



## Mayo Clinic: Colorectal Surgical Site Infections (SSI) Reduction Project

Robert Cima, MD  
*On behalf of the Mayo Clinic CRS SSI Reduction Team*

Minnesota IPAC Meeting  
September 22, 2011

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## Disclosures

- None



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## Hospital Acquired Infections

- 2 million American hospital patients develop HAI per year
- 90,000 deaths per year directly related to HAI
- Estimated direct costs of \$5.7 billion dollars
- Top 4
  - Urinary catheter associated infections (CA-UTI)
  - Surgical site infections (SSI)
  - Catheter associated bloodstream infection (CA-BSI)
  - Ventilator associated pneumonia (VAP)



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### Surgical Site Infections (SSI)

- According to the CDC
  - 2.6% of 30 million operations per year are complicated by SSI
  - SSI are the second most common healthcare associated infection accounting for 17% of all hospital acquired infections
  - In surgical patients, SSI are the most common healthcare associated infection (38%)



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### Colon and Rectal Surgery SSI

- Colon and rectal surgery (CRS) is associated with the highest rate of SSI in the literature
  - Range 3-30%
- Multiple studies have identified
  - Patient specific risk factors
    - Malnutrition, DM, Obesity, Immuno-suppressed, Elderly
  - Disease specific risk factors
    - Inflammatory diseases, Cancer, Concurrent infections
  - Procedure specific risk factors
    - Emergent, Open v. minimally invasive, Duration, Surgeon
- Variable success of reduction efforts
  - No "Magic Bullet"



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### Surgical Site Infections (SSI)

- Implications of SSI
  - Increased length of hospital stay (2- 4 days on average)
  - Increased costs
    - Mayo Clinic CRS data
      - Superficial SSI increased cost by \$2,000 (median)
      - Deep wound SSI increased cost by \$11,000 (median)
      - Organ space SSI increased cost by \$14,000 (median)
  - Increased readmission rates
  - Increased patient morbidity, pain, and discomfort
  - Pose risk to other patients



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### Division of MCR Colon and Rectal Surgery

- One of the oldest dedicated CRS units in the U.S.
- Eight board certified colon and rectal surgeons
- National and International referral practice
  - ~2,500 colorectal procedures annually
- Highest SSI rate in the MCR surgical practice
  - 5%-10.5%\*



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### CRS SSI Reduction Effort 2010

- Drivers
  - MCR IPAC
  - Mayo Clinic Enterprise Leadership
  - MCR Department of Surgery
  - MCR Division of Colon and Rectal Surgery
  - Our Patients



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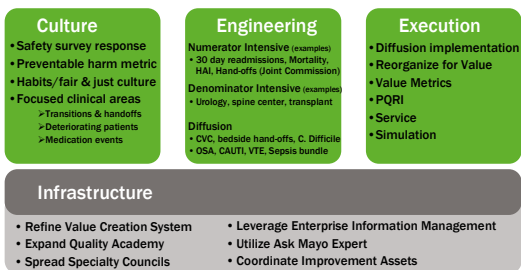
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### Quality Construct

The best care for every patient every day...



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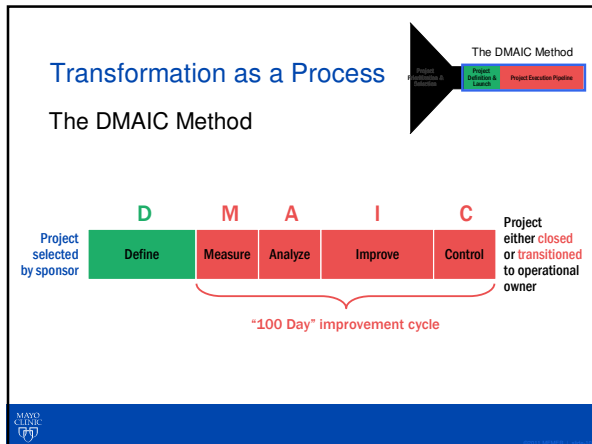
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## Where were we starting?

