

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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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**

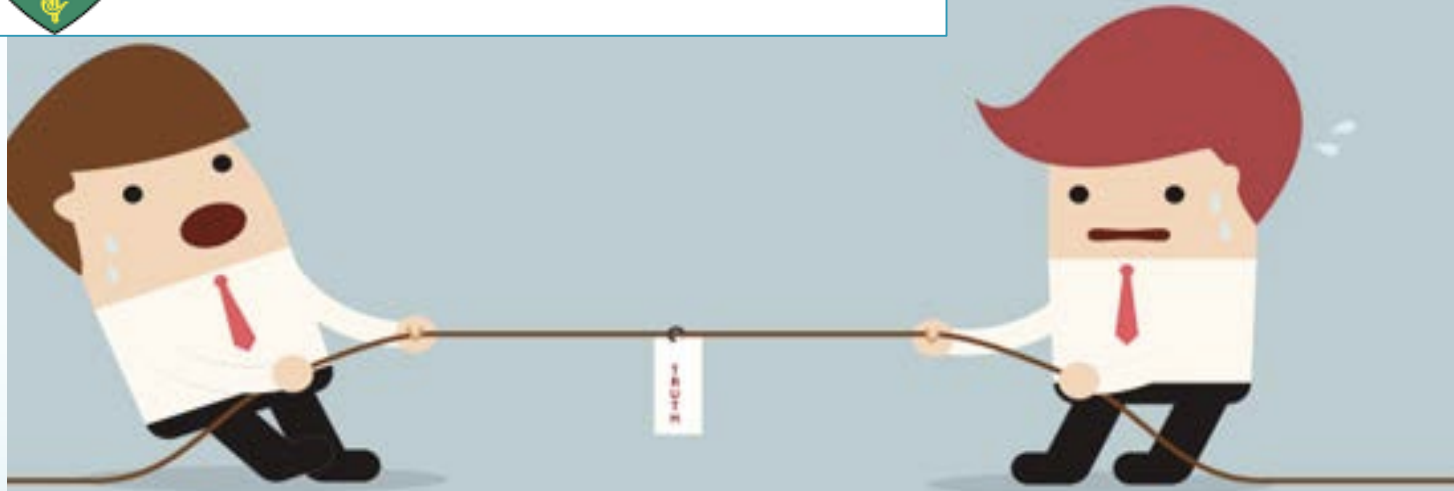
Yale New Haven Hospital: Background information

- 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



Yale University
School of Medicine



YaleNewHavenHealth

Yale New Haven Hospital

Worse than benchmark...

CMS Compare Website 2012

YALE-NEW HAVEN
HOSPITAL

Central line-associated bloodstream infections (CLABSI)

Better than the U.S. National
Benchmark

Catheter-associated urinary tract infections (CAUTI)

Worse than the U.S. National
Benchmark

Surgical site infections from colon surgery (SSI: Colon)

No Different than U.S. National
Benchmark

Surgical site infections from abdominal hysterectomy (SSI: Hysterectomy)

Worse than the U.S. National
Benchmark

SIR 2.19

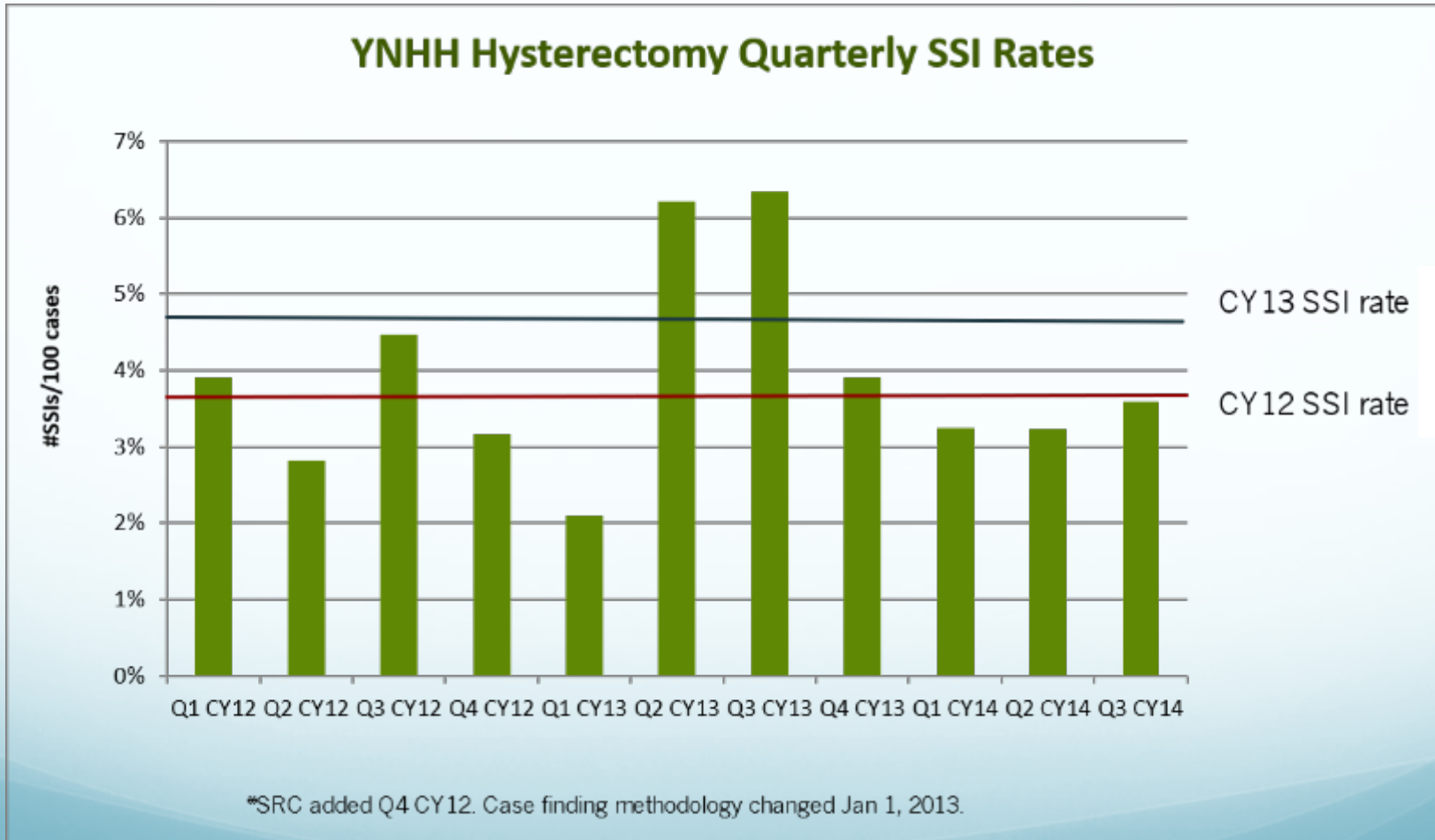
Methicillin-resistant *Staphylococcus Aureus* (MRSA) Blood Laboratory-identified Events
(Bloodstream infections)

No Different than U.S. National
Benchmark

Clostridium difficile (C.diff.) Laboratory-identified Events (Intestinal infections)

Worse than the U.S. National
Benchmark

The starting point...



