research collaborative
• Our primary goal is quality improvement
Planning Retreat – September 2021

First In Person Meeting
First In Person Meeting

Nobody got Covid (from that meeting)
Planning Retreat – September 2021

- Structure
PSQC Structure

- Executive Committee
- Implementation Committee
- Working Groups
- Executive Director
- Program Manager
- Data Analyst
- Project Coordinator
- PSQC Member Hospitals
Executive Committee
Specific Alignment with Organizations
Planning Retreat – September 2021

- Structure
- Size/Scope
Planning Retreat – September 2021

- Structure
- Size/Scope
- Next Projects (2 + 3)
Planning Retreat – September 2021

- Structure
- Size/Scope
- Next Projects
- Future projects
COMMITTEES

Just Like Teamwork. Only Without the Work.
Project Development and Implementation Committee (PDIC)

Dr. Mehul Raval, MD, MS, FAAP, FACS
Anne and Robert H. Lurie Children’s Hospital
Working Groups (Can expand)

- Project # 1 – Mehul Raval
- Project # 2 – Derek Wakeman/Monica Lopez
- Project # 3 – Shawn Rangel
- Project(s) # 4 - TBD
Planning Retreat – September 2021

- Structure
- Size/Scope
- Next Projects
- Future projects
- Monthly SCR forum/Webinar
Planning Retreat – September 2021

- Structure
- Size/Scope
- Next Projects
- Future projects
- Monthly SCR forum/Webinar
- Matchmaker
Mistakes

It could be that the purpose of your life is
Only to serve as a warning to others
Call for all Problems
Agenda

- State of the Collaborative
- Retreat summary/progress since
- Current status with the ACS
The Triad of Surgical Quality Improvement

- CSV
- NSQIP-P
- PSQC

Improving Surgical Care for Children
• State of the Collaborative
• Retreat summary/progress since
• Current status with the ACS
• Project Review
  • Project 1 – Andrew Hu
PSQC Overview

ACS NSQIP Pediatric

PSQC Collaborative January 2020 SAR Performance Dashboard

Surgery Dates July 1, 2018 to June 30, 2019

These graphs depict the percentage of collaborative hospitals assigned to the performance assessment categories based on the current SAR.

![Graphs showing percentage of collaborative hospitals assigned to performance assessment categories based on current SAR.](image-url)
The following graph displays the raw rates of negative appendectomies against preoperative CTs for acute appendicitis cases within collaborative hospitals.
Computed Tomography Scan Reduction In The Workup of Pediatric Appendicitis

Andrew Hu, MBChB, MS; Azraa S. Chaudhury, BA; Terry Fisher, MPH, PMP; Elisa Garcia, BSN, RN, CCRP; Loren Berman, MD; Kuojen Tsao, MD; Stephen B. Shew, MD; Shawn Rangel, MD, MSCE; Kevin P. Lally, MD, MS; Mehul V. Raval, MD, MS
DISCLOSURES

- NUCATS Pilot Grant: UL1TR001422
INTRODUCTION | Well established association between early age radiation exposure and later cancer development
INTRODUCTION | Three Aims

Aim #1
To measure preoperative CT scan use among PSQC members

Aim #2
To identify barriers and facilitators to CT reduction

Aim #3
To facilitate institutional quality improvement efforts to reduce CT
Preoperative CT Rates (%) vs. Negative Appendectomy Rate (%)
IDENTIFYING BARRIERS & FACILITATORS | Theoretical Domains Framework (TDF)

- **Focus groups** including surgeons, radiologists, EM, SCRs
- **Semi-structured interview guide** developed based on TDF
- **Focus groups** probed to identify barriers and facilitators for CT reduction

IDENTIFYING BARRIERS & FACILITATORS | Thematic Saturation Achieved After 13 Focus Groups

- 7 High performing hospitals
- 6 Low performing hospitals
- 13 Pediatric Surgeons
- 5 Pediatric Emergency Medicine Physicians
- 5 Radiologists
- 5 Surgical Clinical Reviewers
IDENTIFYING BARRIERS & FACILITATORS | 4 Key Themes

- Imaging resources
- Protocol implementation & adherence
- Presence of a champion
- QI resources & experience
IMAGING | Majority of HPs have 24/7 high quality pediatric ultrasound

High performers

“...we have the consistency and availability to perform an US

“...our US techs are very good...it's only pediatric radiologists who are interpreting our US

Low performers

“Not having 24/7 ultrasound is another problem and...we get a lot of non diagnostic ultrasounds

“2 of 7 [sonography techs] would actually be able to go ahead and reliably find an appendix on the exam
Majority of HPs have adhered to pre-op imaging protocols and US performance protocols

High performers

“We adopted a guideline for evaluation that included the pediatric appendicitis score to guide whether imaging was necessary.”

“We met with all the [US] techs...we agreed on a standardized template.”

Low performers

“Even though we have the algorithm, they may think that they know what to do better.”

“With turnover in our ER staff, they pretty much have ignored [the protocol] and go straight to imaging.”
All HPs had one champion supporting CT reduction

- 100% of identified champions included radiology

High performers

- It was him who got it going .... we used to do an appendix ultrasound on every abdomen ultrasound [because] the technologist needed the practice
- I think we had champions...they had the support of their entire sections to make decisions for the group

Low performers

- He literally gave up on the project because it was just going nowhere
- I think some of it has to do with current leadership... I'm not sure my beating my head against the wall is worth it for me right now.
Majority of HPs have QI infrastructure in place for interdisciplinary collaboration

#### QI resources & experience

<table>
<thead>
<tr>
<th>% of Hospitals</th>
<th>HP</th>
<th>LP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated QI department</td>
<td>90%</td>
<td>60%</td>
</tr>
<tr>
<td>Prior QI inter-departmental collaboration</td>
<td>80%</td>
<td>20%</td>
</tr>
</tbody>
</table>

**High performers**

- We review them that our NSQIP meetings with regularity. We review aggregate data that's meaningful.
- We have a whole QI department actually...in our clinical quality department, we have nurses pretty much exclusively that helped support.

**Low performers**

- The quality department is myself and my director who's actually leaving.
- We don't have any dedicated administrative and academic time for quality improvement.
IDENTIFYING BARRIERS & FACILITATORS | 4 Key Themes

- Imaging resources
  - Consistent availability of high quality pediatric focused resources
- Protocol implementation & adherence
  - Presence of and adherence to protocols guiding imaging decision making & execution
- Presence of a champion
  - Presence of a radiation reduction champion
- QI resources & experience
  - Availability of QI infrastructure and interdisciplinary collaboration
FACILITATING QI | Aim statements

Aim
By June 30, 2022, the aggregate CT utilization rate for the Collaborative will be reduced from 24.5% to 15%

Balancing Measure
The negative appendectomy rate for the Collaborative will remain at or below 1.75%
FACILITATING QI Implementation Guide

Aim

Reduce on-site CT utilization in pre-op appendicitis cases from 24.5% to 15% by July 1, 2022

Primary Drivers

Utilization of non-ionizing imaging modalities

Improve working relationship across disciplines

Secondary Drivers

Screening patients

Imaging efficacy

Quality improvement culture

Change Concepts

Written protocol for triage of all suspected appendicitis cases in ED

Written protocol for ultrasound performance and interpretation for appendicitis

Training of ultrasound technicians on imaging of appendix

Ultrasound report template in the EHR

Strategy for patients with BMI > 30

Multidisciplinary work group-PFM, PedRAD, Ped Surg, Hospital QI, SCR
FACILITATING QI | Implementation Guide

- Triage Protocols
- Quality Measures
- Intervention Strategies
- Imaging Protocols
FACILITATING QI | Peer Coaching
INTERVENTION STRATEGIES | Seminars

- Session 1: Implementation Guide
- Session 2: Ultrasound
- Session 3: MRI
- Session 4: Case Studies
LIMITATIONS

- Qualitative study with 13 children’s hospitals
- Participating institutions did not include any non-dedicated children’s hospitals
- Focus groups did not contain any representatives from hospital administration or imaging technicians
- Focus group participants were made aware of purpose of study, potentially biasing responses
CT scans continue to be used in the diagnosis of pediatric appendicitis

Multiple factors play important roles in CT scan reduction

Collaborative approach

Institutions have begun to use our resources

Continued Monitoring & Sustainability

Incremental Improvement
Acknowledgements

Azraa Chaudhury  Dr. Mehul V. Raval  Ms. Terry Fisher  Dr. Kevin Lally  Dr. Kuojen Tsao

Dr. Loren Berman  Dr. Shawn Rangel  Dr. Stephen B. Shew
Reducing postoperative CT imaging utilization in pediatric appendicitis

Monica E Lopez, MD MS
Derek Wakeman, MD
Rationale

• Appendicitis is a common surgical emergency

• Significant practice variability

• Computed tomography imaging frequently used

• Increased risk of radiation-associated malignancies
  • Hematologic malignancy risk highest in 0-15 yo

NEJM 2007;357(22):2277–8
Lancet 2012;380(9840):499–505
JAMA Surgery 2021;156(4):343–51
Reduction of CT utilization for Pre-op Imaging of Pediatric Appendicitis

Implementation Guide

Aim Statement

By June 30, 2022, the aggregate CT utilization rate for the Collaborative will be reduced from 24.5% to 15%.

Balancing Measure

The negative appendectomy rate for the Collaborative will remain at or below 1.75%.
Variation in CT Utilization

*Complicated Appendicitis*
Utilization and Performance Benchmarking for Postoperative Imaging in Children With Complicated Appendicitis

Results From a Multicenter Collaborative Cohort Study

Mark A. Kashtan, MD, MPH,* Dionne A. Graham, PhD,† and Shawn J. Rangel, MD, MSCE*✉

Ann Surg 2022;275:816–823
Variation in US Process Measures

Ann Surg 2022;275:816–823
Variation in CT-associated DER

Ann Surg 2022;275:816–823
Postoperative Imaging Utilization

• Clinical Pathways
• Infection Rates
• Institutional US availability/quality
• Postop imaging selection criteria
OS/SSI Rate vs. Postop CT Rate
Project 2 Methodology

• Qualitative methods
  • Semi-structured interviews
  • Low and high outlier performance vs. all centers
  • Shared learning
    • Best practices, culture change, sustainability of implementation strategies

• Postop imaging utilization scorecards

• Implementation of specific QI initiatives

• Other?
Next Steps

• Recruiting Working Group members
• Await review of Collaborative data
• PSQC Project 2 Working Group
  • Meeting 5/26 @9 am CST
PSQC Collaborative (proposed) Project #3: Improving stewardship for surgical antimicrobial prophylaxis

- Overview of the NSQIP-P antimicrobial stewardship pilot
- SAP utilization trends across NSQIP-P hospitals
- Overview of the NSQIP-P prophylaxis utilization site report
- Considerations around prioritization of collaborative efforts
- Thoughts on timeline and next steps....
The American College of Surgeons (ACS) Children’s Surgery Verification Program

Evolution of NSQIP-Pediatric to collect an increasing array of comparative performance data to support CSV requirements...