- We knew we needed SSI rates but which data was the one to base the reduction effort?
  - Institutional IPAC data
    - Quarterly evaluation
    - Culture based
    - Follow-up requires notification
    - Weighted towards deep infections
  - National Surgical Quality Improvement Program (NSQIP)
    - Chart abstraction by trained abstractors
    - Mandated 30 day follow-up with active outreach to patient

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## SSI Surveillance Systems

- **IPAC triggers**
  - Positive culture
  - Readmission to hospital with diagnosis implying a wound or organ space infection
  - Return to the OR with preop diagnosis of wound or organ space infection
  - Call from provider indicating a SSI
  - NHSN definition and risk adjustment
    - Superficial SSI
    - Deep incisional SSI
    - Organ / Space SSI
- **NSQIP abstraction guidelines**
  - Only sample of patients
  - 30 day post-op follow up
  - Standard definitions
    - Wound cellulitis
    - Superficial SSI
    - Deep incisional SSI
    - Organ / Space SSI

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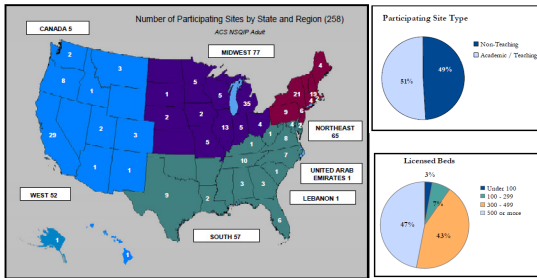
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## NSQIP Sites Locations




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## NSQIP Quality Improvement Process

- Hospitals abstract data by trained abstractors
  - Strict abstraction criteria
- Data is analyzed by ACS NSQIP
- Data is reported back to institution
  - Raw rates
  - Observed/Expected ratio performance compared to other institutions
- Hospitals act on their data
- Hospitals monitor interventions with data




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## ACS NSQIP Case Selection

- Systematic Sampling Process
  - 8-day cycle assures cases have equal chance of being selected
  - The first 40 cases meeting inclusion/exclusion criteria are selected
- Inclusion/Exclusion Criteria
  - Inclusion based on CPT codes
  - Exclusion criteria
    - Under age 16
    - >3 inguinal herniorrhaphies, >3 lumpectomies, or > 3 laparoscopic cholecystectomies per cycle
    - Trauma and Transplant
    - ASA class 5




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## Data Collection

### •Preoperative data

- Demographics - 9 variables
- 40 clinical variables and 13 laboratory variables

### •Intraoperative data

- Surgical Profile - 9 variables
- 18 clinical variables and 3 complications

### •Postoperative data

- 30-day outcomes (inpatient and outpatient)
- 20 complications, 12 laboratory variables, and 9 discharge variables



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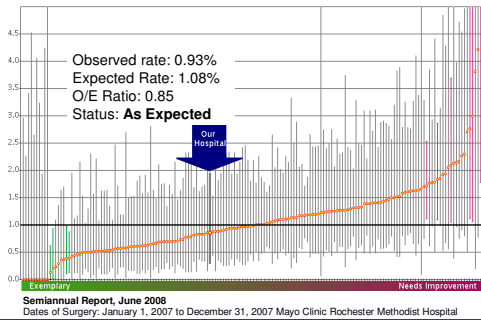
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## RMH Colorectal Surgery 30-Day Mortality



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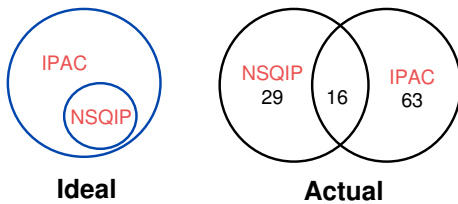
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## Comparison of CRS SSI Recorded Events



To verify the representation of the sample in both the groups  
Time Frame: Jan 2009 to April 2010  
IPAC data identified 79 SSI  
NSQIP data identified 45 SSI



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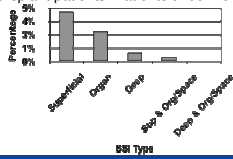
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## Define Phase

- **Goal:** Reduce colorectal surgical site infections by 50% and improve OE ratio from 4<sup>th</sup> decile to 2<sup>nd</sup> decile by Oct 31 2011. 2009 overall SSI rate was 10.5%.
- **Unit of Improvement:** Colorectal Surgical Procedures
  - All patients undergoing colorectal surgery (emergency and elective) at Rochester Methodist Hospital, NSQIP CPT codes for colorectal surgery.
  - All types of Surgical Site Infections (Superficial Incisional, Deep Incisional, and Organ/Space).
  - Excludes: Trauma and Primary Transplant patients. Patients under 18 years of age
- **Defect:** Any Surgical Site Infections
- **Data source:** NSQIP Data Set




