Yale GYN SSI Reduction Project:

An Effective and Sustainable Healthcare Initiative for Reducing the SSI Rate in Hysterectomy Using a Gynecology Specific Bundle

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Surgical Services
Yale New Haven Hospital
Yale SSI Reduction Project
The SSI problem

- Second most common health-care associated infection
- Most common reason for unplanned readmission after hysterectomy
- Increase cost and morbidity
- > 400,000 inpatient, and unclear how many more outpatient annually
- Public reporting since 2013
Yale New Haven Hospital: Background information

- Academic Medical center
- 1541 beds
- EPIC EMR adopted 2013
- Average ~770 hysterectomies yearly
  - Range 713-812
- Perioperative Services
  - 64 Operating rooms
  - 5 perioperative areas, different cost centers

- Anesthesia
  - CRNA
  - Residents

- Many categories of surgeons:
  - Specialty surgeons
    - GYN Oncology, REI, MIGS, Urogyn
  - Community surgeons
    - 18% of cases
  - Resident
Yale New Haven Hospital: Background information
Worse than benchmark...

<table>
<thead>
<tr>
<th>CMS Compare Website 2012</th>
<th>YALE-NEW HAVEN HOSPITAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central line-associated bloodstream infections (CLABSI)</td>
<td>Better than the U.S. National Benchmark</td>
</tr>
<tr>
<td>Catheter-associated urinary tract infections (CAUTI)</td>
<td>Worse than the U.S. National Benchmark</td>
</tr>
<tr>
<td>Surgical site infections from colon surgery (SSI: Colon)</td>
<td>No Different than U.S. National Benchmark</td>
</tr>
<tr>
<td>Surgical site infections from abdominal hysterectomy (SSI: Hysterectomy)</td>
<td>Worse than the U.S. National Benchmark</td>
</tr>
<tr>
<td>Methicillin-resistant <em>Staphylococcus Aureus</em> (MRSA) Blood Laboratory-identified Events (Bloodstream infections)</td>
<td>No Different than U.S. National Benchmark</td>
</tr>
<tr>
<td><em>Clostridium difficile</em> (C.diff.) Laboratory-identified Events (Intestinal infections)</td>
<td>Worse than the U.S. National Benchmark</td>
</tr>
</tbody>
</table>

SIR 2.19
The starting point...

YNHH Hysterectomy Quarterly SSI Rates

CY13 SSI rate 4.7%
CY12 SSI rate 3.6%


Jan 2012 – Sep 2014
More than 50% were Organ Space

**Organ Space**
- NCDx13
- B. fragilis x2 patients
- E. coli x2
- Enterococcus sp.
- Enterococcus sp., S. viridans
- MRSA
- S. aureus
- S. viridans, B. fragilis

**January – June 2014**

**Organ Space**
- Candida albicans
- Enterococcus sp.

**Superficial**
- E. Cloacae, B. fragilis
- E. coli x2
- S. aureus
- NCDx8
- Mixed flora

**Classification of SSIs:**
- Superficial-involves only skin and subcutaneous tissue of the incision
- Deep-involves the deep soft tissues (e.g., fascial and muscle layers) of the incision
- Organ/space-involves any part of the body (excluding skin, fascia or muscle layers) that is opened or manipulated during the operative procedure
Where do we go from here?
The Trans-Abdominal SSI Committee

Leadership

- TRI-CHAIR
  - Gynecologic Surgeon—MD
  - Anesthesiology—MD
  - Nursing Leader
- Sponsor
  - Senior VP/CQO YNHH
  - Surgical Director of Performance and QI
- Expert Content
  - Hospital epidemiology/ID
    - Attending
    - Infection prevention nursing team

Team

- Team
  - Surgeon
    - Attending
    - Resident
  - Anesthesia
    - Attending
    - CRNA
  - Perioperative
    - Nursing managers/leads
    - Educators
  - NSQIP

AIM: Reduce the number of SSIs to “as expected” for transabdominal surgeries by end of FY2015
Yale SSI Project Highlights:
What worked well?

- Tri-Chair Leadership Structure
- GYN Specific Bundle
- Frontline feedback
What is the role of a champion?