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

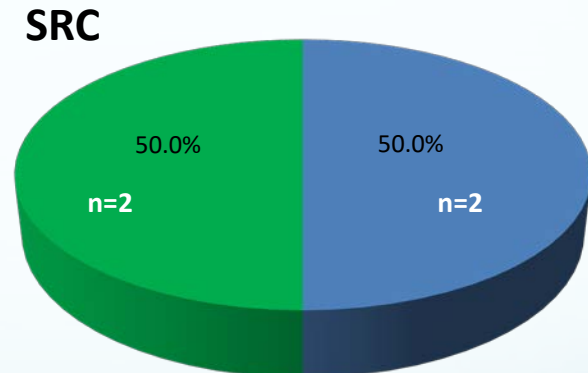
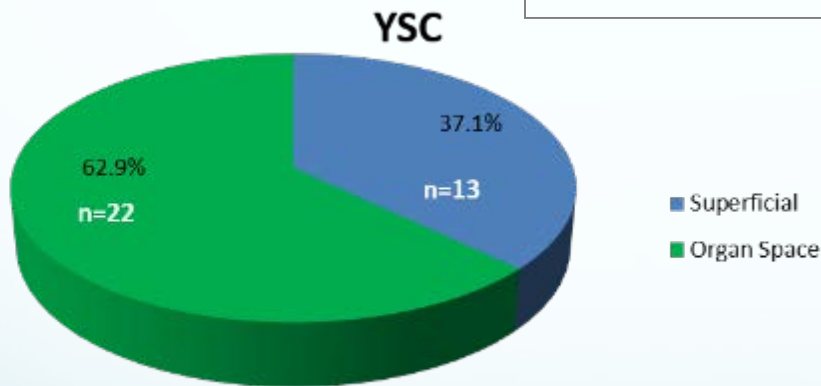
Superficial

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

January – June 2014

Organ Space

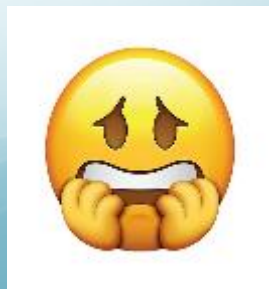
- Candida albicans
- Enterococcus sp.



Classifications 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
 - Anesthesiology—MD
 - Nursing Leader
- Sponsor
 - Senior VP/CQO YNHH
 - Surgical Director of Performance and QI



Yale SSI Project Highlights: What worked well?

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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.”*

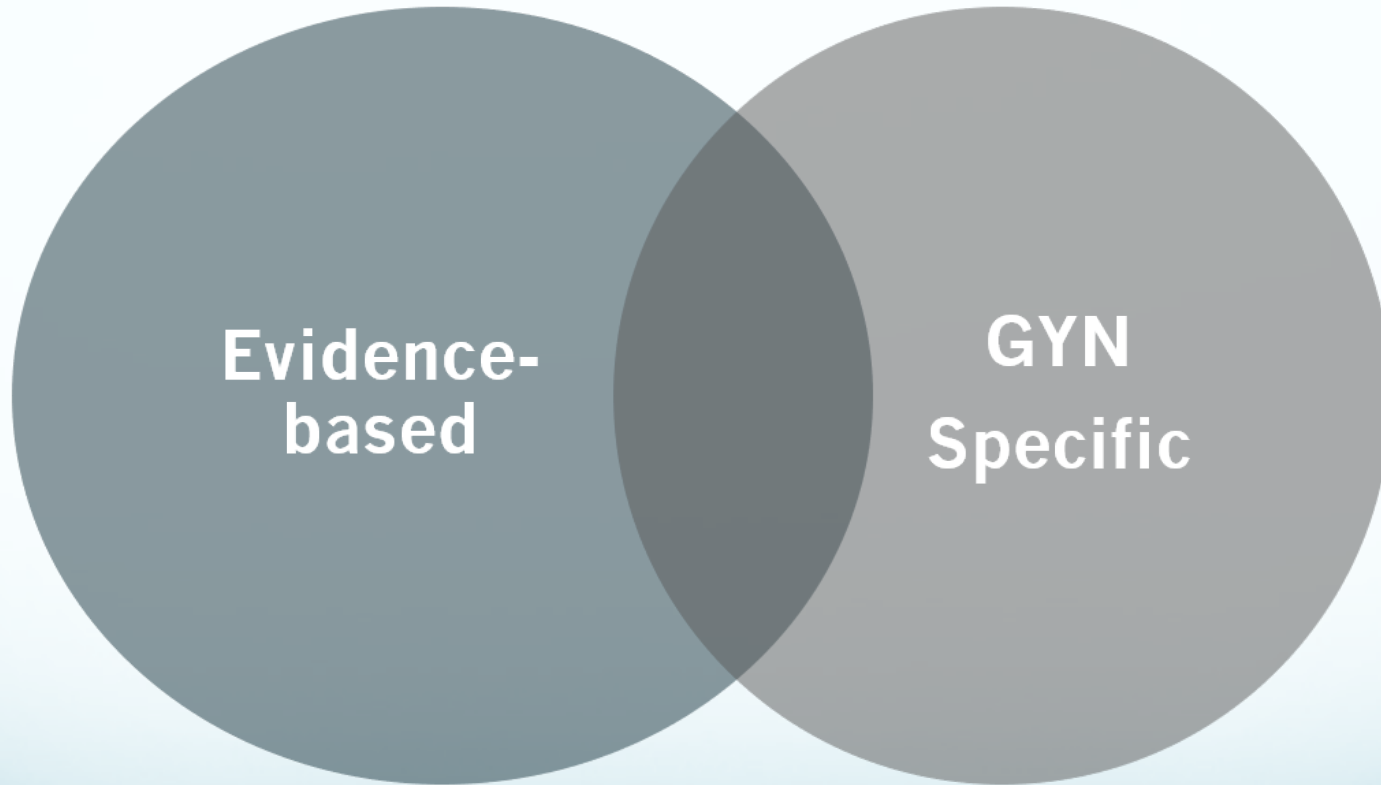
—as defined by the Institute for Healthcare Improvement (IHI)

Creating the Yale bundle...