- Procedure-targeted outcomes and resource utilization measures (2016)
- Time-to-OR process measures for emergent surgical conditions (2018)
- Compliance measures for appropriate use of antimicrobial prophylaxis (2019)

“Hospitals seeking level 1 and 2 status must participate in NSQIP-Pediatric and demonstrate how their NSQIP data was used for driving process improvement...”
Goals of the NSQIP-Pediatric Antimicrobial Stewardship Pilot Project

• To characterize and benchmark variation in the use of SAP across NSQIP Pediatric hospitals

• To provide hospitals with relevant balancing measure data (e.g., SSI rates) to help prioritize efforts around antimicrobial stewardship and infection prevention

• To facilitate sharing of best practices from exemplar hospitals with favorable SAP utilization and SSI profiles
Surgical Antimicrobial Prophylaxis Report: Framework for Measure Development

Clinical practice guidelines for antimicrobial prophylaxis in surgery


Am J Health-Syst Pharm. 2013; 70:19S-28S

- Endorsed by American Society of Hospital Pharmacists (ASHP), Infectious Disease Society of America (IDSA), Surgical Infection Society (SIS)

- Framework used to define “rules” for appropriate utilization; further modified by NSQIP-P Specialty Advisory Councils
Surgical Antimicrobial Prophylaxis Report: Utilization, Compliance & Balancing Measures

SAP measures (adjusted for procedure-mix among hospitals)
Compliance measures based on consensus guidelines:
• % of cases received after incision (“timing non-compliance”)
• % of cases inappropriately broad spectrum of coverage (“spectrum non-compliance”)

Utilization measures based on relative utilization with peers:
• % of cases any SAP utilized (clean cases without use of implants/drains)
• % of cases SAP extended into the postoperative period
• % of cases SAP utilized postoperatively > 24 hours

Balancing measures (adjusted for procedure mix & comorbidities)
• SSI rate (Any, incisional & organ space)
• UTI rate (for Urology procedures)
### NSQIP-Pediatric SAP Pilot Data: Procedure Buckets for case-mix adjustment

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<tr>
<th>Procedure Bucket</th>
<th>Specialty</th>
<th>Cases (n)</th>
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<tr>
<td>GASTROSTOMY</td>
<td>GENERAL SURGERY</td>
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<tr>
<td>PYLOROMYOTOMY</td>
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<tr>
<td>PECTUS</td>
<td>GENERAL SURGERY</td>
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<td>GASTROSTOMY CLOSURE</td>
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<td>COLORECTAL-ANORECTAL MALFORMATION</td>
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<tr>
<td>ESOPHAGUS NON-REFLUX</td>
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<td>COLORECTAL-PULLTHROUGH WITH POUCH</td>
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<td>ENDOSCOPIC AIRWAY</td>
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<tr>
<td>URINARY DIVERSION</td>
<td>UROLOGY</td>
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</tr>
</tbody>
</table>
NSQIP-Pediatric Antimicrobial Stewardship Pilot: Summary Overview of Pilot Data Analysis

- Audit period: 6/2/2019 – 6/30/2020
- 42,590 cases from 92 hospitals
- 413 procedures (CPTs) representing 6 NSQIP-Pediatric specialties
- Measures evaluated at the hospital, specialty & procedural level
- Measures adjusted for differences in procedure-mix and comorbidities (presented as adjusted OR’s)
<table>
<thead>
<tr>
<th>SAP_Bucket</th>
<th>Utilization Rate (by Hospital)</th>
<th>Spectrum Compliance (By Hospital)</th>
<th>Mean Post-Operative Duration (Hours) (By Hospital)</th>
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<tbody>
<tr>
<td></td>
<td>Min (%)</td>
<td>Max (%)</td>
<td>Min (%)</td>
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<tr>
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<td>0.00%</td>
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<tr>
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<td>NEUROSURGERY</td>
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<td>9.76%</td>
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<td>ORTHO</td>
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<td>SPINE</td>
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<td>0.00%</td>
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<td>50.00%</td>
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<td>33.33%</td>
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</table>
Procedure-adjusted utilization of postoperative prophylaxis vs. SSI risk

Complication: SSI vs. Any postoperative prophylaxis
Odds Ratios (ORs)

<table>
<thead>
<tr>
<th>Peds Models</th>
<th>Low Outliers (n)</th>
<th>High Outliers (n)</th>
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<tr>
<td>All Surgeries</td>
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<td>Non-Compliance: Timing Guidelines</td>
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<td>Non-Compliance: Spectrum Guidelines</td>
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<td>31</td>
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<tr>
<td>Overall Antibiotic Utilization</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>Postoperative Duration &gt; 0 Hours</td>
<td>22</td>
<td>31</td>
</tr>
<tr>
<td>Postoperative Duration &gt; 24 Hours</td>
<td>16</td>
<td>28</td>
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<tr>
<td>Complication: All SSI</td>
<td>1</td>
<td>4</td>
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<tr>
<td>Complication: Incisional SSI</td>
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<tr>
<td>Complication: Organ space SSI</td>
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Hospital-level correlation of log-transformed odds ratios between any surgical site infection (incisional or organ space) and use of any postoperative surgical antimicrobial prophylaxis at 93 hospitals, stratified by surgical specialty.
Procedure-adjusted utilization of postoperative prophylaxis > 24 hrs vs. SSI risk

<table>
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<tr>
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<td>Postoperative Duration &gt; 24 Hours</td>
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<td>Complication: All SSI</td>
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<td>Complication: Incisional SSI</td>
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<tr>
<td>Complication: Organ space SSI</td>
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Procedure-adjusted any prophylaxis utilization for clean cases without implants vs. SSI risk

<table>
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<tr>
<th>Complication: SSI vs. Overall prophylaxis utilization</th>
<th>Odds Ratios (ORs)</th>
<th>Peds Models</th>
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<th>High Outliers (n)</th>
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<tr>
<td>All Surgeries</td>
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<td>Complication: All SSI</td>
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<td>Complication: Organ space SSI</td>
<td></td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

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Procedure-adjusted use of inappropriately broad spectrum prophylaxis vs. adjusted SSI risk

<table>
<thead>
<tr>
<th>Peds Models</th>
<th>Low Outliers (n)</th>
<th>High Outliers (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Surgeries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Compliance: Timing Guidelines</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Non-Compliance: Spectrum Guidelines</td>
<td>25</td>
<td>31</td>
</tr>
<tr>
<td>Overall Antibiotic Utilization</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>Postoperative Duration &gt; 0 Hours</td>
<td>22</td>
<td>31</td>
</tr>
<tr>
<td>Postoperative Duration &gt; 24 Hours</td>
<td>16</td>
<td>28</td>
</tr>
<tr>
<td>Complication: All SSI</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Complication: Incisional SSI</td>
<td>1</td>
<td>6</td>
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<tr>
<td>Complication: Organ space SSI</td>
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</tr>
</tbody>
</table>
### Distribution of prophylaxis utilization and SSI outlier status by surgical specialty

*Adjusted for procedure-mix and comorbidity profiles

<table>
<thead>
<tr>
<th>Peds Models</th>
<th>Sites Included</th>
<th>Total Cases (n)</th>
<th>Observed Events (n)</th>
<th>Observed Event Rate (%)</th>
<th>Low Outliers* (n)</th>
<th>High Outliers* (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL SURGERY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Compliance: Timing Guidelines</td>
<td>90</td>
<td>6935</td>
<td>299</td>
<td>4.31%</td>
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<td>7</td>
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<tr>
<td>Non-Compliance: Spectrum Guidelines</td>
<td>90</td>
<td>8738</td>
<td>1459</td>
<td>16.70%</td>
<td>13</td>
<td>16</td>
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<tr>
<td>Antibiotic Utilization for clean cases w/o implants</td>
<td>90</td>
<td>10380</td>
<td>8831</td>
<td>85.08%</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>Postoperative Duration &gt; 0 Hours</td>
<td>90</td>
<td>8817</td>
<td>1905</td>
<td>21.61%</td>
<td>12</td>
<td>20</td>
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<tr>
<td>Postoperative Duration &gt; 24 Hours</td>
<td>90</td>
<td>8817</td>
<td>693</td>
<td>7.86%</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>Complication: All SSI</td>
<td>90</td>
<td>10398</td>
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<td>3.00%</td>
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<td>257</td>
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<tr>
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<td>10398</td>
<td>56</td>
<td>0.54%</td>
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Hospital-level comparative report for prophylaxis utilization and SSI rates (2021)

### Specialty: All Surgeries

<table>
<thead>
<tr>
<th>Model:</th>
<th>Total Cases (n): Your Hospital</th>
<th>Event Rate (%): Your Hospital</th>
<th>Event Rate (%): All Hospitals</th>
<th>OR*</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>335</td>
<td>3.88</td>
<td>4.89</td>
<td>0.94</td>
<td>0.56 - 1.58</td>
<td>As Expected</td>
</tr>
<tr>
<td>Non-compliance with appropriate spectrum</td>
<td>582</td>
<td>5.33</td>
<td>9.40</td>
<td>0.55</td>
<td>0.36 - 0.84</td>
<td>Low</td>
</tr>
<tr>
<td>Overall prophylaxis utilization</td>
<td>596</td>
<td>97.99</td>
<td>86.86</td>
<td>3.24</td>
<td>1.75 - 6.01</td>
<td>High</td>
</tr>
<tr>
<td>Any postoperative prophylaxis</td>
<td>584</td>
<td>52.74</td>
<td>41.15</td>
<td>1.23</td>
<td>0.96 - 1.58</td>
<td>As Expected</td>
</tr>
<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>584</td>
<td>10.62</td>
<td>9.24</td>
<td>1.15</td>
<td>0.83 - 1.59</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: All SSI</td>
<td>601</td>
<td>2.00</td>
<td>1.82</td>
<td>1.10</td>
<td>0.68 - 1.77</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: Incisional SSI</td>
<td>601</td>
<td>1.83</td>
<td>1.39</td>
<td>1.24</td>
<td>0.73 - 2.11</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: Organ space SSI</td>
<td>601</td>
<td>0.17</td>
<td>0.43</td>
<td>0.82</td>
<td>0.36 - 1.86</td>
<td>As Expected</td>
</tr>
</tbody>
</table>

*Odds Ratios (ORs) for all antibiotic utilization measures, with the exception of timing, are adjusted for differences in procedure-mix between hospitals.
*The measure for timing was not adjusted for case-mix as considerations around appropriate timing are the same for all procedures.
*ORs for SSI events are adjusted for procedure and patient-related factors using the same approach as reported in the SAR.
### Specialty: ENT

<table>
<thead>
<tr>
<th>Model:</th>
<th>Total Cases (n):</th>
<th>Event Rate (%)</th>
<th>Event Rate All Hospitals OR</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>20</td>
<td>10.00</td>
<td>7.51</td>
<td>1.54</td>
<td>0.43 - 5.48</td>
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<tr>
<td>Overall prophylaxis utilization</td>
<td>33</td>
<td>90.91</td>
<td>58.83</td>
<td>3.99</td>
<td>0.99 - 19.06</td>
</tr>
<tr>
<td>Any postoperative prophylaxis</td>
<td>30</td>
<td>40.00</td>
<td>9.78</td>
<td>7.47</td>
<td>3.16 - 17.96</td>
</tr>
<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>30</td>
<td>3.33</td>
<td>2.28</td>
<td>1.57</td>
<td>0.25 - 9.86</td>
</tr>
<tr>
<td>Complication: All SSI</td>
<td>33</td>
<td>6.06</td>
<td>2.25</td>
<td>1.32</td>
<td>0.45 - 3.88</td>
</tr>
<tr>
<td>Complication: Incisional SSI</td>
<td>33</td>
<td>3.03</td>
<td>0.98</td>
<td>2.15</td>
<td>0.30 - 19.64</td>
</tr>
<tr>
<td>Complication: Organ space SSI</td>
<td>33</td>
<td>3.03</td>
<td>1.27</td>
<td>1.14</td>
<td>0.36 - 3.65</td>
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</table>

### Specialty: NEUROSURGERY

<table>
<thead>
<tr>
<th>Model:</th>
<th>Total Cases (n):</th>
<th>Event Rate (%)</th>
<th>Event Rate All Hospitals OR</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>23</td>
<td>4.35</td>
<td>2.08</td>
<td>1.39</td>
<td>0.33 - 8.82</td>
</tr>
<tr>
<td>Overall prophylaxis utilization</td>
<td>46</td>
<td>100.00</td>
<td>98.68</td>
<td>1.46</td>
<td>0.11 - 18.96</td>
</tr>
<tr>
<td>Any postoperative prophylaxis</td>
<td>46</td>
<td>21.74</td>
<td>69.85</td>
<td>0.12</td>
<td>0.05 - 0.27</td>
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<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>46</td>
<td>6.80</td>
<td>10.14</td>
<td>1.07</td>
<td>0.42 - 2.72</td>
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<tr>
<td>Complication: All SSI</td>
<td>48</td>
<td>2.08</td>
<td>2.11</td>
<td>1.08</td>
<td>0.30 - 3.92</td>
</tr>
<tr>
<td>Complication: Incisional SSI</td>
<td>48</td>
<td>2.08</td>
<td>1.34</td>
<td>1.18</td>
<td>0.31 - 4.46</td>
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</table>