Ensure team functions effectively by:

• Commitment to process improvement
• Gathering and reflecting on data
• Seeking out best practices
• Engaging voices and perspectives from all aspects of the process

—Agency for Healthcare Research and Quality (AHRQ)
Tri-Chair Leadership Structure

- TRI-CHAIR
  - Gynecologic Surgeon—MD
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  - Nursing Leader

- Sponsor
  - Senior VP/CQO YNHH
  - Surgical Director of Performance and QI
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What worked well?

- Tri-Chair Leadership Structure
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- Frontline feedback
The GYN SSI Bundle

“A **bundle** is a structured way of improving the processes of care and patient outcomes: a small, straightforward set of evidence-based practices—generally three to five—that, when performed collectively and reliably, have been proven to improve patient outcomes.”

—as defined by the Institute for Healthcare Improvement (IHI)
Creating the Yale bundle...

Evidence-based
Creating the Yale bundle...

Evidence-based

GYN Specific
Creating the Yale bundle...

Where can we improve most?
- Yale process metrics
- Epidemiologic data
Creating the Yale bundle...

Where can we improve most?
- Yale process metrics
- Epidemiologic data
<table>
<thead>
<tr>
<th>Strong Recommendation</th>
<th>Weak Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timely and Appropriate Preoperative Antimicrobial Agents</td>
<td>Autologous platelet-rich plasma</td>
</tr>
<tr>
<td><em>(accepted)</em></td>
<td><em>(moderate)</em></td>
</tr>
<tr>
<td>Shower or bath at least night prior</td>
<td>Triclosan-coated sutures</td>
</tr>
<tr>
<td><em>(accepted)</em></td>
<td><em>(moderate)</em></td>
</tr>
<tr>
<td>Skin prep with alcohol-based antiseptic</td>
<td>Application of microbial sealant after prep</td>
</tr>
<tr>
<td><em>(high)</em></td>
<td><em>(low)</em></td>
</tr>
<tr>
<td>No additional prophylactic ABX after surgery even with drain</td>
<td>Use of plastic adhesive drapes +/- antimicrobial properties</td>
</tr>
<tr>
<td><em>(high)</em></td>
<td><em>(high to moderate)</em></td>
</tr>
<tr>
<td>Normothermia</td>
<td>Intraop irrigation of deep/subcut tissues with aqueous iodophor solution (not in dirty/contaminated)</td>
</tr>
<tr>
<td><em>(high to moderate)</em></td>
<td><em>(moderate)</em></td>
</tr>
<tr>
<td>Periop Glycemic control, Target &lt; 200 mg/dL</td>
<td></td>
</tr>
<tr>
<td><em>(high to moderate)</em></td>
<td></td>
</tr>
<tr>
<td>Increase FiO2 during procedure and after extubation</td>
<td></td>
</tr>
<tr>
<td><em>(moderate)</em></td>
<td></td>
</tr>
<tr>
<td>No Antimicrobial agent to incision</td>
<td></td>
</tr>
<tr>
<td><em>(Low)</em></td>
<td></td>
</tr>
</tbody>
</table>

**CDC Guidelines:**
Prevention of SSI (2017)
The GYN SSI Bundle

Preoperative
- Chlorhexadine Wipes, Day of
- Preoperative Warming
- Standard Antibiotic Regimen

Intraoperative
- Standardized Prep
- Maintenance of Normothermia
- Antibiotic Redosing

Postoperative
- Sterile Dressing 24-48 hours

Timely Feedback in SSI Cases

No ABX > 24 hours
The GYN SSI Bundle

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Timely Feedback in SSI Cases

No ABX > 24 hours
Pre-op Chlorhexadine Wipes Day of Surgery reduces infection

- Use at the surgical site, night before or morning of contributes to reducing SSIs
  - Higher concentration of CHG on skin than shower with CHG

- Pre-op use of CHG cloths routinely part of

- “surgical bundles” for colorectal surgery

Lutfiyya W et al. Permamente J 2012;16:10
Lessons Learned:
Pre-op Chlorhexadine Wipes Day of Surgery

- Ease of distribution
- Ensure standardization
  - Not depend on patient, cost, etc.
- Feedback to frontline helped to improve use
- Timing of wipe in inpatients require consideration
The GYN SSI Bundle