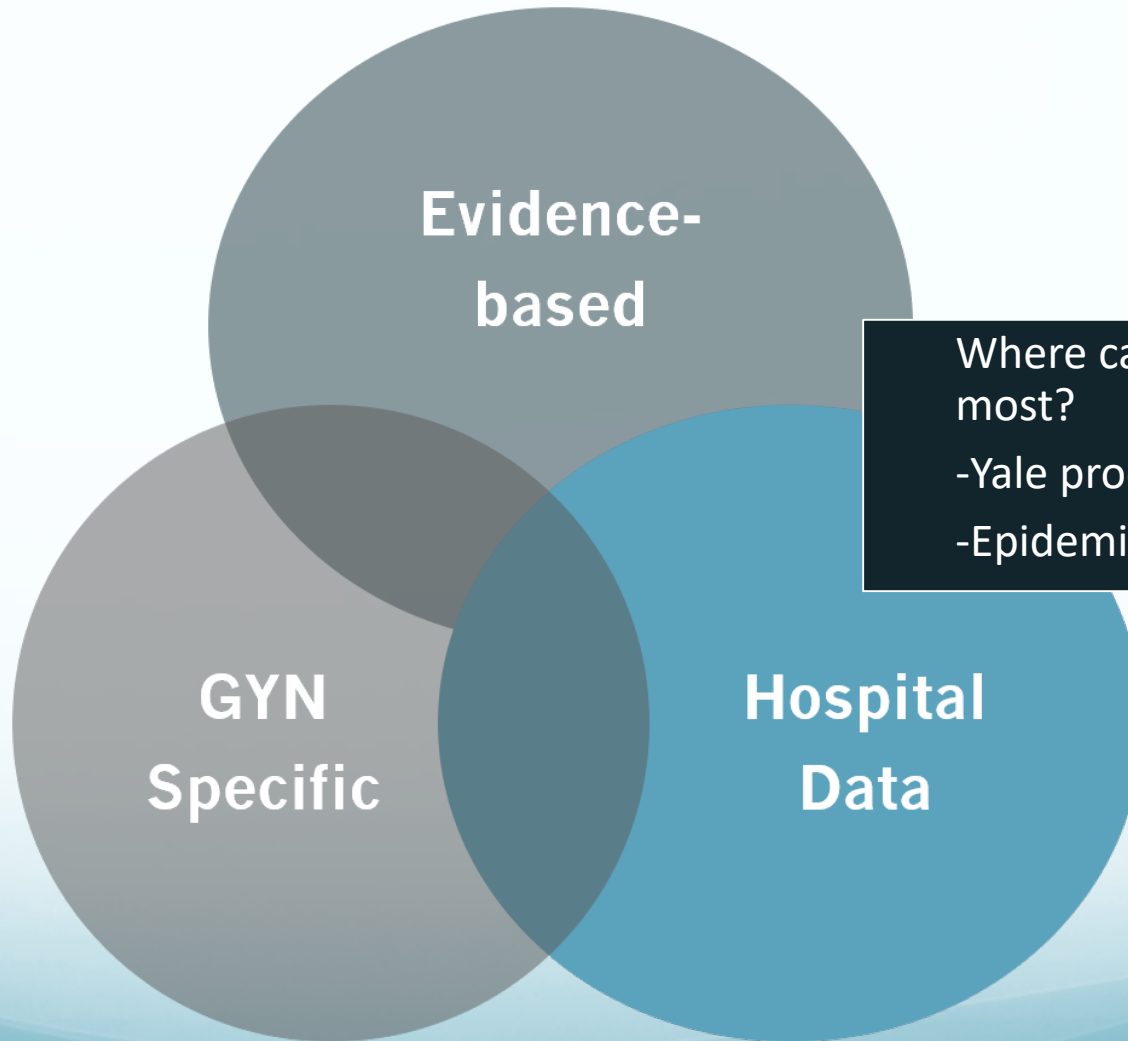


Evidence-based

Creating the Yale bundle...



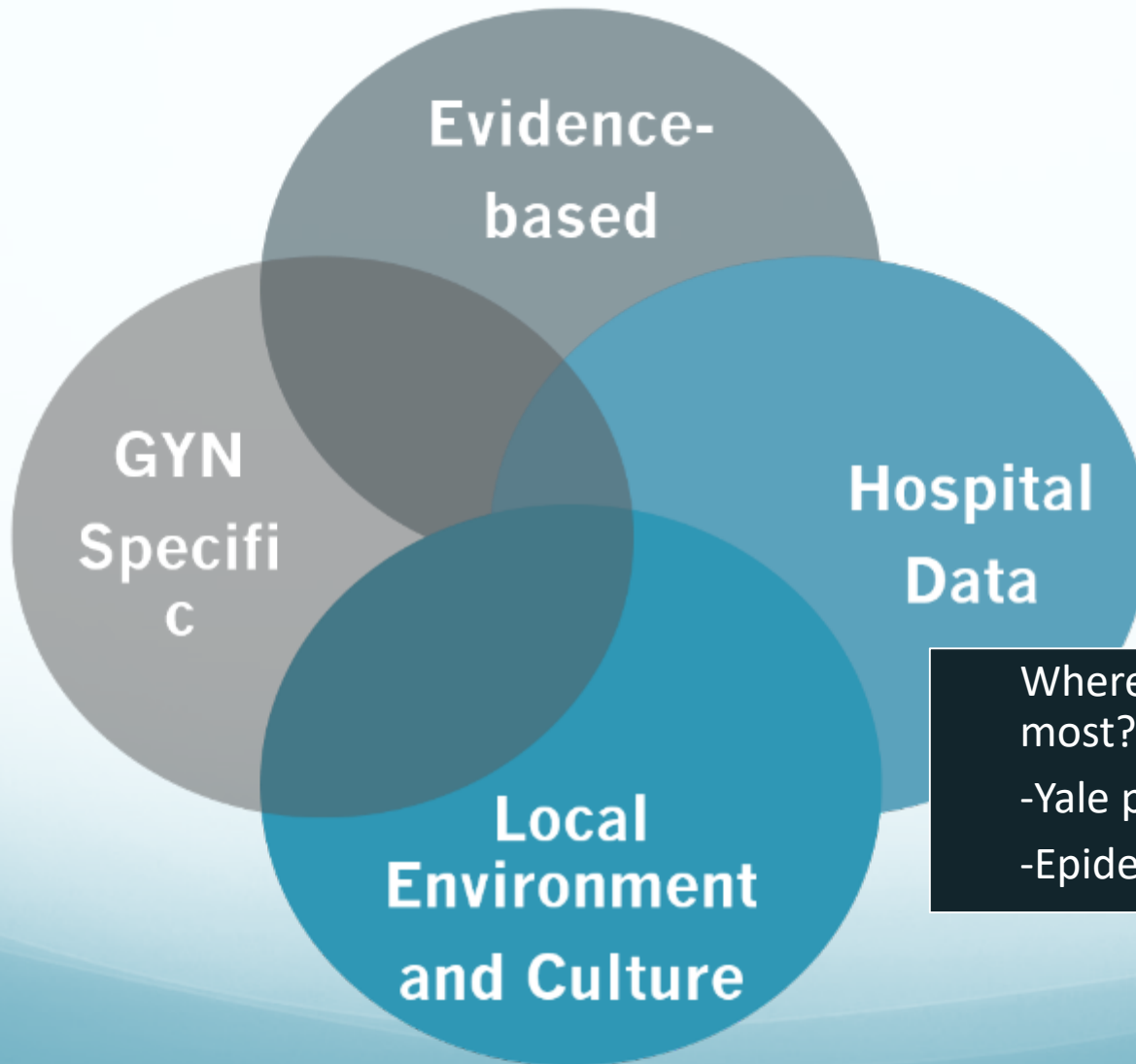
Creating the Yale bundle...



Where can we improve most?

- Yale process metrics
- Epidemiologic data

Creating the Yale bundle...



Where can we improve most?