### Specialty: GENERAL SURGERY

<table>
<thead>
<tr>
<th>Model:</th>
<th>Total Cases (n):</th>
<th>Event Rate (%)</th>
<th>Event Rate All Hospitals OR</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>67</td>
<td>2.99</td>
<td>4.31</td>
<td>0.91</td>
<td>0.38 - 2.17</td>
</tr>
<tr>
<td>Non-compliance with appropriate spectrum</td>
<td>98</td>
<td>10.42</td>
<td>16.70</td>
<td>0.94</td>
<td>0.26 - 3.05</td>
</tr>
<tr>
<td>Overall prophylaxis utilization</td>
<td>100</td>
<td>96.00</td>
<td>85.09</td>
<td>1.93</td>
<td>0.74 - 5.05</td>
</tr>
<tr>
<td>Any postoperative prophylaxis</td>
<td>96</td>
<td>28.13</td>
<td>21.61</td>
<td>1.30</td>
<td>0.81 - 2.38</td>
</tr>
<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>96</td>
<td>8.53</td>
<td>7.68</td>
<td>1.11</td>
<td>0.53 - 2.32</td>
</tr>
<tr>
<td>Complication: All SSI</td>
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<td>5.00</td>
<td>3.00</td>
<td>1.12</td>
<td>0.63 - 2.01</td>
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<tr>
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<td>1.31</td>
<td>0.66 - 2.60</td>
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<td>0.00</td>
<td>0.54</td>
<td>0.82</td>
<td>0.29 - 3.30</td>
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### Specialty: ORTHOPEDIC SURGERY

<table>
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<tr>
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<th>Total Cases (n):</th>
<th>Event Rate (%)</th>
<th>Event Rate All Hospitals OR</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>86</td>
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<td>0.22 - 1.77</td>
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<tr>
<td>Non-compliance with appropriate spectrum</td>
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<td>1.28</td>
<td>0.50</td>
<td>0.08 - 3.00</td>
</tr>
<tr>
<td>Overall prophylaxis utilization</td>
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<td>100.00</td>
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<td>3.23</td>
<td>0.31 - 33.38</td>
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<tr>
<td>Any postoperative prophylaxis</td>
<td>159</td>
<td>57.86</td>
<td>40.14</td>
<td>1.50</td>
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<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>159</td>
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<td>1.76 - 5.84</td>
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<td>Complication: All SSI</td>
<td>159</td>
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<td>1.13</td>
<td>1.02</td>
<td>0.56 - 1.86</td>
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<tr>
<td>Complication: Incisional SSI</td>
<td>159</td>
<td>1.29</td>
<td>1.06</td>
<td>1.03</td>
<td>0.56 - 1.92</td>
</tr>
</tbody>
</table>

### Specialty: MULTISPECIALTY - ENT AND PLASTICS

(Cleft lip & palate cases)

<table>
<thead>
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<th>Model:</th>
<th>Total Cases (n):</th>
<th>Event Rate (%)</th>
<th>Event Rate All Hospitals OR</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>26</td>
<td>11.54</td>
<td>8.74</td>
<td>1.61</td>
<td>0.52 - 4.95</td>
</tr>
<tr>
<td>Overall prophylaxis utilization</td>
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<td>85.30</td>
<td>2.73</td>
<td>0.78 - 9.79</td>
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<tr>
<td>Any postoperative prophylaxis</td>
<td>42</td>
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<td>33.16</td>
<td>1.81</td>
<td>0.88 - 3.70</td>
</tr>
<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>42</td>
<td>14.29</td>
<td>10.58</td>
<td>1.43 - 10.33</td>
<td>High</td>
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### Specialty: UROLOGY

<table>
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<tr>
<th>Model:</th>
<th>Total Cases (n):</th>
<th>Event Rate (%)</th>
<th>Event Rate All Hospitals OR</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>66</td>
<td>3.03</td>
<td>7.71</td>
<td>0.69</td>
<td>0.20 - 2.35</td>
</tr>
<tr>
<td>Non-compliance with appropriate spectrum</td>
<td>82</td>
<td>14.63</td>
<td>12.70</td>
<td>1.51</td>
<td>0.78 - 2.91</td>
</tr>
<tr>
<td>Overall prophylaxis utilization</td>
<td>84</td>
<td>100.00</td>
<td>97.24</td>
<td>1.90</td>
<td>0.39 - 9.22</td>
</tr>
<tr>
<td>Any postoperative prophylaxis</td>
<td>84</td>
<td>79.76</td>
<td>56.18</td>
<td>2.16</td>
<td>1.14 - 4.10</td>
</tr>
<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
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<td>4.76</td>
<td>11.03</td>
<td>0.45</td>
<td>0.19 - 1.08</td>
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<tr>
<td>Complication: UTI</td>
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<td>0.34</td>
<td>0.80</td>
<td>0.38 - 1.64</td>
</tr>
</tbody>
</table>

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### Specialty: ENT

<table>
<thead>
<tr>
<th>Model:</th>
<th>Total Cases (n): Your Hospital</th>
<th>Event Rate (%): Your Hospital</th>
<th>Event Rate (%): All Hospitals</th>
<th>OR*</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>20</td>
<td>10.00</td>
<td>7.51</td>
<td>1.54</td>
<td>0.43 - 4.56</td>
<td>As Expected</td>
</tr>
<tr>
<td>Overall prophylaxis utilization</td>
<td>33</td>
<td>90.91</td>
<td>58.83</td>
<td>3.99</td>
<td>0.99 - 16.06</td>
<td>As Expected</td>
</tr>
<tr>
<td>Any postoperative prophylaxis</td>
<td>30</td>
<td>40.00</td>
<td>9.78</td>
<td>7.47</td>
<td>3.16 - 17.96</td>
<td>High</td>
</tr>
<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>30</td>
<td>3.33</td>
<td>2.28</td>
<td>1.57</td>
<td>0.25 - 9.86</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: All SSI</td>
<td>33</td>
<td>6.06</td>
<td>2.25</td>
<td>3.12</td>
<td>0.45 - 3.88</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: Incisional SSI</td>
<td>33</td>
<td>3.03</td>
<td>0.88</td>
<td>2.15</td>
<td>0.30 - 19.64</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: Organ space SSI</td>
<td>33</td>
<td>3.03</td>
<td>1.27</td>
<td>1.14</td>
<td>0.36 - 3.65</td>
<td>As Expected</td>
</tr>
</tbody>
</table>

*OR: Odds Ratio; CI: Confidence Interval; As Expected: The measure for timing was not adjusted for case mix; As Expected: The measure for timing was not adjusted for case mix; As Expected: The measure for timing was not adjusted for case mix.

**Specialty: NEUROSURGERY**

<table>
<thead>
<tr>
<th>Model:</th>
<th>Total Cases (n): Your Hospital</th>
<th>Event Rate (%): Your Hospital</th>
<th>Event Rate (%): All Hospitals</th>
<th>OR*</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>23</td>
<td>4.35</td>
<td>2.08</td>
<td>2.38</td>
<td>0.33 - 8.62</td>
<td>As Expected</td>
</tr>
<tr>
<td>Overall prophylaxis utilization</td>
<td>46</td>
<td>100.00</td>
<td>98.68</td>
<td>1.46</td>
<td>0.11 - 19.69</td>
<td>As Expected</td>
</tr>
<tr>
<td>Any postoperative prophylaxis</td>
<td>46</td>
<td>21.74</td>
<td>69.85</td>
<td>0.12</td>
<td>0.05 - 0.27</td>
<td>Low</td>
</tr>
<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>46</td>
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<td>1.07</td>
<td>0.42 - 2.72</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: All SSI</td>
<td>48</td>
<td>2.08</td>
<td>2.11</td>
<td>1.08</td>
<td>0.30 - 3.92</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: Incisional SSI</td>
<td>48</td>
<td>2.08</td>
<td>1.34</td>
<td>1.18</td>
<td>0.31 - 4.46</td>
<td>As Expected</td>
</tr>
</tbody>
</table>

**Specialty: GENERAL SURGERY**

<table>
<thead>
<tr>
<th>Model:</th>
<th>Total Cases (n): Your Hospital</th>
<th>Event Rate (%): Your Hospital</th>
<th>Event Rate (%): All Hospitals</th>
<th>OR*</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>67</td>
<td>2.99</td>
<td>4.31</td>
<td>0.91</td>
<td>0.39 - 2.17</td>
<td>As Expected</td>
</tr>
<tr>
<td>Non-compliance with appropriate spectrum</td>
<td>98</td>
<td>9.42</td>
<td>16.70</td>
<td>0.54</td>
<td>0.26 - 1.05</td>
<td>As Expected</td>
</tr>
<tr>
<td>Overall prophylaxis utilization</td>
<td>100</td>
<td>96.00</td>
<td>85.08</td>
<td>1.93</td>
<td>0.74 - 5.05</td>
<td>As Expected</td>
</tr>
<tr>
<td>Any postoperative prophylaxis</td>
<td>96</td>
<td>28.13</td>
<td>21.61</td>
<td>1.30</td>
<td>0.81 - 2.38</td>
<td>As Expected</td>
</tr>
<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>96</td>
<td>8.53</td>
<td>7.86</td>
<td>1.11</td>
<td>0.53 - 2.32</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: All SSI</td>
<td>100</td>
<td>5.00</td>
<td>3.00</td>
<td>1.12</td>
<td>0.63 - 2.01</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: Incisional SSI</td>
<td>100</td>
<td>5.00</td>
<td>2.47</td>
<td>1.31</td>
<td>0.66 - 2.60</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: Organ space SSI</td>
<td>100</td>
<td>0.00</td>
<td>0.54</td>
<td>0.24</td>
<td>0.09 - 0.54</td>
<td>As Expected</td>
</tr>
</tbody>
</table>

*OR: Odds Ratio; CI: Confidence Interval; As Expected: The measure for timing was not adjusted for case mix; As Expected: The measure for timing was not adjusted for case mix; As Expected: The measure for timing was not adjusted for case mix.

**Specialty: ORTHOPEDIC SURGERY**

<table>
<thead>
<tr>
<th>Model:</th>
<th>Total Cases (n): Your Hospital</th>
<th>Event Rate (%): Your Hospital</th>
<th>Event Rate (%): All Hospitals</th>
<th>OR*</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>85</td>
<td>1.16</td>
<td>4.43</td>
<td>0.62</td>
<td>0.22 - 1.77</td>
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</tr>
<tr>
<td>Non-compliance with appropriate spectrum</td>
<td>159</td>
<td>0.00</td>
<td>1.28</td>
<td>0.50</td>
<td>0.08 - 3.00</td>
<td>As Expected</td>
</tr>
<tr>
<td>Overall prophylaxis utilization</td>
<td>159</td>
<td>100.00</td>
<td>94.22</td>
<td>3.23</td>
<td>0.31 - 33.38</td>
<td>As Expected</td>
</tr>
<tr>
<td>Any postoperative prophylaxis</td>
<td>159</td>
<td>57.86</td>
<td>40.14</td>
<td>1.50</td>
<td>1.02 - 2.21</td>
<td>High</td>
</tr>
<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>159</td>
<td>10.69</td>
<td>4.49</td>
<td>2.32</td>
<td>1.76 - 5.84</td>
<td>As Expected</td>
</tr>
<tr>
<td>Complication: All SSI</td>
<td>159</td>
<td>1.26</td>
<td>1.13</td>
<td>1.02</td>
<td>0.56 - 1.86</td>
<td>As Expected</td>
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<td>Complication: Incisional SSI</td>
<td>159</td>
<td>1.26</td>
<td>1.06</td>
<td>1.03</td>
<td>0.56 - 1.92</td>
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*OR: Odds Ratio; CI: Confidence Interval; As Expected: The measure for timing was not adjusted for case mix; As Expected: The measure for timing was not adjusted for case mix; As Expected: The measure for timing was not adjusted for case mix.

**Specialty: MULTISPECIALTY - ENT AND PLASTICS**

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<th>Event Rate (%): Your Hospital</th>
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<th>OR*</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>26</td>
<td>11.54</td>
<td>8.74</td>
<td>1.61</td>
<td>0.52 - 4.95</td>
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<tr>
<td>Overall prophylaxis utilization</td>
<td>43</td>
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<td>85.30</td>
<td>2.73</td>
<td>0.76 - 9.79</td>
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<td>Any postoperative prophylaxis</td>
<td>42</td>
<td>40.48</td>
<td>33.16</td>
<td>1.81</td>
<td>0.88 - 3.70</td>
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<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>42</td>
<td>14.29</td>
<td>5.18</td>
<td>3.05</td>
<td>1.43 - 10.33</td>
<td>High</td>
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</tbody>
</table>

*OR: Odds Ratio; CI: Confidence Interval; As Expected: The measure for timing was not adjusted for case mix; As Expected: The measure for timing was not adjusted for case mix; As Expected: The measure for timing was not adjusted for case mix.