**Preoperative**
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- Sterile Dressing 24-48 hours

Timely Feedback in SSI Cases

No ABX > 24 hours
Maintaining Perioperative Normothermia

- **Endorsed by:**
  - SCIP
  - AORN
  - CMS
  - Joint Commission

- **Recommend normal body temperature during and immediately after surgical procedures ≥ 1 hr duration**
Preop Patient Warming improves hypothermia

- Studies in non-OB/GYN patients have shown
  - pre-warming of patients for 15-30 min can help prevent or minimize intraoperative hypothermia

- A few studies have found that pre-warming of C-section patients can
  - Prevent or minimize intraoperative hypothermia
  - Reduce post-cesarean shivering in mothers
  - May yield higher temperatures and umbilical vein pH in babies

Just B et al. Anesthesiology 1993;79:214
Sessler DI et al. Anesthesiology 1995;82:674
## Hypothermia Predisposes to Surgical Site Infection

<table>
<thead>
<tr>
<th>First Author</th>
<th>Type of Surgery</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurz A</td>
<td>Colorectal</td>
<td>NEJM 1996;334:1209</td>
</tr>
<tr>
<td>Flores-Maldonado A</td>
<td>Cholecystectomy</td>
<td>Arch Med Res 2001;32:227</td>
</tr>
<tr>
<td>McAnally HB</td>
<td>Pediatric cardiovascular</td>
<td>Pediatr Infect Dis J 2001;20:459</td>
</tr>
<tr>
<td>Seamon MJ</td>
<td>Trauma</td>
<td>Ann Surg 2012;255:789</td>
</tr>
<tr>
<td>Hendren S</td>
<td>Colectomy</td>
<td>Ann Surg 2013;257:469</td>
</tr>
<tr>
<td>Melling A</td>
<td>Clean surgery</td>
<td>Lancet 2001;358:876</td>
</tr>
<tr>
<td>Wong PF</td>
<td>Major bowel surgery</td>
<td>Br J Surg 2007;94:421</td>
</tr>
</tbody>
</table>

2828
Yale Data 2013: Hypothermia was best predictor of SSI

A forward stepwise logistic regression analysis:
- Age, BMI, diabetes, cancer
- Procedure time
- Surgical approach (Lap/Robotic vs open)
- Number of temperature readings < 36.0 C

Result:
- **Number of temperature readings < 36.0 C** was the single best independent predictor of SSI (P < 0.05)
- Adding surgical approach to the model, the model was also significant (P < 0.05)

Source: John Boyce MD, Renee Fekieta PhD
Yale data 2013:
Upper Bair Hugger did not ensure normothermia

- Frequency of use of overbody Bair Huggers was analyzed
  - 35 Cases and 99 random controls with temperatures recorded
- 52 (28.8%) of the 134 patients had > 50% of temps < 36.0 C
- 50 (96%) of the 52 patients with half or more temps in the hypothermic range (< 36.0 C) had an overbody Bair Hugger used intraoperatively
- A finding supported by published literature
Yale data 2013:
Hypothermia < 36 degrees correlated with SSI

There was no trend in specific Surgeons or Rooms.
Yale Perioperative Warming 2013

- Bair Paws
- Underbody
- Overbody
- Feedback
Lessons Learned: Peri-operative warming

• Initial variations in method of obtaining temperature
  • Esophageal probe

• Rooms were difficult to monitor in old buildings

• Bair Huggers not turned on though they had it on

• Sliding in Trendelenberg with use of underbody warmer
  • No underbody for laparoscopic hysterectomy
  • Use Pink Pad to prevent sliding

• Feedback to frontline helped to improve use

• Teaching of CRNAs helped to close this gap
The GYN SSI Bundle

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- Sterile Dressing 24-48 hours

Timely Feedback in SSI Cases

No ABX > 24 hours
Yale Guideline for Antibiotic Prophylaxis for Hysterectomy, 2014

- Pharmacy, Hospital Epidemiology/infection control, Gynecology

- Cefazolin 2 gms (no 1 gm dosing)
  - Unless > 120 kg, then 3 gm dosing
- Automated reminder of anesthesia at 3 hours for re-dosing of Ancef
- Metronidazole 500 mg, in addition, for cases of known or suspected GYN malignancy
  - Cefazolin “push” over 2-3 min
  - Metronidazole can be given IV over 20 min
### Table 1. Antimicrobial Prophylactic Regimens by Procedure*