- Yale process metrics
- Epidemiologic data

Strong Recommendation

Timely and Appropriate Preoperative Antimicrobial Agents
(accepted)

Shower or bath at least night prior
(accepted)

Skin prep with alcohol-based antiseptic
(high)

No additional prophylactic ABX after surgery even with drain
(high)

Normothermia
(high to moderate)

Periop Glycemic control, Target < 200 mg/dL
(high to moderate)

Increase FiO2 during procedure and after extubation
(moderate)

No Antimicrobial agent to incision
(Low)

Weak Recommendation

Autologous platelet-rich plasma
(moderate)

Triclosan-coated sutures
(moderate)

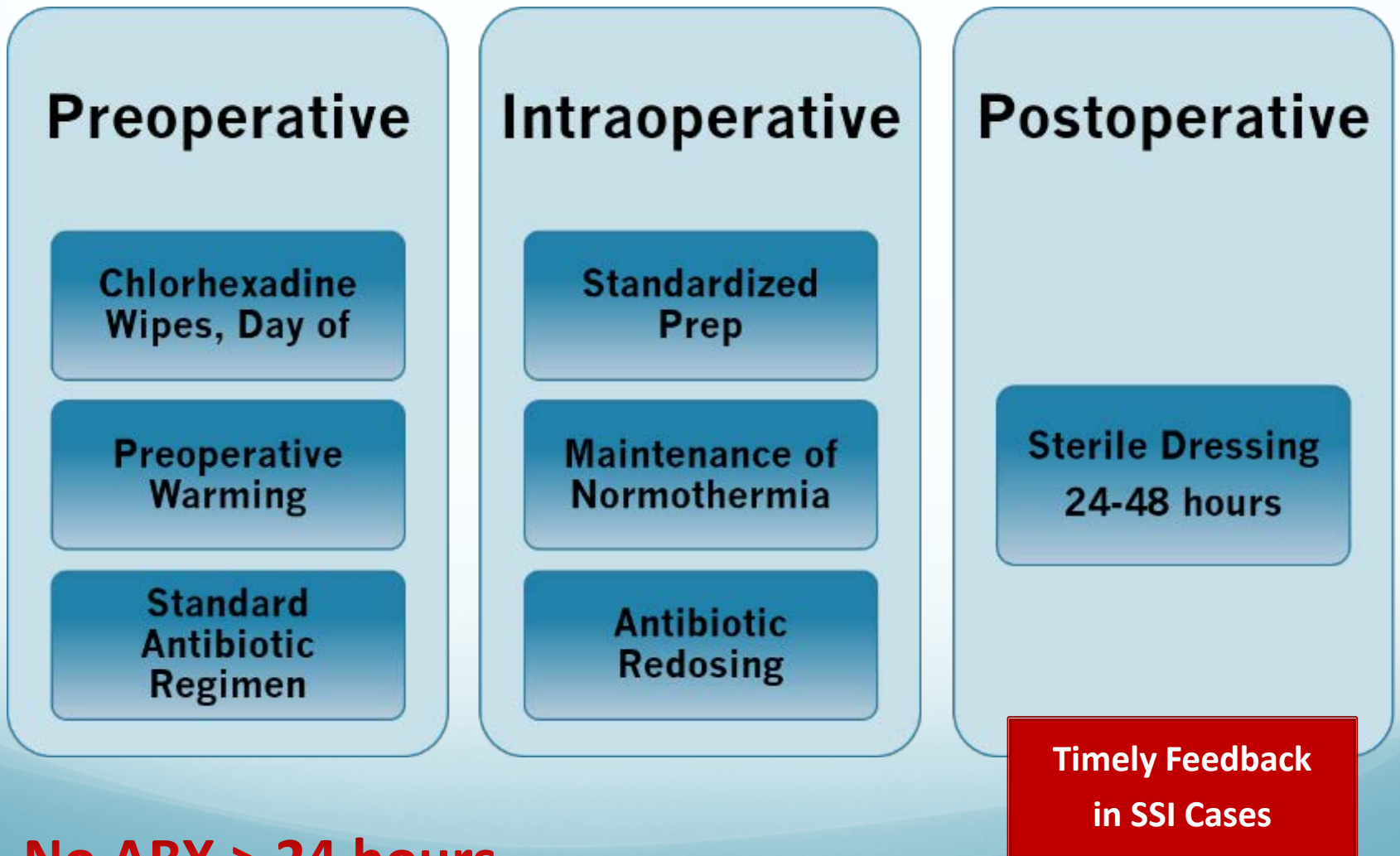
Application of microbial sealant after prep
(low)

Use of plastic adhesive drapes +/- antimicrobial properties
(high to moderate)

Intraop irrigation of deep/subcut tissues with aqueous iodophor solution (not in dirty/contaminated)
(moderate)

CDC Guidelines: Prevention of SSI (2017)

The GYN SSI Bundle



No ABX > 24 hours

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

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

Edmiston C et al. Am J Infect Control 2007;35:89

Wick EC et al. J Am Coll Surg 2012;215:193

Lutfiyya W et al. Permanente J 2012;16:10

Cima R et al. J Am Coll Surg 2013;216:23

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

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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

Horn E-P et al. Anesth Analg 2002;94:409

Chung Sh et al. Korean J Anesthesiol 2012;62:454

Horn EP et al. Anaesthesia 2012;67:612

Hypothermia Predisposes to Surgical Site Infection

First Author	Type of Surgery	Reference
Kurz A	Colorectal	NEJM 1996;334:1209
Flores-Maldonado A	Cholecystectomy	Arch Med Res 2001;32:227
McAnally HB	Pediatric cardiovascular	Pediatr Infect Dis J 2001;20:459
Weber WP	Visceral, vascular, trauma	Ann Surg 2008;247:918
Sumer BD	Head and Neck	Arch Otolaryngol Head Neck Surg 2009;135:682
Seamon MJ	Trauma	Ann Surg 2012;255:789
Hendren S	Colectomy	Ann Surg 2013;257:469
Melling A	Clean surgery	Lancet 2001;358:876
Wong PF	Major bowel surgery	Br J Surg 2007;94:421

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)