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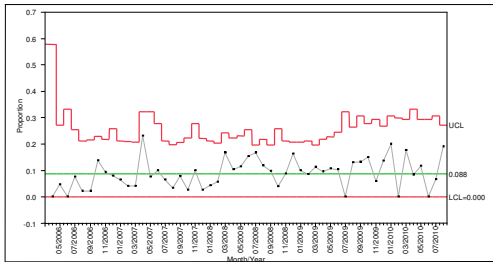
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## Measurement Phase

Metric 1 – Observed Colorectal SSIs  
Baseline: 10% (2009) → Target: 5%




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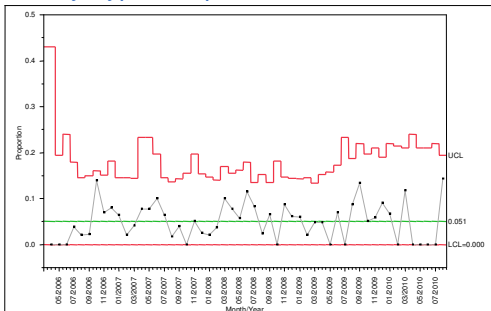
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## SSIs by Type - Superficial




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### What About the Surgeon's Practices

- Distributed a detailed survey of relevant practice/procedure questions related to elements thought to contribute to colorectal SSIs
- All surgeons in the practice included
- All responded
- Shared findings with surgeons at practice meeting



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### What About the Surgeon?

Survey of surgeon practices for "relevant" items

1. Do you routinely order a bowel preparation?
2. If you use a bowel preparation, do you order oral antibiotics with the bowel preparation?
3. If you do not use a bowel preparation, do you still order oral antibiotics?
4. Do your patients routinely receive an enema prior to arriving in the operating room?
5. Do you routinely provide your patients with a medicated soap (antibacterial) to shower with prior to surgery?
6. For left-sided colectomies/rectal surgery, do you irrigate the rectum?
7. What skin preparation do you routinely use?
8. Do you routinely use an loban type drape over the prepared abdomen during your procedures?
9. Do you routinely use wound protectors during the operation? (ie sponges under fixed retractors or a wound protector product)
10. Do you routinely use saline or antibiotic irrigation of the abdomen?



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### What about the Surgeon?

11. Do you routinely air test all colorectal anastomoses?
12. For small bowel or colon anastomoses, what type anastomosis do you routinely perform?
13. Do you routinely have antibiotics re-dosed at four hours for your longer cases?
14. Your routine fascial closure is what style?
15. Do you use fresh clean instruments that had not been on the table during the case to close the abdomen?
16. Do you have the team members change gloves and/or gowns just prior to abdominal closure?
17. Do you routinely irrigate the subcutaneous space prior to skin closure with saline and/or antibiotic irrigation?
18. Do you routinely use a subcutaneous drain at the site of the primary incision closure?
19. Do you routinely use a subcutaneous drain at the site of an ostomy?
20. When do you remove the dressing applied in the operating room if it is not soiled?
21. Do you have your patients shower/bathe with medicated (antibacterial) soap while in the hospital?



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## Surgeon Survey Results

- Demonstrated
  - Wide variability amongst the surgeons on most elements
    - We all trained at the Mayo Clinic but all do something different
  - Started a conversation on the “best” practice
  - Gained consensus to move towards more standardization on specific surveyed items



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## Principles of Our Reduction Effort

- Interventions across the episode of care
- Multi-disciplinary
- Engage staff, patient, and families
- Standardize as many processes as possible
- Ensure high compliance with elements
  - Quick audits
- Build the elements into the system
- Frequent feedback and communication



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## The Team

- Project Leader: Robert Cima, MD
- Black Belt: Gene Dankbar, Systems and Procedures
- Kimberly Aronhalt, RN, Infection Control and Prevention
- Diane Foss, RN, Kim Gaines, RN, Nursing, Pamela Grubbs, RN,
- Pamela Maxson, RN, PhD, Jennifer Wolforth, RN, Nursing
- Sharon Nehring, RN, Roxanne Hyke, RN, Diane Tyndale, RN, NSQIP
- Jenna Lovely, PharmD, Pharmacy Services
- Sarah Pool, RN, Surgical Services, Lynn Quast, RN, Surgical Services
- Jim Rogers, Systems and Procedures
- Rajesh Pendlimari, MBBS, Research Fellow, CRS
- Karen Piotrowicz, RN, Mid-level Provider, CRS