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Antibiotic</th>
<th>Dose (single dose)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hysterectomy</td>
<td>Cefazolin†</td>
<td>1 g or 2 g‡ IV</td>
</tr>
<tr>
<td>Urology procedures, including those involving mesh</td>
<td>Clindamycin§ plus g</td>
<td>600 mg IV</td>
</tr>
<tr>
<td></td>
<td>gentamicin or quinolone* or aztreonam</td>
<td>1.5 mg/kg IV or 1 g IV</td>
</tr>
<tr>
<td></td>
<td>Metronidazole§ plus g</td>
<td>500 mg IV</td>
</tr>
<tr>
<td></td>
<td>g benzylpenicillin or quinolone* or aztreonam</td>
<td>1.5 mg/kg IV or 400 mg IV</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
2013 Clinical Practice Guidelines

• American Society of Health-System Pharmacists (ASHP)
• The Infectious Disease Society of America (IDSA)
• The Surgical Infection Society (SIS)
• The Society for Healthcare Epidemiology of America (SHEA)
2013 Hysterectomy Guidelines

- **Ancef**
  - 1 gm
  - 2 gm 80-120 kg
  - Increase to 3 gms, if >120 kg
- **Given 1 hour prior to skin incision**
  - Can be too little time, but no guideline
  - Studies suggest >15 minutes (Induction)
- **Redosing**
  - Double half-life from time of initial dose
  - Ancef 1.2-2.2 hours, recommend redosing at 4 hours

- Bratzler et al
Anaerobes in Abdominal Hysterectomy-Related SSIs

YNHH, 2012 - 2014

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Number of Isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteroides fragilis</td>
<td>10</td>
</tr>
<tr>
<td>Enterococcus</td>
<td>7</td>
</tr>
<tr>
<td>E. Coli</td>
<td>6</td>
</tr>
<tr>
<td>Meth-sensitive S. aureus</td>
<td>6</td>
</tr>
<tr>
<td>Candida</td>
<td>3</td>
</tr>
<tr>
<td>MRSA</td>
<td>3</td>
</tr>
<tr>
<td>Mixed flora</td>
<td>3</td>
</tr>
<tr>
<td>Others</td>
<td>7 (1 anaerobic)</td>
</tr>
</tbody>
</table>

Of patients whose SSI wounds were cultured and yielded organisms, anaerobes were recovered from 11/39 (28.2%)
Anaerobes and cancer cases were correlated

- At Yale, 2012 through Q2 2014
  - 8 (+) anaerobe in 21 (+) SSI pts (+) cancer (38.1%)
  - 3 (+) anaerobe in 18 (+) SSI pts (-) cancer (16.7%)

- Conclusion: Anaerobes were a problem among patients with cancer who undergo complex hysterectomies

- If bowel surgery performed, categorized under colon surgery
Yale Guideline for Antibiotic Prophylaxis for Hysterectomy, 2014

- Pharmacy, Hospital Epidemiology/infection control, Gynecology

- Cefazolin 2 gms (no 1 gm dosing)
  - Unless > 120 kg, then 3 gm dosing
- Automated reminder of anesthesia at 3 hours for re-dosing of Ancef
- Metronidazole 500 mg, in addition, for cases of known or suspected GYN malignancy
  - Cefazolin “push” over 2-3 min
  - Metronidazole can be given IV over 20 min
LESSONS LEARNED:
Antibiotic prophylaxis

- Have it available in the room
  - Pyxis anesthesia

- Administration sometimes <10 minutes to skin
  - Order sets

- Surgeon pushback initially

- Timely and peer feedback to surgeons and anesthesia works

- Automation of reminders

- Pharmacy also tracks prophylaxis and alerts in real time
The GYN SSI Bundle

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Timely Feedback in SSI Cases

No ABX > 24 hours
Yale Standardized Surgical Prep

- Chloroprep standardized
  - All GYN surgery abdominal prep
  - Labor and birth abdominal prep

- Hibiclens as vaginal prep
  - Standardized since 2014
  - Use of disposable sponge sticks
  - No reports of adverse side effects