**Specialty: GASTRO**

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<th>Event Rate (%): Your Hospital</th>
<th>Event Rate (%): All Hospitals</th>
<th>OR*</th>
<th>95% CI</th>
<th>Outlier Status</th>
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<tbody>
<tr>
<td>Non-compliance with appropriate timing</td>
<td>66</td>
<td>3.03</td>
<td>7.71</td>
<td>0.69</td>
<td>0.20 - 2.35</td>
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<td>Non-compliance with appropriate spectrum</td>
<td>82</td>
<td>14.63</td>
<td>12.70</td>
<td>1.51</td>
<td>0.78 - 2.91</td>
<td>As Expected</td>
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<tr>
<td>Overall prophylaxis utilization</td>
<td>84</td>
<td>100.00</td>
<td>97.24</td>
<td>1.90</td>
<td>0.39 - 9.22</td>
<td>As Expected</td>
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<tr>
<td>Any postoperative prophylaxis</td>
<td>84</td>
<td>79.76</td>
<td>56.18</td>
<td>2.16</td>
<td>1.14 - 4.10</td>
<td>High</td>
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<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td>84</td>
<td>4.76</td>
<td>11.03</td>
<td>0.45</td>
<td>0.19 - 1.08</td>
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<td>Complication: UTI</td>
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<td>0.00</td>
<td>3.47</td>
<td>0.80</td>
<td>0.38 - 1.94</td>
<td>As Expected</td>
</tr>
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</table>

*OR: Odds Ratio; CI: Confidence Interval; As Expected: The measure for timing was not adjusted for case mix; As Expected: The measure for timing was not adjusted for case mix; As Expected: The measure for timing was not adjusted for case mix.

**Specialty: SENSORY**

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<th>Model:</th>
<th>Total Cases (n): Your Hospital</th>
<th>Event Rate (%): Your Hospital</th>
<th>Event Rate (%): All Hospitals</th>
<th>OR*</th>
<th>95% CI</th>
<th>Outlier Status</th>
</tr>
</thead>
<tbody>
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<td>Non-compliance with appropriate timing</td>
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</tr>
<tr>
<td>Overall prophylaxis utilization</td>
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</tr>
<tr>
<td>Any postoperative prophylaxis</td>
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</tr>
<tr>
<td>Postoperative prophylaxis &gt; 24 Hours</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Complication: All SSI</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Complication: Incisional SSI</td>
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<td></td>
</tr>
<tr>
<td>Complication: Organ space SSI</td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

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Using the case details SAP report to “drill down” on areas of practice variation

<table>
<thead>
<tr>
<th>Surgical Specialty</th>
<th>CPT</th>
<th>CPT Description</th>
<th>% Receiving No Antibiotics After Incision Closure - Your Hospital</th>
<th>% Receiving No Antibiotics After Incision Closure - All Hospitals</th>
<th>% Receiving Antibiotics Up to 24 Hours After Incision Closure - Your Hospital</th>
<th>% Receiving Antibiotics Up to 24 Hours After Incision Closure - All Hospitals</th>
<th>% Receiving Antibiotics Between 24 and 48 Hours After Incision Closure - Your Hospital</th>
<th>% Receiving Antibiotics Between 24 and 48 Hours After Incision Closure - All Hospitals</th>
<th>% Receiving Antibiotics Greater than 48 Hours After Incision Closure - Your Hospital</th>
<th>% Receiving Antibiotics Greater than 48 Hours After Incision Closure - All Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27422</td>
<td>RECONSTRUCTION OF DISLOCATING PATELLAR, WITH EXTENSIVE DEVELOPMENT, HISTOCUTANEOUS ADVANCEMENT OF MEDIAL OR LATERAL BUMPS, TRICOMPONENT TYPHOID PROCESSION</td>
<td>60.0%</td>
<td>69.6%</td>
<td>33.3%</td>
<td>26.6%</td>
<td>6.7%</td>
<td>3.4%</td>
<td>0.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27485</td>
<td>ARREST, HEMIEPIPHYSEAL, DISTAL FEMUR OR PROXIMAL TibIA OR FIBULA (EG, GENU VARUS OR VALGUS)</td>
<td>87.5%</td>
<td>87.5%</td>
<td>6.3%</td>
<td>12.3%</td>
<td>6.3%</td>
<td>0.2%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27146</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE</td>
<td>7.1%</td>
<td>14.1%</td>
<td>78.6%</td>
<td>74.7%</td>
<td>14.3%</td>
<td>8.7%</td>
<td>0.0%</td>
<td>2.5%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27147</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH FEMORAL OSTEOTOMY AND WITH OPEN REDUCTION OF HIP</td>
<td>77.8%</td>
<td>88.3%</td>
<td>11.1%</td>
<td>10.1%</td>
<td>11.1%</td>
<td>11.1%</td>
<td>14.3%</td>
<td>7.9%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27450</td>
<td>OSTEOTOMY, FEMUR, SHAFT OR SUPRACONDYLAR; WITH FIXATION</td>
<td>60.0%</td>
<td>88.2%</td>
<td>50.0%</td>
<td>50.0%</td>
<td>11.4%</td>
<td>0.0%</td>
<td>0.4%</td>
<td>0.0%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27156</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH FEMORAL OSTEOTOMY AND WITH OPEN REDUCTION OF HIP</td>
<td>0.0%</td>
<td>18.8%</td>
<td>71.4%</td>
<td>61.9%</td>
<td>14.3%</td>
<td>11.4%</td>
<td>14.3%</td>
<td>7.9%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27258</td>
<td>OPEN TREATMENT OF SPONTANEOUS HIP DISLOCATION, REPLACEMENT OF FEMORAL HEAD IN ACETABULUM (INCLUDING TENOTOMY, ETC);</td>
<td>0.0%</td>
<td>16.9%</td>
<td>100.0%</td>
<td>76.6%</td>
<td>0.0%</td>
<td>4.5%</td>
<td>0.0%</td>
<td>1.9%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27259</td>
<td>LENGTHENING OF HAMSTRING TENDON; MULTIPLE TENDONS, BILATERAL</td>
<td>50.0%</td>
<td>56.0%</td>
<td>50.0%</td>
<td>41.6%</td>
<td>0.0%</td>
<td>1.8%</td>
<td>0.0%</td>
<td>0.6%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27395</td>
<td>LENGTHENING OF HAMSTRING TENDON; MULTIPLE TENDONS, BILATERAL</td>
<td>0.0%</td>
<td>24.7%</td>
<td>75.0%</td>
<td>68.1%</td>
<td>25.0%</td>
<td>7.1%</td>
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</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27709</td>
<td>LENGTHENING OF HAMSTRING TENDON; MULTIPLE TENDONS, BILATERAL</td>
<td>0.0%</td>
<td>18.8%</td>
<td>71.4%</td>
<td>61.9%</td>
<td>14.3%</td>
<td>11.4%</td>
<td>14.3%</td>
<td>7.9%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27147</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH FEMORAL OSTEOTOMY AND WITH OPEN REDUCTION OF HIP</td>
<td>0.0%</td>
<td>16.9%</td>
<td>100.0%</td>
<td>76.6%</td>
<td>0.0%</td>
<td>4.5%</td>
<td>0.0%</td>
<td>1.9%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27156</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE</td>
<td>50.0%</td>
<td>56.0%</td>
<td>50.0%</td>
<td>41.6%</td>
<td>0.0%</td>
<td>1.8%</td>
<td>0.0%</td>
<td>0.6%</td>
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<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27151</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH FEMORAL OSTEOTOMY</td>
<td>0.0%</td>
<td>24.7%</td>
<td>75.0%</td>
<td>68.1%</td>
<td>25.0%</td>
<td>7.1%</td>
<td>0.0%</td>
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</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27147</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH FEMORAL OSTEOTOMY AND WITH OPEN REDUCTION OF HIP</td>
<td>0.0%</td>
<td>16.9%</td>
<td>100.0%</td>
<td>76.6%</td>
<td>0.0%</td>
<td>4.5%</td>
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<td>1.9%</td>
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<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27156</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE</td>
<td>50.0%</td>
<td>56.0%</td>
<td>50.0%</td>
<td>41.6%</td>
<td>0.0%</td>
<td>1.8%</td>
<td>0.0%</td>
<td>0.6%</td>
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<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27151</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH FEMORAL OSTEOTOMY</td>
<td>0.0%</td>
<td>24.7%</td>
<td>75.0%</td>
<td>68.1%</td>
<td>25.0%</td>
<td>7.1%</td>
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</table>

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<th>% Receiving Antibiotics Between 24 and 48 Hours After Incision Closure - Your Hospital</th>
<th>% Receiving Antibiotics Between 24 and 48 Hours After Incision Closure - All Hospitals</th>
<th>% Receiving Antibiotics Greater than 48 Hours After Incision Closure - Your Hospital</th>
<th>% Receiving Antibiotics Greater than 48 Hours After Incision Closure - All Hospitals</th>
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<tbody>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27422</td>
<td>RECONSTRUCTION OF DISLOCATING PHELONIA; WITH EXTENSOR MEALIGNMENT AND FASCICULUS ADVANCEMENT AND/OR INTERNAL OR EXTERNAL FIXATION (ERPT; CAMPBELL, GOLDBERG procedures)</td>
<td>60.0%</td>
<td>69.6%</td>
<td>33.3%</td>
<td>26.6%</td>
<td>6.7%</td>
<td>3.4%</td>
<td>0.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27485</td>
<td>ARREST, HEMIEPIPHYSEAL, DISTAL FEMUR OR PROXIMAL TIBIA OR FIBULA (EG, GENU VARUS OR VALGUS)</td>
<td>87.5%</td>
<td>87.5%</td>
<td>6.3%</td>
<td>12.3%</td>
<td>6.3%</td>
<td>0.2%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27146</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH FEMORAL OSTEOTOMY AND WITH OPEN REDUCTION OF HIP</td>
<td>0.0%</td>
<td>15.5%</td>
<td>78.6%</td>
<td>67.6%</td>
<td>21.4%</td>
<td>11.6%</td>
<td>0.0%</td>
<td>5.3%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27147</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH OPEN REDUCTION OF HIP</td>
<td>7.1%</td>
<td>14.1%</td>
<td>78.6%</td>
<td>74.7%</td>
<td>14.3%</td>
<td>8.7%</td>
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<td>2.5%</td>
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<tr>
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<td>50.0%</td>
<td>88.2%</td>
<td>50.0%</td>
<td>11.4%</td>
<td>0.0%</td>
<td>0.4%</td>
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<td>ORTHOPEDIC SURGERY</td>
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<td>77.8%</td>
<td>88.3%</td>
<td>11.1%</td>
<td>10.1%</td>
<td>11.1%</td>
<td>1.1%</td>
<td>0.0%</td>
<td>0.5%</td>
</tr>
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<td>ORTHOPEDIC SURGERY</td>
<td>27150</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH OPEN REDUCTION OF HIP</td>
<td>0.0%</td>
<td>18.8%</td>
<td>71.4%</td>
<td>61.9%</td>
<td>14.3%</td>
<td>11.4%</td>
<td>14.3%</td>
<td>7.9%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27151</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH OPEN REDUCTION OF HIP</td>
<td>0.0%</td>
<td>16.9%</td>
<td>100.0%</td>
<td>76.6%</td>
<td>0.0%</td>
<td>4.5%</td>
<td>0.0%</td>
<td>1.9%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27152</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH OPEN REDUCTION OF HIP</td>
<td>0.0%</td>
<td>34.0%</td>
<td>100.0%</td>
<td>58.9%</td>
<td>0.0%</td>
<td>6.4%</td>
<td>0.0%</td>
<td>0.7%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27258</td>
<td>OPEN TREATMENT OF SPONTANEOUS HIP DISLOCATION (DEVELOPMENTAL, INCLUDING CONGENITAL OR PATHOLOGICAL), REPLACEMENT OF FEMORAL HEAD IN ACETABULUM (INCLUDING TENOTOMY, ETC)</td>
<td>0.0%</td>
<td>34.0%</td>
<td>100.0%</td>
<td>58.9%</td>
<td>0.0%</td>
<td>6.4%</td>
<td>0.0%</td>
<td>0.7%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27395</td>
<td>LENGTHENING OF HAMSTRING TENDON; MULTIPLE TENDONS, BILATERAL</td>
<td>50.0%</td>
<td>62.5%</td>
<td>50.0%</td>
<td>41.6%</td>
<td>0.0%</td>
<td>1.6%</td>
<td>0.0%</td>
<td>0.6%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27709</td>
<td>OSTEOTOMY; TIBIA AND FIBULA</td>
<td>0.0%</td>
<td>24.7%</td>
<td>75.0%</td>
<td>68.1%</td>
<td>25.0%</td>
<td>7.1%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27156</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH FEMORAL OSTEOTOMY AND WITH OPEN REDUCTION OF HIP</td>
<td>0.0%</td>
<td>15.6%</td>
<td>50.0%</td>
<td>70.1%</td>
<td>50.0%</td>
<td>6.5%</td>
<td>0.0%</td>
<td>7.8%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>27157</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH FEMORAL OSTEOTOMY AND WITH OPEN REDUCTION OF HIP</td>
<td>0.0%</td>
<td>8.6%</td>
<td>50.0%</td>
<td>75.7%</td>
<td>50.0%</td>
<td>9.7%</td>
<td>0.0%</td>
<td>5.9%</td>
</tr>
</tbody>
</table>
Using the case details SAP report to “drill down” on areas of practice variation