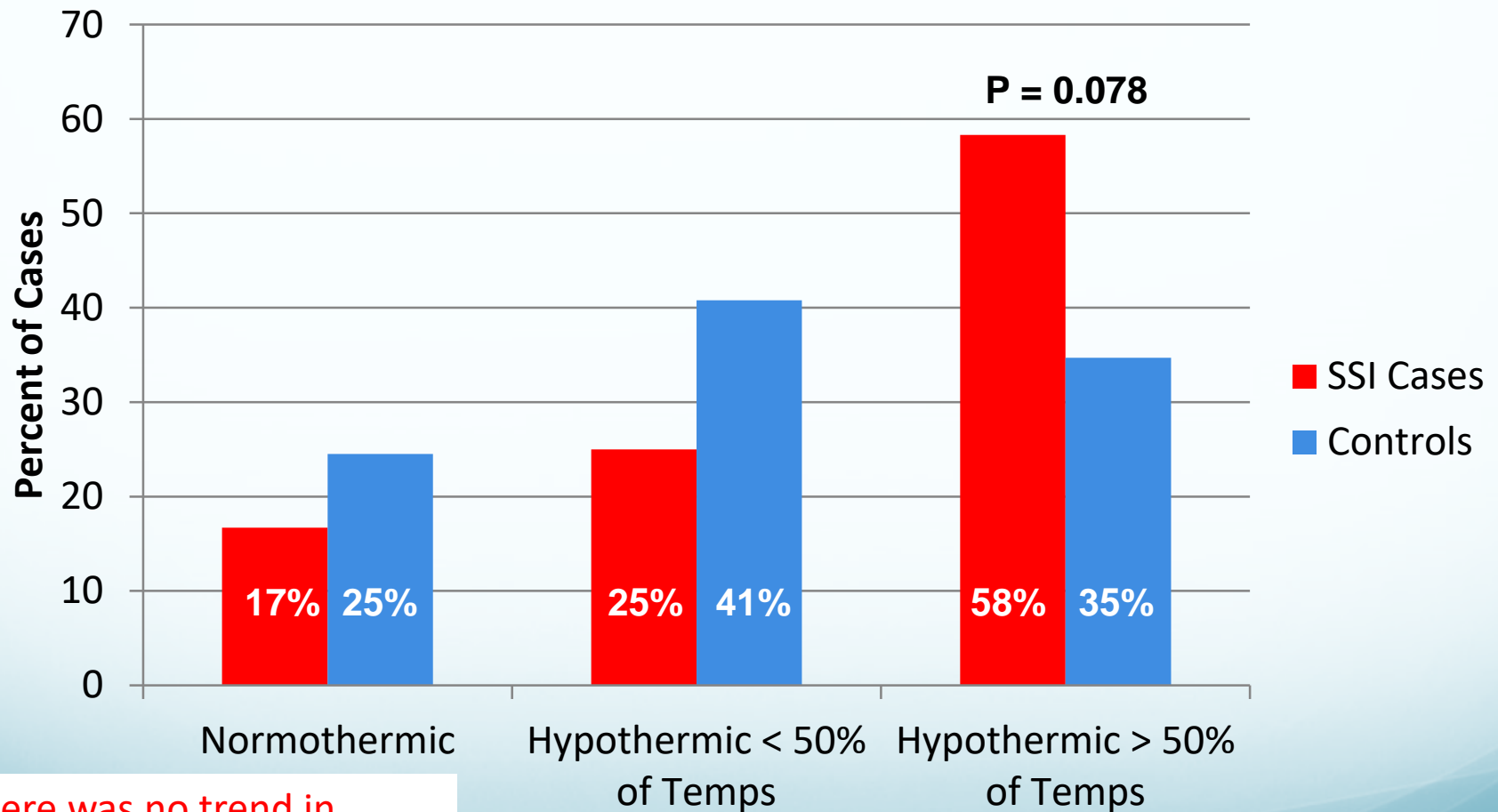
Yale data 2013:

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 \geq 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

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in SSI Cases

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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

Antibiotic Prophylaxis for Hysterectomy

Table 1. Antimicrobial Prophylactic Regimens by Procedure*

Procedure	Antibiotic	Dose (single dose)
Hysterectomy	Cefazolin [†]	1 g or 2g [†] IV
Urogynecology procedures, including those involving mesh	Clindamycin [§] plus gentamicin or quinolone [‡] or aztreonam	600 mg IV 1.5 mg/kg IV 400 mg IV 1 g IV
	Metronidazole [§] plus gentamicin or quinolone [‡]	500 mg IV 1.5 mg/kg IV 400 mg IV
	None	



**ACOG
PRACTICE
BULLETIN**



2013 Clinical Practice Guidelines

SURGICAL INFECTIONS
Volume 14, Number 1, 2013
Mary Ann Liebert, Inc.
DOI: 10.1089/sur.2013.9999

***Surgical Infection
Society Guidelines***

Clinical Practice Guidelines for Antimicrobial Prophylaxis in Surgery

Dale W. Bratzler,¹ E. Patchen Dellinger,² Keith M. Olsen,³ Trish M. Perl,⁴ Paul G. Auwaerter,⁵
Maureen K. Bolon,⁶ Douglas N. Fish,⁷ Lena M. Napolitano,⁸ Robert G. Sawyer,⁹ Douglas Slain,¹⁰
James P. Steinberg,¹¹ and Robert A. Weinstein¹²

- 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)

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- 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

Pathogen	Number of Isolates
<i>Bacteroides fragilis</i>	10
<i>Enterococcus</i>	7
<i>E. Coli</i>	6
Meth sensitive <i>S. aureus</i>	6

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

Mixed flora	3
Others	7 (1 anaerobic)

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

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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

ChloroPrep 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

ChloroPrep 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 ChloroPrep vs DuraPrep, so no conclusion regarding which might be better

Hibiclens for Vaginal Prep



The American College of
Obstetricians and Gynecologists
WOMEN'S HEALTH CARE PHYSICIANS

COMMITTEE OPINION

Number 571, September 2013

(Reaffirmed 2017)

Committee on Gynecologic Practice

This document reflects emerging clinical and scientific advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed.

[PDF Format](#)

Solutions for Surgical Preparation of the Vagina

ABSTRACT: Currently, only povidone-iodine preparations are approved for vaginal surgical-site antisepsis. However, there are compelling reasons to consider chlorhexidine gluconate solutions for off-label use in surgical preparation of the vagina, especially in women with allergies to iodine. Although chlorhexidine gluconate solutions with high concentrations of alcohol are contraindicated for surgical preparation of the vagina, solutions with low concentrations of alcohol (eg, 4%) are both safe