- Abdominal-Perineal Prep
  - Established standard
  - Video
    - Residents
    - Attendings
    - OR Staff
  - Health stream
ChloraPrep as single product

• Retrospective review of 1000 consecutive C-section cases
  • 70% isopropyl alcohol + CHG vs povidone-iodine
  • Baseline characteristics same in both groups
  • Skin closure with staples was more common in povidone-iodine group

• Results
  • No significant difference in SSI rates
  • 5% of alcohol + CHG group
  • 5.8% in povidone-iodine group

• Retrospective study involving 256 Gyn laparotomies found that 2% CHG followed by 70% alcohol significantly reduced SSIs when compared to povidone-iodine scrub and paint

Menderes G et al. Obstet Gynecol 2012;120:1037
Levin I et al. J Women’s Health 2011;20:321
ChloraPrep as single product

- Systematic review and meta-analysis of surgical site preps
- Six studies included 5031 patients
- CHG-containing regimens were compared with regimens utilizing povidone-iodine
- Results: CHG reduced SSIs compared to povidone-iodine
  - (pooled odds ratio = 0.68, P = 0.019)
- No head-to-head comparison of ChloraPrep vs DuraPrep, so no conclusion regarding which might be better

Hibiclens for Vaginal Prep

• 4% chlorhexadine gluconate, 4% isopropyl alcohol
• More effective in skin flora in RCT of clean-contaminated procedures.
• Bactericidal in presence of blood.
• RCTs 1200 - no adverse reaction
• Yale standardized since 2013 for all vaginal prep, no reported adverse events
There was no standard abdomino-perineal prep

- Internal quality study performed:
  - Significant variation in audit of 50 cases.
- No specified order (bottom vs top first) for prep
- Drape placement variation
- Foley placement at times prior to drape, allowing for contamination
- Varied usage of Chloroprep demonstrated.
- Variable application of Hibiclens (volume within the vagina)
Abdominal Perineal Surgical Preparation Video
LESSONS LEARNED:
Surgical Site Preparation

• Use of video:
  • Delivered consistent and standardized message
  • Empowered staff and housestaff

• Two chlorhexidine/alcohol prep types was confusing
  • Duraprep - paint
  • Chloraprep - 30 seconds at incision (Video)
Yale SSI Project Highlights: What worked well?

- Tri-Chair Leadership Structure
- GYN Specific Bundle
- Frontline feedback
Feedback leads to accountability

We are what we repeatedly do. Excellence, then, is not an act, but a habit.
Ongoing SSI Evaluation and Feedback

- Evaluation of progress and status
  - Use process metrics and SSI cases to monitor compliance with measures
  - Monthly processes in place
  - Multidisciplinary review of successes and missed opportunities

- Feedback to team
  - Multidisciplinary
  - Successes and misses
  - Formal and informal processes
Evaluation: Monthly Process Metrics

• Defined process metrics from bundle components
  • Compliance with pre-op warming, intra-op warming, antibiotics, CHG wipes, and prep choice pulled from Epic documentation
  • Intra-op prep application technique observed

• Feedback occurs
  • 1:1 informal ‘cup of coffee’ peer to peer
  • Manager, Educator to staff
Evaluation:
Monthly SSI Data Review

- SSI events are reviewed monthly and evaluated against bundle components
- Information validated by team members
- Feedback via formal process
- Collate themes from SSI cases for future work