<table>
<thead>
<tr>
<th>Surgical Specialty</th>
<th>SAP Bucket</th>
<th>CPT</th>
<th>CPT Description</th>
<th>Number of Total Cases - Your Hospital</th>
<th>Number of Total Cases - All Hospitals</th>
<th>% of Any SSIs - Your Hospital</th>
<th>% of Any SSIs - All Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>ORTHO</td>
<td>27422</td>
<td>RECONSTRUCTION OF DISLOCATING PATELLA; WITH EXTENSOR REALIGNMENT AND/OR MUSCLE ADVANCEMENT OR RELEASE (EG, CAMPBELL, GOLDWAITE TYPE PROEDURE)</td>
<td>45</td>
<td>268</td>
<td>2.2%</td>
<td>1.5%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>ORTHO</td>
<td>27485</td>
<td>ARREST, HEMIEPIPHYSEAL, DISTAL FEMUR OR PROXIMAL TIBIA OR FIBULA (EG, GENU VARUS OR VALGUS)</td>
<td>16</td>
<td>877</td>
<td>0.0%</td>
<td>1.5%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>ORTHO</td>
<td>27146</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE;</td>
<td>14</td>
<td>213</td>
<td>7.1%</td>
<td>1.4%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>ORTHO</td>
<td>27165</td>
<td>OSTEOTOMY, INTERTROCHANTERIC OR SUBTROCHANTERIC INCLUDING INTERNAL OR EXTERNAL FIXATION AND/OR CAST</td>
<td>14</td>
<td>446</td>
<td>0.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>ORTHO</td>
<td>27475</td>
<td>ARREST, EPiphyseal, ANY METHOD (EG, EPIPHYSIODESIS); DISTAL FEMUR</td>
<td>12</td>
<td>266</td>
<td>0.0%</td>
<td>0.8%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>ORTHO</td>
<td>28116</td>
<td>OSTECTOMY, EXCISION OF TARSAL COALITION</td>
<td>9</td>
<td>192</td>
<td>0.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>ORTHOPEDIC SURGERY</td>
<td>ORTHO</td>
<td>27156</td>
<td>OSTEOTOMY, ILIAC, ACETABULAR OR INNOMINATE BONE; WITH FEMORAL OSTEOTOMY AND WITH OPEN REDUCTION OF HIP</td>
<td>7</td>
<td>208</td>
<td>0.0%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>
Considerations around prioritization: Where are the opportunities and what is important?

• Which areas of prophylaxis stewardship should we tackle?
  • Not giving SAP past incision closure (or more than 24 hours)?
  • Not giving overly broad-spectrum agents?
  • Not giving when not indicated (eg, clean case without implant)?

• Broad or narrow set of procedure groups?

• Multispecialty vs. General Surgery?
Procedure-Associated SAP utilization & mean postoperative treatment duration

Bubble size = relative contribution to cumulative SAP utilization (Days of Treatment) from all procedural buckets

- Spine
- Cleft Palate
- Cleft Lip
- Urinary Reflux
- Ureteral Reconstruction
- Cleft Bone Graft
- Pectus
- Colorectal

Mean duration of postoperative SAP (days)

Postoperative SAP use (%)

0.0%  10.0%  20.0%  30.0%  40.0%  50.0%  60.0%  70.0%  80.0%  90.0%  100.0%
Variation in Hospital-level Mean Postop Duration and SSI Rates for Spine Procedures

Post-operative Mean Duration (Hours)

Any SSI Rate (%)
Variation in Hospital-level Mean Postop Duration and SSI Rates for Neurosurgery

Any SSI Rate (%) vs. Post-operative Mean Duration (Hours)

- Neurosurgery
- Aggregate Mean Duration (21.84 Hrs)
- Aggregate Any SSI (2.15%)
Variation in Hospital-level Mean Postop Duration and SSI Rates for Cleft Palate Repair

Cleft Palate

Aggregate Mean Duration (20.44 Hrs)

Aggregate Any SSI (0.08%)
Some thoughts on timeline and next steps for collaborative planning/roll-out...

- Agree on low hanging fruit....**what do we tackle?**
- Establish PSQC interest early
  - Establish stewardship teams at participating PSQC sites
  - Education and engagement around review/sharing of new data & site-specific reports (1/2021-12/2021; 152 sites); session planned at Q/S conference
- Develop dedicated PSQC SAP utilization report (? Early/mid 2023)
- Identify high performers (SAP stewards with low SSI rates)
- Deeper dive (lessons learned from PSQC projects 1&2)(mid/late 2023)
  - Qualitative interviews; identification of best practices
- Development of toolbox resources; implementation strategies (late 2023)
• First set of “official” SAP reports to be released this Summer
  • SAP/SSI data from 1/2021-12/2021; 152 sites
  • Session planned at Q/S conference to review data & new site reports
• Timeline for PSQC reports realistically early/mid 2023
• Develop dedicated PSQC SAP utilization report
• Identify high performers (SAP stewards with low SSI rates)
• Deeper dive (lessons learned from PSQC projects 1&2)
  • Qualitative interviews
  • Identification of best practices
  • Development of toolbox resources
  • Implementation strategy
Introduction to Dissemination & Implementation Science

Lillian S. Kao, MD, MS| May 11, 2022

UTHealth Houston
McGovern Medical School
Disclosures

• No relevant financial disclosures.
FIGURE 2: MSQC Learning Health System Model
In a learning health care system, research influences practice and practice influences research.

LHS

EVALUATE

IMPLEMENT

DESIGN

INTERNAL AND EXTERNAL SCAN

DISSEMINATE

ADJUST
Research to Practice

Pre-Intervention

Efficacy & Effectiveness Trials

Dissemination & Implementation

17 years (14% of research)
Dissemination

Targeted distribution of information and intervention materials to a specific public health or clinical practice audience

Please wash your hands
The use of strategies to adopt and integrate evidence-based health interventions and change practice patterns within specific settings
QI or Implementation?

Quality Improvement Operations

Quality Improvement Science

Implementation Science

Lane-Fall MB and Fleisher LA. Anesthesiology Clin, 2018.
<table>
<thead>
<tr>
<th>QI Operations</th>
<th>QI Science</th>
<th>Implementation Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term focus (initial)</td>
<td>Medium to long-term focus (initial)</td>
<td></td>
</tr>
<tr>
<td>Local practice applicability</td>
<td>Applicability to multiple practices</td>
<td></td>
</tr>
<tr>
<td>Theoretical models <em>not</em> very important</td>
<td>Theoretical models extremely important</td>
<td></td>
</tr>
<tr>
<td>Effectiveness outcomes</td>
<td>Implementation outcomes</td>
<td></td>
</tr>
</tbody>
</table>
D&I Science

Models, Frameworks, & Theories

Understand and/or explain influencing factors

Describe and/or guide processes

Evaluate processes

Diffusion of Innovations

- Innovators: 2.5%
- Early Adopters: 13.5%
- Early Majority: 34%
- Late Majority: 34%
- Laggards: 16%

Market share %

0 25 50 75 100
Promoting Action on Research Implementation in Health Services

Evidence (Strong)

- Meta-analyses of RCTs
- Randomized controlled trials
- Cohort studies
- Case-control studies
- Case series/case reports/expert opinion

Evidence (Weak)

Evidence is strong, context is strong.

Evidence is weak, context is strong.

Evidence is strong, context is weak.

Evidence is weak, context is weak.

- **Consolidated**
- **Framework for**
- **Implementation in**
- **Research**

https://cfirguide.org/
Constructs

Intervention — Mediator — Outcome

Process (i.e., execution as intended)

Moderators

Intervention Characteristics (i.e., complexity)
Inner Setting (i.e., culture, leadership engagement, available resources)
Characteristics of Individuals (i.e., self-efficacy)

http://cfirguide.org/constructs.html
Domains:
- Innovation characteristics
- Outer setting
- Inner setting

Characteristics of individuals:
- Knowledge and beliefs
  - Self-efficacy
- Stage of change
- Identification with organization
- Other

Implementation Strategy:
- Conduct ongoing training
- Model and simulate change

Self-efficacy techniques:
- Conduct ongoing training
- Provide ongoing consultation
- Make training dynamic
- Model and simulate change
<table>
<thead>
<tr>
<th>Domain</th>
<th>Barrier/Facilitator (Construct)</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics of individuals</td>
<td>Knowledge and beliefs about the intervention (B)</td>
<td>Develop educational materials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identify and prepare champions</td>
</tr>
<tr>
<td></td>
<td>Self-efficacy (B)</td>
<td>Model and simulate change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conduct ongoing training</td>
</tr>
<tr>
<td>Intervention characteristics</td>
<td>Evidence strength and quality (F)</td>
<td>Conduct educational meetings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conduct local consensus discussions</td>
</tr>
<tr>
<td></td>
<td>Trialability (F)</td>
<td>Stage implementation scale-up</td>
</tr>
<tr>
<td>Inner setting</td>
<td>Leadership engagement (B)</td>
<td>Involve executive boards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Obtain formal commitments</td>
</tr>
</tbody>
</table>

https://cfirguide.org/choosing-strategies/
<table>
<thead>
<tr>
<th>Implementation Strategy</th>
<th>Importance</th>
<th>Feasibility</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use evaluative and iterative strategies</td>
<td>★★★★★</td>
<td>★★★★★</td>
<td>Audit and provide feedback</td>
</tr>
<tr>
<td>Provide interactive assistance</td>
<td>★★★★</td>
<td>★★★</td>
<td>Provide clinical supervision</td>
</tr>
<tr>
<td>Adapt and tailor to context</td>
<td>★★★★</td>
<td>★★★★</td>
<td>Tailor strategies</td>
</tr>
<tr>
<td>Develop stakeholder interrelationships</td>
<td>★★★★</td>
<td>★★★★</td>
<td>Identify and prepare champions</td>
</tr>
<tr>
<td>Train and educate stakeholders</td>
<td>★★★★★</td>
<td>★★★★★</td>
<td>Develop educational materials</td>
</tr>
<tr>
<td>Support clinicians</td>
<td>★★★★</td>
<td>★★★</td>
<td>Remind clinicians</td>
</tr>
<tr>
<td>Engage consumers</td>
<td>★★★★★</td>
<td>★★★</td>
<td>Involve patients and family members</td>
</tr>
<tr>
<td>Utilize financial strategies</td>
<td>★★★★★</td>
<td>★★</td>
<td>Develop disincentives</td>
</tr>
<tr>
<td>Change infrastructure</td>
<td>★★</td>
<td>★★</td>
<td>Create/change credentialing standards</td>
</tr>
</tbody>
</table>

RE-AIM

- **Reach**: How do I reach the targeted population with the intervention?
- **Effectiveness**: How do I know my intervention is effective?
- **Implementation**: How do I ensure the intervention is delivered properly?
- **Adoption**: How do I develop organizational support to deliver my intervention?
- **Maintenance**: How do I incorporate the intervention so it is delivered over the long term?