- 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

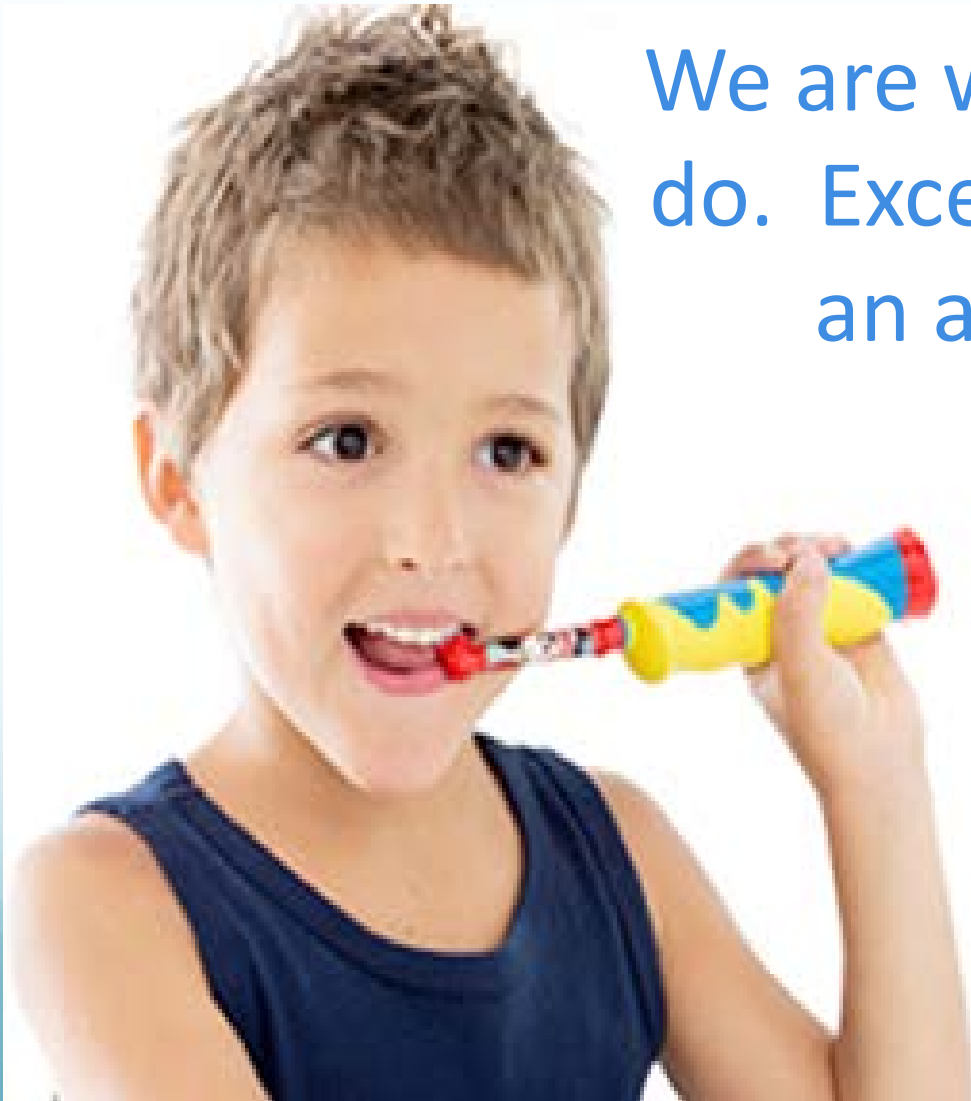
- Use of video:
 - Delivered consistent and standardized message
 - Empowered staff and housestaff
- Two chlorhexidine/alcohol prep types was confusing
 - Duraprep- paint
 - Chloraprep - 30 seconds at incision
(Video)

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

Surgeon	OR Room	Emergent	Prior Location	Wndclass	Pre OP Warming: Bair paws	CHG Wipes	Prep	Upper Body Warming	Lowerbody, Full Underbody OR Lithotomy	% <36	abx choice	Min prior to incision	BMI	Redosed	Duration	Closure	Infection Date	Infection Type	PATOS	Organism
XXXX	SP07	Y	EP47	CC	Y	Y	chloraprep	N	Lower body	0	already on antibiotics received dose 2g Cefazolin before incision	0:20	29	Y	4:03	midline incision with #1 PDS in a running fashion. closed the skin of all the wounds with staples	10/20/2017	superficial	N	No culture
XXXX	SRC 12	Y	3SOUTH	D	N	Y	chloraprep	Y	N	24%	already on antibiotics received dose 2g Cefazolin before incision	0:29	22.8	Y	3:56	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	10/29/2017	Organ Space	Y	mixed

- Feedback via formal process
- Collate themes from SSI cases for future work

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



MEMO

Yale
NewHaven
Health
Yale New Haven
Hospital

TO: XXXXXX,MD

FROM: Surgical Site Infection
Performance Improvement Team
XXXX, MD Tri-Chair
XXXX, RN Tri-Chair
XXXX, MD Tri-Chair

DATE: [Pick the date]

RE: Surgical site infection prevention
guidance

CC: Medical Staff Office
Chair of Department

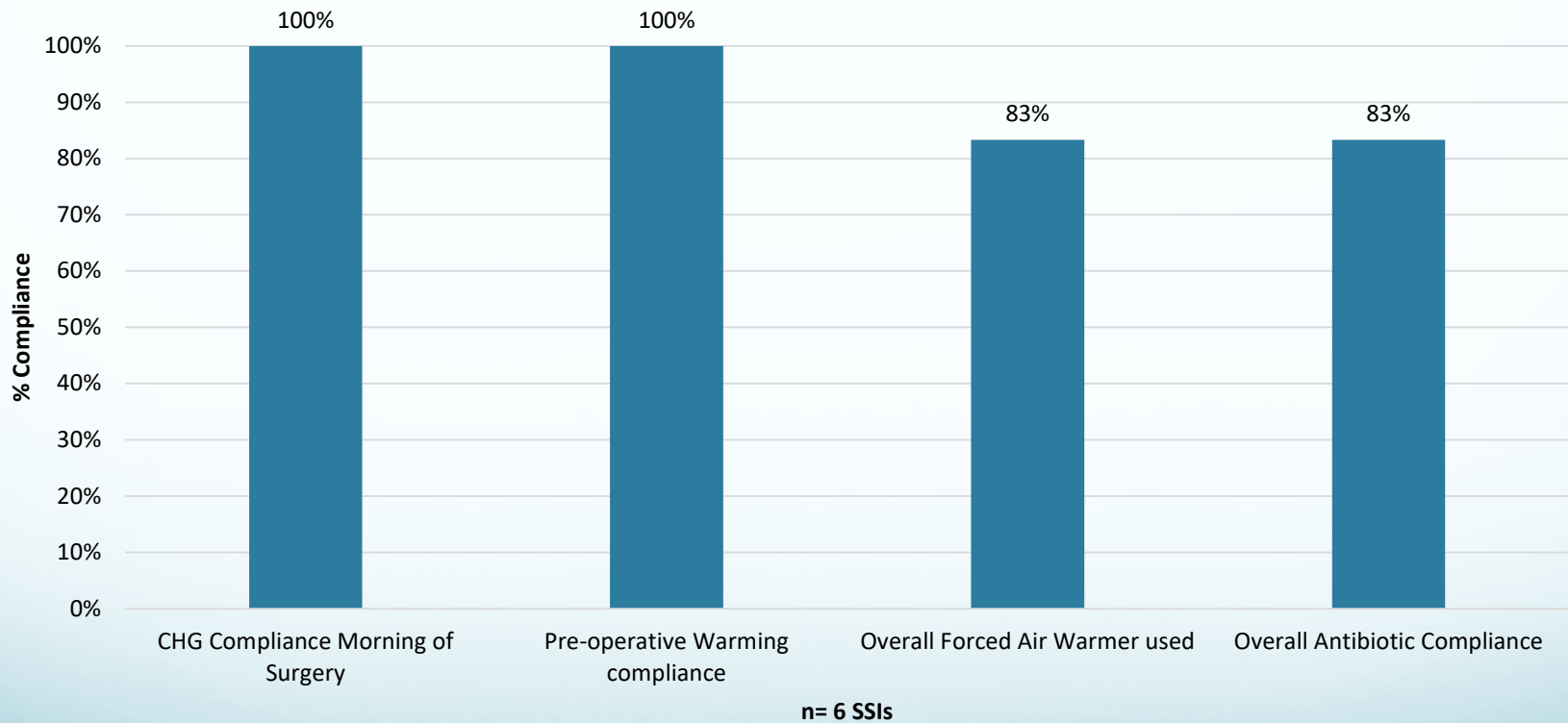
Infection Prevention identified that your patient, XXXX MR XXXX, who underwent a total abdominal hysterectomy and bilateral salpingo-oophorectomy on XX/XX/XX, subsequently developed a superficial surgical site infection (SSI). On XX/XX/XX, purulent drainage was noted around the stoma which was drained. The criteria used by Infection Prevention to identify SSIs are based on definitions developed by the Centers for Disease Control and Prevention/National Healthcare Safety Network.