<table>
<thead>
<tr>
<th>Surgeon</th>
<th>OR Room</th>
<th>Emergent</th>
<th>Prior Location</th>
<th>Windclass</th>
<th>Pre OP Warming</th>
<th>Bair paws</th>
<th>CHG Wipes</th>
<th>Prep</th>
<th>Upper Body Warming</th>
<th>Lowerbody, Full Underbody OR Lithotomy</th>
<th>% &lt;36</th>
<th>abx choice</th>
<th>Min prior to incision</th>
<th>BMI</th>
<th>Redosed</th>
<th>Duration</th>
<th>Closure</th>
<th>Infection Date</th>
<th>Infection Type</th>
<th>PATOS</th>
<th>Organism</th>
</tr>
</thead>
<tbody>
<tr>
<td>XXXX</td>
<td>SP07</td>
<td>Y</td>
<td>EP47</td>
<td>CC</td>
<td>Y</td>
<td>Y</td>
<td>chloraprep</td>
<td>N</td>
<td>Lower body</td>
<td>0</td>
<td>0:20</td>
<td>already on antibiotics received dose 2g Cefazolin before incision</td>
<td>29</td>
<td>Y</td>
<td>4:03</td>
<td>midline incision with #1 PDS in a running fashion, closed the skin of all the wounds with staples</td>
<td>10/20/2017</td>
<td>superficial</td>
<td>N</td>
<td>No culture</td>
<td></td>
</tr>
<tr>
<td>XXXX</td>
<td>SRC 12</td>
<td>Y</td>
<td>3SOUTH</td>
<td>D</td>
<td>N</td>
<td>Y</td>
<td>chloraprep</td>
<td>Y</td>
<td>N</td>
<td>24%</td>
<td>0:29</td>
<td>already on antibiotics received dose 2g Cefazolin before incision</td>
<td>22.8</td>
<td>Y</td>
<td>3:56</td>
<td>closed the fascia of the right lower quadrant port site and the umbilical port site with 0 Vicryl sutures in a figure-of-eight fashion, closed the midline hand port site with #1 PDS in a running fashion</td>
<td>10/29/2017</td>
<td>Organ Space</td>
<td>Y</td>
<td>mixed</td>
<td></td>
</tr>
</tbody>
</table>
Evaluation Leads to Process Review and Refined Education Delivery

• Use missed opportunities to move project forward
  • Process metrics
    • Pre-op warming – documentation accuracy
  • SSI case reviews
    • Antibiotic – timing, availability in OR

• Education
  • Department based to unit based
  • Annual: didactic Healthstream
Lessons Learned

- Keep the feedback positive (5:1)
- Maintain feedback loop – continually
- Repetition
- Communication and education re: bundle
- Annual education processes best
Next Steps for Feedback...

- Formalized and Confidential
- Monthly and Multidisciplinary
- SSI cases
  - Misses
  - SSI other opportunities
- Collaboration with Legal and Medical Staff Office
Monthly SSI Data Review: Compliance/Misses

FY2017 Abdominal Hysterectomy SSI Overall Compliance with SSI Bundle

- CHG Compliance Morning of Surgery: 100%
- Pre-operative Warming compliance: 100%
- Overall Forced Air Warmer used: 83%
- Overall Antibiotic Compliance: 83%

n= 6 SSIs
How did we do?

*From 4.7% SSI Rate in 2013...*
FY2017: Less than 1% SSI and Sustaining

- 6 Abd. Hysterectomy Surgical Site Infections

![Pie Chart]

- Superficial: 83%
- Organ Space: 17%
Abdominal Hysterectomy SSI Standardized Infection Ratio CY2012-CY2016

YNHH Abdominal Hysterectomy Overall SIR (2006-2008 Baseline)
Trends 95% CIs
CY 2012 - CY 2016

- SIR higher than predicted
- SIR same as predicted
- SIR lower than predicted
Abdominal Hysterectomy SSI *CMS Standardized Infection Ratio CY2012-CY2016

*CMS SIR Excludes all superficial incisional SSIs.
a. April 2013: Chlorexidine-impregnated wipes, pre-operative warming, standardized aseptic technique, primary dressing 24-48 hours
b. March 2014: Intraoperative normothermia,
c. October 2014: Standardized antibiotic dosing
d. December 2014: Direct feedback
Yale SSI Project Highlights: What worked well?

- **Tri-Chair Leadership Structure**
  - Oversight
  - Frontline practitioner/surgeon involvement
  - Stakeholder buy-in
  - Communication

- **GYN Specific Bundle**
  - Based on Institutional data

- **Frontline feedback**
  - Consistent and standardized process
  - Sustainability
Next Steps...

- Perioperative glycemic control and FIO2
- Work with other services with outlier SSI rates
- Ensure sustainability
  - Automating process metric reports
  - Surveillance of institutional data
  - SSI education for housestaff and in Healthstream
Acknowledgements:
John Boyce, MD
Robert Stout, MD
Susan Maxwell, RN
Transabdominal SSI Team