[https://www.re-aim.org/about/what-is-re-aim/](https://www.re-aim.org/about/what-is-re-aim/)
RE-AIM

Reach
The absolute number, proportion and representativeness of participating individuals

Effectiveness
The impact on important outcomes

Maintenance
Institutionalization (setting)
Long-term effects (individual)

Implementation
Fidelity (setting)
Compliance (individual)

Adoption
The absolute number, proportion and representativeness of settings and agents

https://www.re-aim.org/about/what-is-re-aim/
Models, frameworks, and theories can be used to identify barriers and facilitators to dissemination and implementation.

Context and fit of an intervention to a context impact implementation success.

Strategies for dissemination and implementation should leverage facilitators and address barriers within that context.

Implementation outcomes should be measured in addition to effectiveness.
Applying Implementation Science to Pediatric Surgical Quality Improvement: Enhanced Recovery After Surgery

Mehul V. Raval, MD, MS
Associate Professor of Surgery and Pediatrics
Vice Chair of Quality and Safety
Disclosures/Acknowledgements

Disclosures:
- Abbot Nutrition - Consultant
- Finley Law - Consultant

Research Funding Acknowledgements:
- Pediatric Surgical Research Collaborative (PedSRC)
- Crohn’s and Colitis Foundation (CCF): Litwin Pioneers Award
- NIH — This research is supported by the Eunice Kennedy Shriver National Institute Of Child Health & Human Development of the National Institutes of Health under Award Number R01HD099344. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.
Agenda

- Need for studies that focus on both outcomes & implementation
- Evolution of the ENRICH-US Trial
- Practical application of some of the concepts
Why is the ENRICH-US study needed?

- Strong evidence that interventions take 20 years to get from bench to bedside
- Many effective surgical interventions from clinical trials and health services research ultimately fail to be translated into clinical practice
Why is the ENRICH-US study needed?

- In the US, less than half of children currently receive recommended evidence-based pediatric care
- “If we want more evidence-based practice, we need more practice-based evidence.”
  - LW Green (Am J Pub Health 2006)
My experience

- NSQIP-Pediatric
- QI projects
- PDSA

- Challenges
  - Culture
  - Leadership
  - Resources
Past Failures....

- Implementation Science is the study and application of methods to integrate evidence-based research into practice.

Prior work:

Provider interviews and Patient/family focus groups

Surgical effectiveness studies
Step 1: select intervention

Step 2: assess context for intervention
Affected individuals

Step 3: implementation process
Adapt surgical intervention
Execute surgical intervention
Refine implementation strategy
Reflect and evaluate

Assess surgical outcomes

This step-by-step model is adapted from the Consolidated Framework for Implementation Research and describes key domains that are part of the preimplementation and implementation processes.
Implementation Science and Quality Improvement

- **QI emerged from industry**
  - Systems-level work to improve the quality and safety of care
  - Performance is measured to assess improvements (process measure, compliance, order set use, etc)

- **Implementation evolved from behavioral science**
  - Uses theory-based models to promote the systematic uptake of evidence-based interventions into practice
  - Focuses on the scientific study of timely uptake (acceptability, feasibility, sustainability, etc)
Innovative Study Designs

LOS

Adoption
Feasibility
Sustainability

Efficacy Studies → Effectiveness Studies → Implementation Research → Improved processes, outcomes

Hybrid Designs

Hybrid Type 1
Primary: Effectiveness
Secondary: Implementation

Hybrid Type 2
Equal focus on effectiveness and implementation

Hybrid Type 3
Primary: Implementation
Secondary: Effectiveness

ENRICH-US
5 Active Implementation Frameworks (AIFs)

- 3 factors for successful outcomes
- Effective Practices
- Effective Implementation
- Enabling context
- Significant Outcomes

5 Active Implementation Frameworks
5 Active Implementation Frameworks (AIFs)

3 factors for successful outcomes

Effective Practices

Usable Innovations

Effective Implementation

Stages

Drivers

Enabling context

Teams

Improvement Cycles

= Significant Outcomes

5 Active Implementation Frameworks
Framework should:

- Optimize initial success
- Mitigate obstacles
- Foster collaboration for group learning
- Provide structure
- Ensure scheduled data feedback

5 AIFs

AIF Descriptions

Well-operationalized innovations that are teachable, learnable, doable, and readily assessed in practice.

ENRICH-US Plan

- Evidence-based ERPs with validation by expert panels
- High readiness for adoption
- Supportive pilot data
- Implementation tools ready
What is Enhanced Recovery???

- 1999 Henrick Kehlet et al. published
  - 2-day stay after sigmoid colon resection
- 20 years later we are still trying to implement and emulate
Evidence Supporting Enhanced Recovery

- 13 Randomized Controlled Trials
  - Hundreds of publications

- ERAS®Society
  - www.erassociety.org

- ERAS results in
  - 2-3 day reduction in the length of stay
  - Decreased rate of complications by 20-30%
  - No increase in readmission
Enhanced Recovery in Children

Research review

Enhancing recovery in pediatric surgery: a review of the literature

Julia K. Shinnick, BA, Heather L. Short, MD, Kurt F. Heiss, MD, Matthew T. Santore, MD, Martin L. Blakely, MD, MSCR, and Mehul V. Raval, MD, MS
Table 4. Elements of ERAS guidelines implemented by studies addressing general pediatric surgery included in this review.

<table>
<thead>
<tr>
<th>Author and Year</th>
<th>Preoperative Counseling</th>
<th>Standardized Anesthetic Protocol</th>
<th>Antimicrobial Prophylaxis and Skin Preparation</th>
<th>Modifications of Surgical Access</th>
<th>Nonroutine Nasogastric Intubation</th>
<th>Minimized Perioperative Fasting</th>
<th>Early Mobilization</th>
<th>Selective or No Preoperative Bowel Prep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reismann, et al. 2007</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Mattioli, et al. 2009</td>
<td>+</td>
<td>*</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Schukfeh, et al. 2014</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Vrecenak and Mattel, 2014</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

* Use of blended and locoregional anesthesia systematically; + Present; – Not Present; blank = No data provided.

None of the studies discussed inclusion of the following ERAS Society recommendations for perioperative care in elective colonic surgery: preoperative optimization, preoperative fasting limited to clear fluids up to 2 h before the procedure and solid foods 6 h before the procedure, carbohydrate treatment, no preoperative bowel prep, thromboembolism prophylaxis, a multimodal approach to postoperative nausea and vomiting for those at risk, intraoperative normothermia, maintenance of normovolemia, nonroutine drainage of peritoneal cavity after colonic anastomosis, routine transurethral bladder drainage, efforts to prevent postoperative ileus, or postoperative glucose control.
Mean Length of Hospital Stay

- Reissmann, et al. 2007
  - CONTROL Fundoplication
  - CONTROL Bowel Anastomosis
  - CONTROL Pyeloplasty
  - CONTROL Nephrectomy
  - CONTROL Hypospadias
  - CONTROL Appendectomy
  - CONTROL Composite

  - CONTROL Composite

  - CONTROL Composite

- Schuitkph, et al. 2014
  - CONTROL Fundoplication
  - CONTROL Pyloromyotomy
  - CONTROL Hypospadias
  - CONTROL Appendectomy
  - CONTROL Composite

- Vrecnak and Mattel. 2014
  - CONTROL Composite

* No data provided; * Significant (P<0.05)
Enhanced Recovery in Children
Enhanced Recovery in Children

- Other examples:
  - Pediatric/thoracic
  - Bariatric
  - Pectus
  - Same day discharge:
    - Cholecystectomy
    - Appendectomy
  - Ortho/Neuro
    - Spine
  - Urology
    - Hypospadias surgery
    - Complex reconstructions
  - Plastics/ENT/OMFS
    - Cleft repairs
  - Etc.
A survey of pediatric surgeons' practices with enhanced recovery after children's surgery

Heather L. Short a, Natalie Taylor b, Mitali Thakore b, Kaitlin Piper b, Katherine Baxter a, Kurt F. Heiss a, Mehul V. Raval a,*

a Division of Pediatric Surgery, Department of Surgery, Emory University School of Medicine, Children's Healthcare of Atlanta, Atlanta, GA, USA
b Rollins School of Public Health, Emory University, Atlanta, GA, USA
Survey Results

- APSA members (N=1,052): 257 surveys (24%)

<table>
<thead>
<tr>
<th>Implementation Preparedness</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Willing</td>
<td>6 (2.4%)</td>
</tr>
<tr>
<td>Willing, But Not Prepared</td>
<td>16 (6.3%)</td>
</tr>
<tr>
<td>Willing, Somewhat Prepared</td>
<td>89 (34.9%)</td>
</tr>
<tr>
<td>Willing, Extremely Prepared</td>
<td>95 (37.3%)</td>
</tr>
<tr>
<td>Already Implementing</td>
<td>49 (19.3%)</td>
</tr>
</tbody>
</table>

- ~14 of 21 adult ERP elements were uniformly acceptable to pediatric surgeons
Survey Results

<table>
<thead>
<tr>
<th>Theme</th>
<th>Related Comments</th>
</tr>
</thead>
</table>
| Skepticism of ERAS Framework         | “The ERP guideline should already be in effect as they are commonly studied guidelines that have shown benefit.”  
                                      | “We already do all of the components that the survey covers, we just do not call it ‘enhanced recovery’.  
                                      | “I am unfamiliar with formal ‘enhanced recovery protocols’, but it appears that my partners and I are already implementing most of the suggestions on an informal basis.” |
| Current ERAS Implementation           |                                                                                                                                                                                                             |
| Hospital-level Acceptance/Feasibility | “Biggest limitation — a third of our faculty [is] not on board [or is] resistant to protocols/standardization. Some of us are already implementing aspects of this care, but not uniform for the group.”  
                                      | “If advantage can be shown, [the] only problem is overcoming inertia.”                                                                                                                                         |
| Opposition to Protocolized Care       | “I would say the major barrier to implementation would not be institutional, but would be convincing surgeons like myself that a checklist applied to every patient is better than individualized care.” |
| Need for Evidence                     | “We need pediatric specific data... kids are not little adults, and there is too little outcome data to reach a consensus regarding best practice. The idea is intuitively appealing and many aspects are approaching standard of care in our hospital. The impact of age, weight, BMI, and disease process etc., may all impact optimal practice... these should be published.” |

“I would say the major barrier to implementation would not be institutional, but would be convincing surgeons like myself that a checklist applied to every patient is better than individualized care.”
Appropriateness of a pediatric-specific enhanced recovery protocol using a modified Delphi process and multidisciplinary expert panel

Heather L. Short, Natalie Taylor, Kaitlin Piper, Mehul V. Raval

Division of Pediatric Surgery, Department of Surgery, Emory University School of Medicine, Children’s Healthcare of Atlanta, Atlanta, GA, USA
Rollins School of Public Health, Emory University, Atlanta, GA, USA
Expert Panel

**Modified Delphi Process (RAND/UCLA Methodology)**
- Pre-rating
- Literature compendium
- In-person expert panel session
- Post-rating

**Participants**
- 8 pediatric surgeons
- 2 pediatric anesthesiologist
- 1 pediatric anesthesia pain expert
- 2 pediatric gastroenterologist
- 1 nurse practitioner
- 2 patient representatives

**Focused on the 7 Most Contentious Elements from the National Survey**
- Mechanical bowel prep
- Perioperative fasting
- VTE prophylaxis
- Standardized anesthetic protocols
- NGT use
- Goal directed fluids
- Hyperglycemia management
Pre-Meeting Survey
Post-Meeting Survey

Avoidance of Mechanical Bowel Preparation
Avoidance of Prolonged Perioperative Fasting
Use of Venous Thromboembolism Prophylaxis

Use of Standardized Anesthetic Protocol
Avoidance of Routine Nasogastric Tube Insertion
Use of Goal-Directed Fluid Therapy
Use of Insulin to Control Severe Hyperglycemia
## Recommended ERP for Children