Upon further review of the medical record, all elements of our current surgical site infection prevention bundle were followed. However, the SSI-PI team would appreciate any feedback you can provide regarding this case so we can identify trends to prevent future infections.

The entire surgical team has been notified of this surgical site infection through individual memos. This feedback is important as all individuals of the surgical team share responsibility in practicing 200% accountability to ensure delivery of the highest quality of care. We appreciate your time and effort as well as your assistance in following the surgical site infection prevention bundle. The

Monthly SSI Data Review: Compliance/Misses

FY2017 Abdominal Hysterectomy SSI Overall Compliance with SSI Bundle



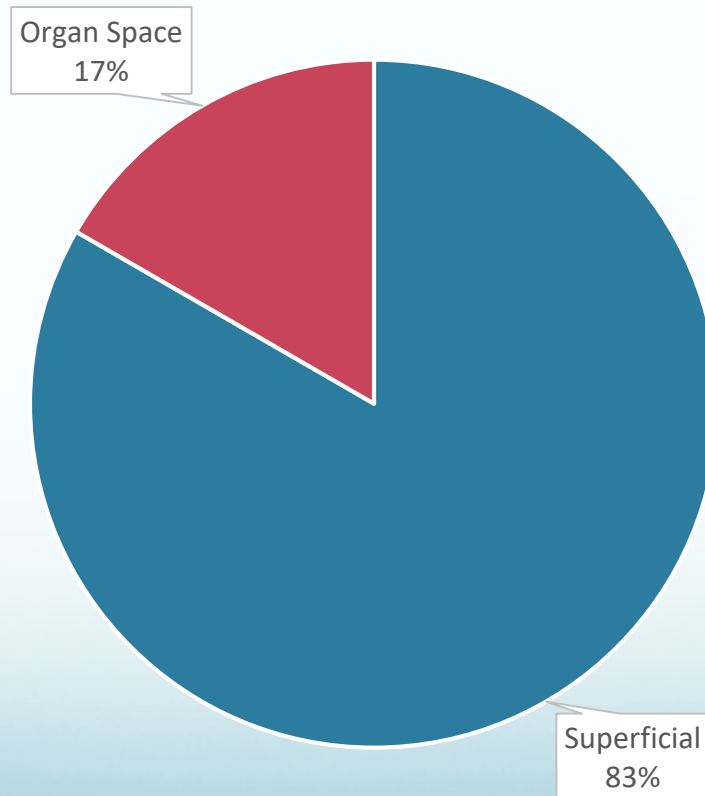
How did we do?

From 4.7 % SSI Rate in 2013...