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## Pre-operative Elements

- Pre-op antibiotic ordering
  - Procedure scheduling software automatically provides SCIP appropriate choices
  - Weight-based dosing
  - Software automatically orders intra-operative re-dosing dose if historical data for the specific procedure and surgeon demonstrated an average case duration >3 hours







## Anesthesia Antibiotic Reminder Screen

A reminder will display 30 minutes after Chart+ has been started in the OR. The reminder delay can be set to maximum of 30 minutes.

Once an antibiotic has been documented, the window will hide for the recommended dosing interval minus 30 minutes.




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## Anesthesia Antibiotic Reminder Screen

### For example:

- >The initial Cefazolin dose was documented at 11:00, current time is 14:00
- >The reminder window appears, prompting re-dosing of "Cefazolin"
- >The reminder can be delayed up to 30 minutes
- >The reminder resets to 3 hours once the dose is charted




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## Intra-operative Elements

### • "Closing" Process

- At the time of fascia closure
  - All staff change gloves
  - Gowns if soiled
  - Field re-blocked with sterile towels
  - Instruments used during case removed and "closing tray" brought onto the field




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## Post-operative Elements



- All order-sets discontinue SCIP compliant antibiotics after two post-op doses or single dose when appropriate
  - Pharmacist part of team and queries service
- Hand hygiene essential on floor
  - Physician/Nursing initiative
  - Patient and Family initiative
- Sterile dressing on until morning of POD 2
  - Document removal
- Chlorhexidine shower/wipes daily after dressing removal
- Standard post-op order-sets orders urinary catheter removal at 8 am the morning after surgery
- Dismiss with chlorhexidine soap bottle for use at home




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## Process audits

- Audits of elements to determine compliance
  - Use different data sources
    - SCIP UHC data
    - Institutional hand hygiene compliance
    - OR process data
- Assess counterbalance effects
  - Does closing process increase operative times?
- Cost implications
  - Impact of standardizing skin preparation




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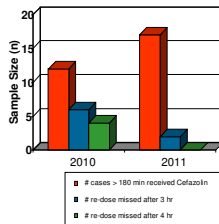
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## Antibiotic Re-dosing

- Cefazolin re-dose after 3-4hr if Op time > 3hr
- Antibiotic "watcher" effective after 1/1/11
- Re-dosing after 4 hr improved from 8/12 (66%) in 2/2010 to 17/17 (100%) in 2/2011




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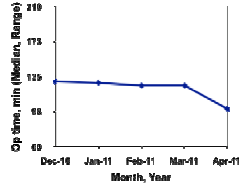
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### Operative Time – has it increased due to our changes?

- Analysis of Op. time over last 4 months
- Right Hemicolectomy with no concurrent procedures were selected
- No difference in operative times were noted ( $p=0.26$ )




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### NSQIP Reported Cases: 2011

Month	Total Cases	Super. SSI	Deep SSI	O/S SSI	Total Obs	Total %
Jan	13	1	0	1	2	15.4
Feb	20	0	0	2	2	10
Mar	23	0	0	0	1	4.4
Apr	11	0	0	1	1	9.1
May	19	0	0	0	0	0
June	22	0	0	1	1	4.5
Total	100	2	0	5	7	7.0

5.7%




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### Mayo Clinic CRS SSI Reduction Effort

- Lessons Learned
  - Multi-disciplinary approach is essential
    - Physicians, nursing (pre, intra-op, floor), pharmacy, CST, SA, administration, supply chain, quality, S&P, IT, Patient Education, Infection Control, WOCN, NSQIP team
  - Understand your own data
  - Address the entire surgical episode of care
    - Pre-, Intra-, Post-operative elements may influence SSI rates
    - Interventions designed for each phase
  - Introduce elements of change and audit compliance
  - No evidence for which of element(s) makes a difference in the "bundle"
    - **Get over it:** the outcome is all that matters
  - Too early to tell if we have made a long-term difference but the early results looks promising




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Mayo Clinic – *The Needs of the Patient Come First*  
W. J. Mayo, MD



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