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<td>Standard anesthetic protocol</td>
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<td>No intraperitoneal perianastomotic drains</td>
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<td>No intraperitoneal perianastomotic drains</td>
<td>Goal-directed/near-zero fluid therapy</td>
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<td>Goal-directed/near-zero fluid therapy</td>
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<td>Early removal of urinary catheters</td>
<td>Goal-directed/near-zero fluid therapy</td>
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<td>Prevention of postoperative ileus</td>
<td>Prevention of postoperative ileus</td>
<td>Opioid-sparing pain regimen</td>
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<td>Early mobilization</td>
<td>Audit protocol compliance and outcomes</td>
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<td>Audit protocol compliance and outcomes</td>
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Implementation of an enhanced recovery protocol in pediatric colorectal surgery

Heather L. Short, Kurt F. Heiss, Katelyn Burch, Curtis Travers, John Edney, Claudia Venable, Mehul V. Raval

Division of Pediatric Surgery, Department of Surgery, Emory University School of Medicine, Children’s Healthcare of Atlanta, Atlanta, GA, USA
Division of Pediatrics, Emory University School of Medicine, Atlanta, GA, USA
Division of Pediatric Anesthesiology, Department of Anesthesiology, Emory University School of Medicine, Children’s Healthcare of Atlanta, Atlanta, GA, USA
Pilot Study Results

- In the U.S. 70-100K children currently live with IBD
- ~15% undergo surgery within 5 years of diagnosis
Fig. 1. Median length of stay (LOS) and number of ERAS elements received per patient by study year.
Fig 2. Secondary outcomes and median length of stay (LOS) by year.
CONCLUSIONS:

- ERP in children undergoing GI surgery is feasible and safe.
- Expect shorter LOS & less opioid utilization with no increases in complications/readmissions.
Context

**Provider interviews & Patient/family focus groups**

- Surgical effectiveness studies
- Step 1: select intervention
- Step 2: assess context for intervention
- Affected individuals

**Step 3: implementation process**
- Adapt surgical intervention
- Execute surgical intervention
- Refine implementation strategy
- Reflect and evaluate

**Assess surgical outcomes**

This step-by-step model is adapted from the Consolidated Framework for Implementation Research and describes key domains that are part of the preimplementation and implementation processes.

*JAMA Surgery* October 2015 Volume 150, Number 10

jamasurgery.com
A baseline assessment of enhanced recovery protocol implementation at pediatric surgery practices performing inflammatory bowel disease operations☆☆☆☆☆

Jonathan Vacek a,*, Teaniese Davis b, Benjamin T. Many a, Sharron Close c, Sarah Blake d, Yue-Yung Hu a,e,f, Jane L. Holl e, Julie Johnson e,l, Jennifer Stroppe g, Mehul V. Raval a,e,l

a Division of Pediatric Surgery, Department of Surgery, Northwestern University Feinberg School of Medicine, Ann & Robert H. Lurie Children’s Hospital of Chicago, Chicago, IL
b Center for Research and Evaluation, Kaiser Permanente, Georgia
c Department of Pediatric Advanced Practice Nursing, Nell Hodgson Woodruff School of Nursing, Emory University, Atlanta, GA
d Department of Health Policy and Management, Rollins School of Public Health, Emory University, Atlanta, GA
e Surgical Outcomes and Quality Improvement Center, Northwestern University Feinberg School of Medicine, Chicago, IL
f Center for Healthcare Studies, Institute of Public Health and Medicine, Northwestern University Feinberg School of Medicine, Chicago, IL
g Division of Gastroenterology, Department of Pediatrics, Northwestern University Feinberg School of Medicine, Ann & Robert H. Lurie Children’s Hospital of Chicago, Chicago, IL
A baseline assessment of pediatric surgery practice

Results: The assessment revealed an average of 6.3 ERP elements being practiced at each site. The most commonly practiced elements were using minimally invasive techniques (100%), avoiding intraabdominal drains (89%), and ileus prophylaxis (72%). The preoperative phase had the most elements with no adherence including patient education, optimizing medical comorbidities, and avoiding prolonged fasting. There was no association with number of elements utilized and total number of surgeons in the department, annual IBD surgery volume, and hospital size. Lack of buy-in from colleagues, electronic medical record adaptation, and resources for data collection and analysis were identified barriers.

Figure 1. Visual representation of ERP Readiness Survey results. Outer ring: domains of ERP implementation. Middle ring: variable implementation of ERP components (seen in burnt red, yellow, and green). Innermost ring: representing barriers.
Age- and Sex-Specific Needs for Children Undergoing Inflammatory Bowel Disease Surgery: A Qualitative Study

Salva N. Balbale, PhD, a,b,e Willemijn L.A. Schäfer, PhD, c
Teaniese "Tina" Davis, PhD, MPH, d Sarah C. Blake, PhD, MA, e
Sharron Close, PhD, MS, f Joseph E. Perry, BS, g Raul Perez Zarate, BS, g
Martha-Conley Ingram, MD, MPH, b,c,g Jennifer Strople, MD, h
Julie K. Johnson, PhD, MSPH, b,c Jane L. Holl, MD, MPH, i
and Mehul V. Raval, MD, MS b,c,g
**Context**

| Reported by individual stakeholder groups: clinicians | Patient preoperative counseling and education should be tailored for preadolescent versus older children | You are trying to explain to a 10-year-old why they’re going to have this ostomy. That’s a completely different conversation than explaining that to an 18-year-old. The level of education, the level of understanding, the way they may or may not feel about it, their previous biases, etc., are going to be completely different, right? So I think that those are two different... There’s different ways in order to help the patient come along with you in the goal to optimize their recovery. Different resources for different families and different levels of understanding of what we’re trying to achieve. [Surgeon] |

---

**Undergoing Inflammatory Bowel Disease Surgery: A Qualitative Study**

| Reported by individual stakeholder groups: patients | Patient concerns about postoperative pain | My only fear was the pain afterward. I will say that when I got my ileostomy, the only pain that I had afterward was muscular. I felt like I had done like two million sit ups, but my colostomy surgery was extremely painful. It was in a lot of pain. I was very out of it. [Patient] |

*Julie K. Johnson, PhD, MSPH, Jane L. Holl, MD, MPH, and Mehul V. Raval, MD, MS*
Implementation Teams

Tools

3. You will be prescribed two oral antibiotics, Neomycin and Flagyl. Please take them from three hours before you scheduled surgery until the evening of the day before surgery. These help in fight the risk of infection during surgery.
4. You've been prescribed a pain medication called Noroxin to take the morning of surgery before you leave your room. You should take the pill when you drink your preoperative drink as described above. This will help control pain after the operation.
5. You will have a shower prep if your surgery is going to be done in your room before surgery. If so, you will be instructed ahead of time.
https://enrich-us.org
5 AIFs

AIF Descriptions

Well-operationalized innovations that are teachable, learnable, doable, and readily assessed in practice.

Supportive teams to define infrastructures and support methods and improve outcomes.

ENRICH-US Plan

- Evidence-based ERPs with validation by expert panels
- High readiness for adoption
- Supportive pilot data
- Implementation tools ready

- Local team: surgical champion, QI expert, coordinator, PALs, etc.
- PedSRC learning collaboratives (6 sites/LC)
Implementation Teams

- Implementation Team

Implementation Team

- Surgeon Champion
- Anesthesia Champion
- Patient Advocate Liaison (PAL)
- QI Leader
- Project Coordinator
- Data Abstractor

- Executive Sponsors
- Study Coordinator
- Anesthesia Champion
- Nurse Champions
- Child Life Specialist
- Hospital Level QI Leader
- Patient Advocate Liaison

Local Implementation Team Meetings
- 1-2x per Month
- Local implementation of ENRICH-US to resolve obstacles
- Discuss local context & adaptation
- Develop workflow & delineate tasks
- Review local data and lessons learned
- Discuss past and upcoming patients

Cluster Learning Collaborative Meetings
- 1x per Month (12 months)
- Promote shared experiences and learning
- Hear from national experts on enhanced recovery
- Review and discuss data to identify obstacles, drivers of implementation
- Discuss optimal strategies of implementation
<table>
<thead>
<tr>
<th>AIF Descriptions</th>
<th>ENRICH-US Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-operationalized innovations that are teachable, learnable, doable, and readily assessed in practice.</td>
<td>• Evidence-based ERPs with validation by expert panels</td>
</tr>
<tr>
<td>Supportive teams to define infrastructures and support methods and improve outcomes.</td>
<td>• High readiness for adoption</td>
</tr>
<tr>
<td>Drivers of success including development of competencies, obtaining organization supports, and engaging leadership.</td>
<td>• Supportive pilot data</td>
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<td>• Implementation tools ready</td>
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<td>• PedSRC learning collaboratives (6 sites/LC)</td>
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<td></td>
<td>• Monthly training curriculum</td>
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<td>• Coaching by topic experts</td>
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<td>• Fidelity assessment</td>
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<td>• System-level interventions</td>
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<td>• Facilitative leadership</td>
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</table>
What is a Learning Collaborative?

- **Teams** coming together to **learn, share, and apply quality improvement and implementation methods**

IHI Learning Collaborative Model

PRE WORK

LC SESSION 1

ACTION PERIOD

LC SESSION 2

ACTION PERIOD

LC SESSION 3

PLAN

DO

STUDY

ACT
Learning Collaborative Agenda

- **Scheduled monthly video-conference (1-hour) for the next 12 months**

- **Encourage ALL members of your IMPLEMENTATION TEAM to take part** (recording will be posted on Cluster 2 webpage)

### LC SESSIONS 12-MONTH SCHEDULE

<table>
<thead>
<tr>
<th>LC Session</th>
<th>Topic</th>
<th>Examples of topics to be discussed during the LC</th>
<th>Your tasks and Milestones (M&amp;S)</th>
<th>Homework for the next LC Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC 1</td>
<td>Cluster 2: Thurs Oct 28, 2021 Cluster 3: Apr 2022</td>
<td>Introduction to ENRICH-US, S APPs, LCS</td>
<td>How did your team identify and engage a patient representative? Did you use the recruitment flyer provided by the ENRICH-US coordinating team? What tasks and responsibilities do you anticipate the PALS to have once recruited?</td>
<td>Review collaboration portal at <a href="https://www.enrich-us.org/AccountLogin">https://www.enrich-us.org/AccountLogin</a></td>
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</tbody>
</table>

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<thead>
<tr>
<th>M&amp;S 1: Assemble your IMPLEMENTATION TEAM</th>
<th>M&amp;S 2: Schedule your monthly/bi-monthly IMPLEMENTATION TEAM meetings</th>
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<tr>
<td>LC 2</td>
<td>Nov 7, 2021</td>
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<tr>
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<td>3: May 2022</td>
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<td>LC 3</td>
<td>Dec 16, 2021</td>
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<td></td>
<td>3: June 2022</td>
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<tr>
<td>LC 4</td>
<td>Jan 27, 2022</td>
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<tr>
<td></td>
<td>3: July 2022</td>
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</table>
Framework should:

- Optimize initial success
- Mitigate obstacles
- Foster collaboration for group learning
- Provide structure
- Ensure scheduled data feedback

### AIF Descriptions

- **Usable Innovations**
  Well-operationalized innovations that are teachable, learnable, doable, and readily assessed in practice.

- **Teams**
  Supportive teams to define infrastructures and support methods and improve outcomes.

- **Drivers**
  Drivers of success including development of competencies, obtaining organization supports, and engaging leadership.

- **Stages**
  Integrated, non-linear process starting with exploration and ending with full implementation of an innovation into practice.