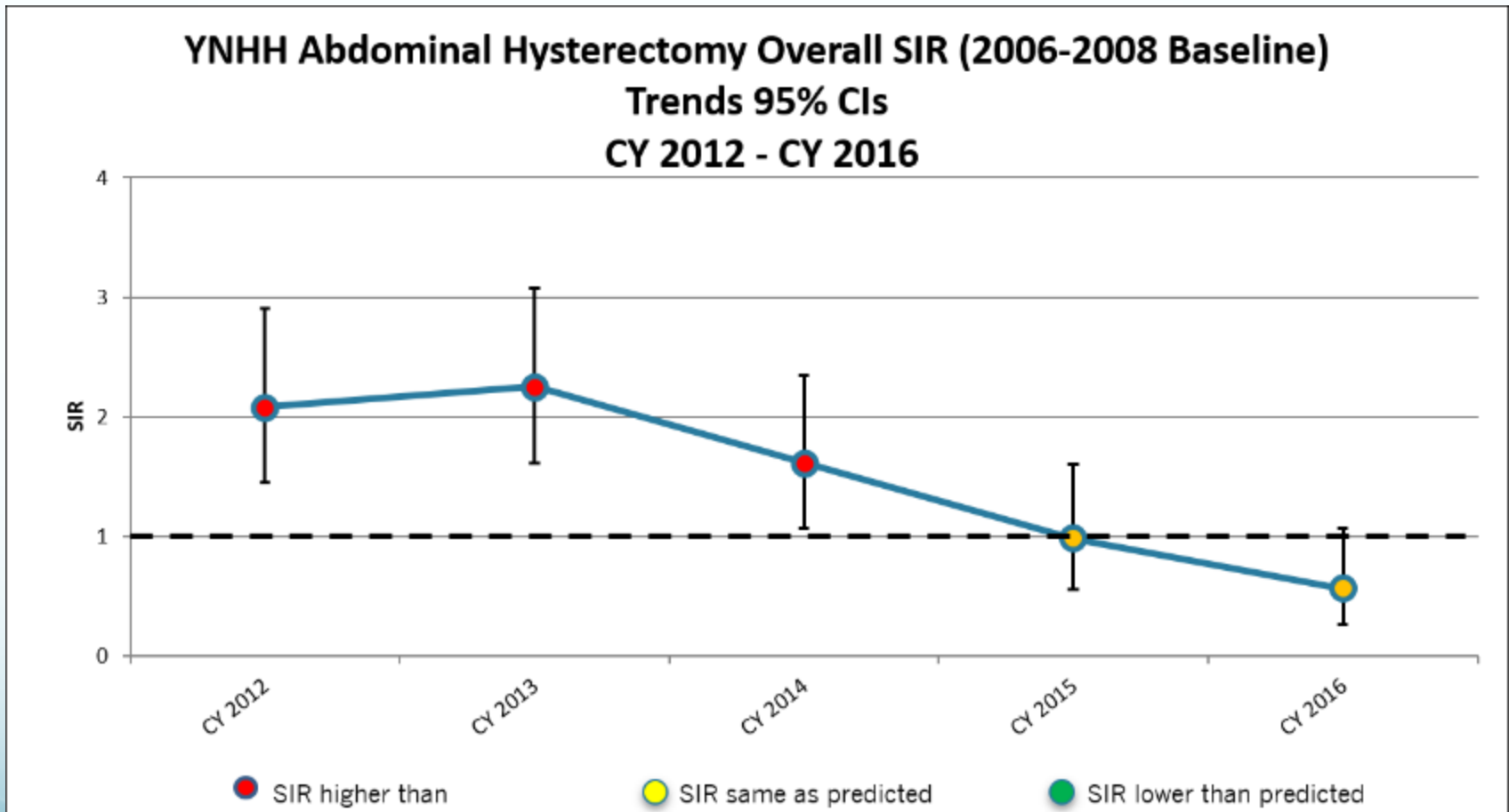


FY2017: Less than 1% SSI and Sustaining

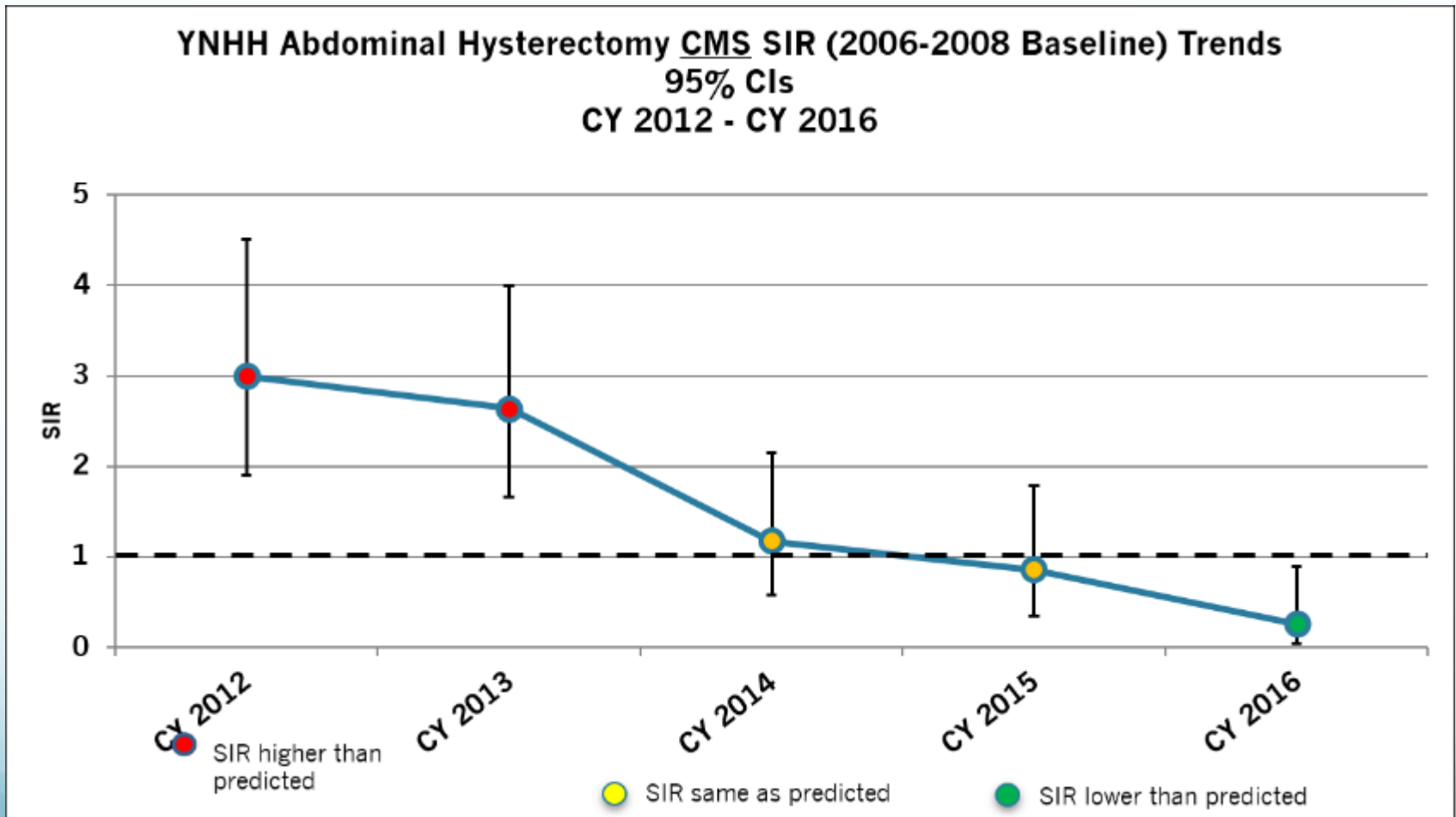
- 6 Abd. Hysterectomy Surgical Site Infections



Abdominal Hysterectomy SSI Standardized Infection Ratio CY2012-CY2016



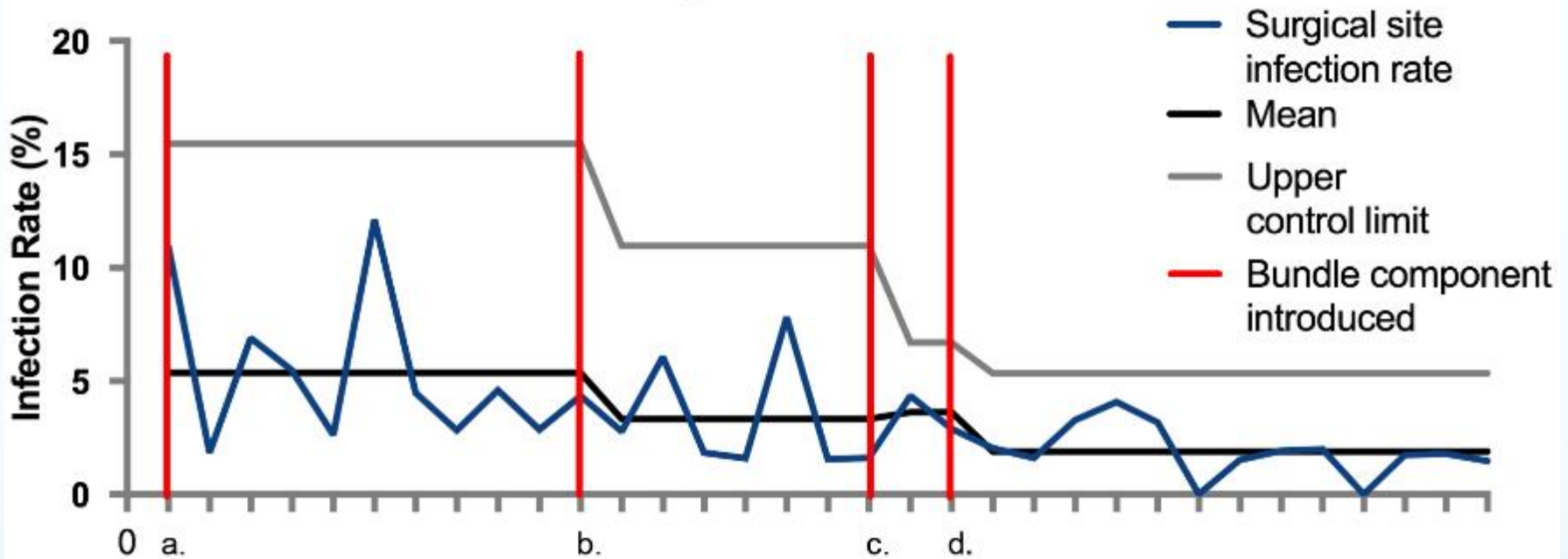
Abdominal Hysterectomy SSI *CMS Standardized Infection Ratio CY2012-CY2016



*CMS SIR Excludes all superficial incisional SSIs.

Yale SSI Prevention Project 2013-2015

All Surgical Site Infections



- April 2013: Chlorhexidine-impregnated wipes, pre-operative warming, standardized aseptic technique, primary dressing 24-48 hours
- March 2014: Intraoperative normothermia,
- October 2014: Standardized antibiotic dosing
- 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



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