### ENRICH-US Plan

- Evidence-based ERPs with validation by expert panels
- High readiness for adoption
- Supportive pilot data
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- Local team: surgical champion, QI expert, coordinator, PALs, etc.
- PedSRC learning collaboratives (6 sites/LC)

- Monthly training curriculum
- Coaching by topic experts
- Fidelity assessment
- System-level interventions
- Facilitative leadership

- Exploration completed
- Installation/initial implementation phase
- Full implementation and sustainability assessment
Study Approaches

- Creation of 3 Learning Collaboratives
- Stepped-wedge design
Framework should:

- Optimize initial success
- Mitigate obstacles
- Foster collaboration for group learning
- Provide structure
- Ensure scheduled data feedback

**AIF Descriptions**

- Well-operationalized innovations that are teachable, learnable, doable, and readily assessed in practice.
- Supportive teams to define infrastructures and support methods and improve outcomes.
- Drivers of success including development of competencies, obtaining organization supports, and engaging leadership.
- Integrated, non-linear process starting with exploration and ending with full implementation of an innovation into practice.
- Based on Plan, Do, Study, Act (PDSA) process with rapid cycle feedback for continuous QI and learning

**ENRICH-US Plan**

- Evidence-based ERPs with validation by expert panels
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- Coaching by topic experts
- Fidelity assessment
- System-level interventions
- Facilitative leadership
- Exploration completed
- Installation/initial implementation phase
- Full implementation and sustainability assessment
- Quarterly data-driven feedback sessions to learning collaboratives
- QI expert on each team
**Average ERP Completion – Cluster 1**

- Intracranial Infection: 17.0%
- Fluid Management: 34.0%
- Avoid Prolonged Fasting: 45.6%
- Minimally Invasive Procedure: 51.1%
- Early Oral Nutrition: 51.1%
- Urinary Drain Avoidance: 55.3%
- Hypothermia Prevention: 60.0%
- Gut Stimulation: 68.1%
- Preadmission Education: 72.3%
- Optimize Medical Comorbidities: 74.5%
- Non-Opioid Analgesia: 74.5%
- Intra-abdominal Drain Avoidance: 80.9%
- NG Tube Avoidance: 60.9%
- Antibiotic Prophylaxis: 60.9%
- VTE Prophylaxis: 82.0%
- Early Mobilization: 83.0%
- Post-Op Non-Opioids: 83.0%

---

**ERP Completion**

- Your cluster is **EXCELLENT** at 4 ENRICH-US elements.
- Your cluster is **VERY GOOD** at 9 ENRICH-US elements.
- Your cluster **NEEDS IMPROVEMENT** for 3 ENRICH-US elements.
- Your cluster **NEEDS SIGNIFICANT IMPROVEMENT** for 1 ENRICH-US element.

*Please note that patients who have been enrolled but have not yet undergone surgery are included in this analysis, which may affect percentages.*
Average ERP Completion Rate for Cluster 1

- The average ERP completion for Cluster 1 is 62%. This means that the average patient in Cluster 1 will receive 62% of the ENRICH-US protocol elements currently.

- ERP completion rate is calculated by taking the sum of:
  
  \[
  \frac{\text{[# of completed ERP elements]}}{\text{[total # of ERP elements]}}
  \]
  
  and dividing by the total number of enrolled patients.

*Please note that patients who have been enrolled but have not yet undergone surgery are included in this analysis, which may affect percentages.
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<td>Avoid Prolonged Fasting</td>
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<td>0%</td>
<td>33%</td>
<td>82%</td>
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<td>33%</td>
<td>78%</td>
<td>100%</td>
<td>100%</td>
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<td>50%</td>
<td>67%</td>
<td>22%</td>
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<td>91%</td>
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<td>100%</td>
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<td>100%</td>
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<td>67%</td>
<td>45%</td>
<td>100%</td>
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<tr>
<td>NG Tube Avoidance</td>
<td>64%</td>
<td>50%</td>
<td>67%</td>
<td>78%</td>
<td>100%</td>
<td>100%</td>
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<tr>
<td>Urinary Drain Avoidance</td>
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<td>33%</td>
<td>50%</td>
<td>56%</td>
<td>73%</td>
<td>0%</td>
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<tr>
<td>VTE Prophylaxis</td>
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<td>33%</td>
<td>83%</td>
<td>78%</td>
<td>100%</td>
<td>100%</td>
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<td><strong>Intraoperative Elements</strong></td>
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<td>Early Mobilization</td>
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<td>83%</td>
<td>100%</td>
<td>100%</td>
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<td>67%</td>
<td>11%</td>
<td>100%</td>
<td>0%</td>
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<td>Gut Stimulation</td>
<td>86%</td>
<td>33%</td>
<td>83%</td>
<td>44%</td>
<td>82%</td>
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<td>50%</td>
<td>83%</td>
<td>89%</td>
<td>100%</td>
<td>100%</td>
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</table>

**Postoperative Elements**
IMPLEMENTATION Report Card by Site

- Data-driven approach
- Quarterly progress report by site about implementation progress
Framework should:

- Optimize initial success
- Mitigate obstacles
- Foster collaboration for group learning
- Provide structure
- Ensure scheduled data feedback

### AIF Descriptions

- **Usable Innovations**
  - Well-operationalized innovations that are teachable, learnable, doable, and readily assessed in practice.

- **Teams**
  - Supportive teams to define infrastructures and support methods and improve outcomes.

- **Drivers**
  - Drivers of success including development of competencies, obtaining organization supports, and engaging leadership.

- **Stages**
  - Integrated, non-linear process starting with exploration and ending with full implementation of an innovation into practice.

- **Improvement Cycles**
  - Based on Plan, Do, Study, Act (PDSA) process with rapid cycle feedback for continuous QI and learning

### ENRICH-US Plan

- **Evidence-based ERPs with validation by expert panels**
- **High readiness for adoption**
- **Supportive pilot data**
- **Implementation tools ready**

- **Local team:** surgical champion, QI expert, coordinator, PALs, etc.
- **PedSRC learning collaboratives** (6 sites/LC)

- **Monthly training curriculum**
- **Coaching by topic experts**
- **Fidelity assessment**
- **System-level interventions**
- **Facilitative leadership**

- **Exploration completed**
- **Installation/initial implementation phase**
- **Full implementation and sustainability assessment**

- **Quarterly data-driven feedback sessions to learning collaboratives**
- **QI expert on each team**
Framework should:

- Optimize initial success
- Mitigate obstacles
- Foster collaboration for group learning
- Provide structure
- Ensure scheduled data feedback

**AIF Descriptions**

- Well-operationalized innovations that are teachable, learnable, doable, and readily assessed in practice.
- Supportive teams to define infrastructures and support methods and improve outcomes.
- Drivers of success including development of competencies, obtaining organization supports, and engaging leadership.
- Integrated, non-linear process starting with exploration and ending with full implementation of an innovation into practice.

Based on Plan, Do, Study, Act (PDSA) process with rapid cycle feedback for continuous QI and learning.

**ENRICH-US Plan**

- Evidence-based ERPs with validation by expert panels
- High readiness for adoption
- Supportive pilot data
- Implementation tools ready
- Local team: surgical champion, QI expert, coordinator, PALs, etc.
- PedSRC learning collaboratives (6 sites/LC)
- Monthly training curriculum
- Coaching by topic experts
- Fidelity assessment
- System-level interventions
- Facilitative leadership
- Exploration completed
- Installation/initial implementation phase
- Full implementation and sustainability assessment
- Quarterly data-driven feedback sessions to learning collaboratives
- QI expert on each team
Journey

- Literature Review (Lit Rev)
- Survey
- Expert Panel
- Pilot Study
- Pre-imp work

R01 Multicenter Study

Appropriateness of a pediatric-specific enhanced recovery protocol using a modified Delphi process and multidisciplinary expert panel

A survey of pediatric surgeons' practices with enhanced recovery after children's surgery

Research review

Enhancing recovery in pediatric surgery: a review of the literature
Sites and Site PIs

1. Seattle Children’s Hospital
   PI: Adam Goldin

2. Doernbecher Children’s Hospital
   PI: Mubeen Jafri

3. Children’s Hospital of Los Angeles
   PI: Chris Gayer

4. Primary Children’s Hospital
   PI: Scott Short

5. Dallas Children’s Hospital
   PI: Samir Pandya

6. Children’s Memorial Hermann Hospital
   PI: Matthew Harting

7. Texas Children’s Hospital
   PI: Sohail Shah

8. LeBonheur Children’s Hospital
   PI: Ash Gosain

9. Ann and Robert H. Lurie Children’s Hospital
   PI: Seth Goldstein

10. Riley Children’s Hospital
    PI: Brian Gray

11. Shands Children’s Hospital
    PI: Saleem Islam

12. MUSC Children’s Hospital
    PI: Rob Cina

13. Duke University
    PI: Liz Tracy

14. Children’s Hospital of Richmond at VCU
    PI: Jason Sulkowski

15. John R. Oishei Children’s Hospital
    PI: Kaveh Vali

16. Cohen Children’s Medical Center
    PI: Aaron Lipskar

17. Alfred I. duPont Hospital for Children
    PI: Erin Teeple

18. Children’s Hospital Boston
    PI: Craig Lellehei

★ Northwestern Univ – coordinating center
    PI: Raval/Holl
Conclusions

- Enhanced recovery in pediatrics is gaining significant momentum
- Dual focus on:
  - Clinical outcomes
  - Implementation outcomes
  - Thus we can (hopefully) observe the effect of implementation on clinical outcomes
- Future is promising
Study Team

COORDINATING CENTER TEAM

Co-PI
Jane Holl

Co-PI
Mehul Raval

Project
Manager
Erin Wymore

Project
Coordinators
Peter Graffy
Deysi Paniagua

Statisticians:
Yao Tian
Lynn Huang

Research Fellows:
Martha Ingram
Andrew Hu
Audra Reiter
Wyn Sullivan

Administrative Support
Karen Miller

Grants Administrator
Will Edwards

Expert Collaborators

Northwestern University
A. Yang, Collaborator
K. Bilimoria, Collaborator
Y. Hu, Qualitative Methods
J. Johnson, Implementation
W. Schäfer, Collaborator
N. Monson, Web Design
S. Balbale, Implementation

Emory University
S. Blake, Mixed Methods
S. Close, Patient Centered
T. Davis, Qualitative Methods
K. Heiss, Collaborator
Study Website, Email, and Logo

- **www.enrich-us.org**

- **Email address:** enrich-us@northwestern.edu

- **Logo:**
Questions?

www.enrich-us.org

Study: enrich-us@northwestern.edu
Mehul: mraval@luriechildrens.org
What Can the PSQC Do For You?

APSA

May 11, 2022
Matchmaking

- 2021
  - Unplanned Extubations in NICU and PICU
  - Appy imaging choices protocols
  - Standardizing US Report Templates

- 2022
  - Post-op sepsis protocols
  - Billing practices
  - Neonatal return to OR
SCR Webinars

- Monthly Topics
  - Time Management
  - NSQIP SAR Presentations
  - 30 Day Follow-up
  - Demographic Collection
Pilot Project

- Members with a project idea will submit it using RedCAP. A subgroup of the PSQC Project Development and Implementation Committee (PDIC) will review submissions once per month.

- Submissions will be evaluated using the following criteria:
  - Feasibility-20 points
  - Level of evidence-10 points
  - Importance to pediatric surgery community- 10 points
  - Outcome improvement- 20 points
  - Generalizability—20 points

- Submissions scoring 60 points or more will be reviewed by the entire PDIC at its next occurring meeting
Current Instrument: PSQC Pilot Project Submission Form v. 2.0

Possible Branching Logic and Calculated Fields Will Not Function on this Page. They Only Work on the Survey Pages and Data Entry Forms.

Please consider the difference between research and quality improvement as you formulate your answers. The goal of research is to add to the knowledge base or generate new knowledge through testing of a hypothesis. The goal of QI is to improve practices based on the best available knowledge.

**Record ID**

**First Name**

**Last Name**

**Institution**

**Email**

**What is your QI project title?**

**What data would you use from your current SAR to get started?** (i.e., category, model, etc.)

**How will you measure success?**

**Does your SCR have the time to participate in any additional abstraction needs for this project?**

**Are there any hospitals within the PSQC you feel would be good partners on this project?**

Please list the hospitals here.
Pediatric Surgery Quality Collaborative (PSQC)

The Pediatric Surgery Quality Collaborative is a partnership with the American College of Surgeons National Surgery Quality Improvement Program Pediatric (ACS NSQIP-P) and NSQIP-P member hospitals.

The PSQC was launched on January 1, 2020, with a mission to develop a national partnership of children’s hospitals, surgical providers, and the American College of Surgeons who share the mission of delivering high quality, cost effective, patient-centered surgical care.

UPCOMING EVENTS

In-Person Meeting at APSA
Merrill Marquis, San Diego, CA
Wednesday, May 11
1:00-5:00PM PDT

SCR Monthly Webinar
Tuesday, May 17
1:00-2:00PM CDT

In-Person Meeting after ACS Quality and Safety National Conference
Lurie Children’s, Chicago, IL
Monday, July 18
1:00-5:00PM CDT
Project Guides

Reduction of CT utilization for Pre-op Imaging of Pediatric Appendicitis

Implementation Guide
Open Discussion
Thank you