Postop Infection Following Abdominal Hysterectomy Risk Factors and Effective Interventional Strategies

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Objectives

- To examine risk factors for surgical site infection following hysterectomy

- To review current infection prevention strategies for hysterectomy procedures

Why focus on hysterectomy?

- One of the most commonly performed operations, particularly in the United States
- Lifetime risk of a hysterectomy is 45%
- Vast majority are for benign gynecological conditions
- Literature on gyn cancer hysterectomy outcomes is very limited

Reporting of hysterectomy infections

- Inpatient
- Abdominal, not vaginal
- Open or laparoscopic included
- Implications
- Risk adjustment

Epidemiology

Rates of Infection

- Total Abdominal Hysterectomy
- Laparoscopic hysterectomy
- Vaginal hysterectomy
- Robot-assisted hysterectomy

Changes in trends of hysterectomy procedures (benign)

- 40% decline in inpatient settings
- Move to outpatient settings
- Minimally invasive
- Surveillance challenges

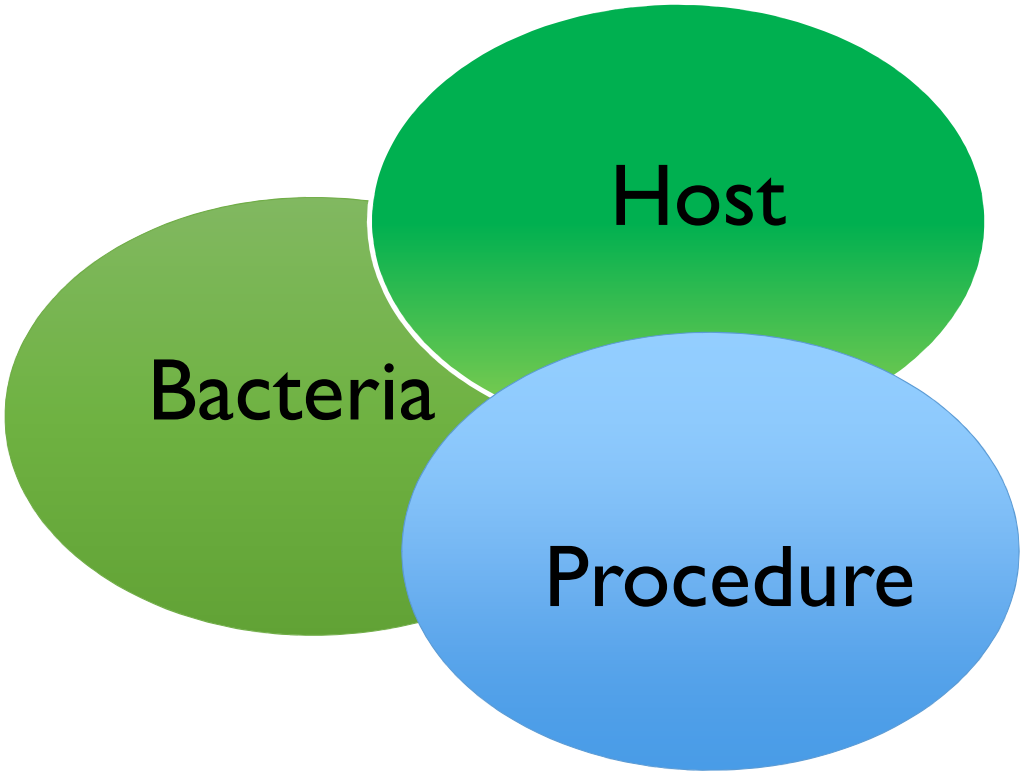
Risk factors for SSI

Risk factor

- Obesity
- Blood Transfusion
- Blood loss during surgery

Surg Infect (Larchmt). 2011 Dec;12(6):491-6. doi: 10.1089/sur.2010.103. Epub 2011 Dec 5.
Beyond core measures: identifying modifiable risk factors for prevention of surgical site infection after elective total abdominal hysterectomy.
Young H[1], Bliss R, Carey JC, Price CS.

Pathogenesis of SSI



Risk factors for SSI

- Secondary database analysis of the 2005-09 American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) participant use data files
- Women undergoing hysterectomies performed by gynecologic services.
- Voluntary and confidential.
  - This information is collected by a formal chart review process in addition to 30-day postoperative follow-up on patients.

Am J Obstet Gynecol. 2013 Nov; 209(5): 10.1016/j.ajog.2013.06.018.
Published online 2013 Jun 13. doi: 10.1016/j.ajog.2013.06.018
Surgical site infection after hysterectomy
AeuMuro G. Lake, MD et al.

Variable	Adjusted OR	95% CI	*P*
Route of hysterectomy			
TVH (referent)	1	--	--
Laparotomy	3.74	(2.26, 6.22)	<.001
Laparoscopic	1.45	(0.83, 2.56)	.20
Operative time > 75th percentile duration	1.84	(1.40, 2.44)	<.001
ASA Class 3 or higher	1.79	(1.31, 2.43)	<.001
BMI category			
BMI < 30 kg/m^2 (referent)	1	--	--
BMI ≥ 30 and < 40 kg/m^2	1.31	(0.94, 1.81)	.11
BMI ≥ 40 kg/m^2	2.65	(1.85, 3.80)	<.001
Diabetes mellitus	1.54	(1.06, 2.24)	.02

Laparotomy included total abdominal hysterectomy and supracervical hysterectomy Laparoscopic included laparoscopic-assisted vaginal hysterectomy, total laparoscopic hysterectomy, and laparoscopic supracervical hysterectomy.

OR= Odds Ratio; CI= Confidence Interval; TVH = total vaginal hysterectomy; ASA= American Society of Anesthesiologists; BMI= body mass index

Box 3. Patient Risk Factors for Surgical Site Infection

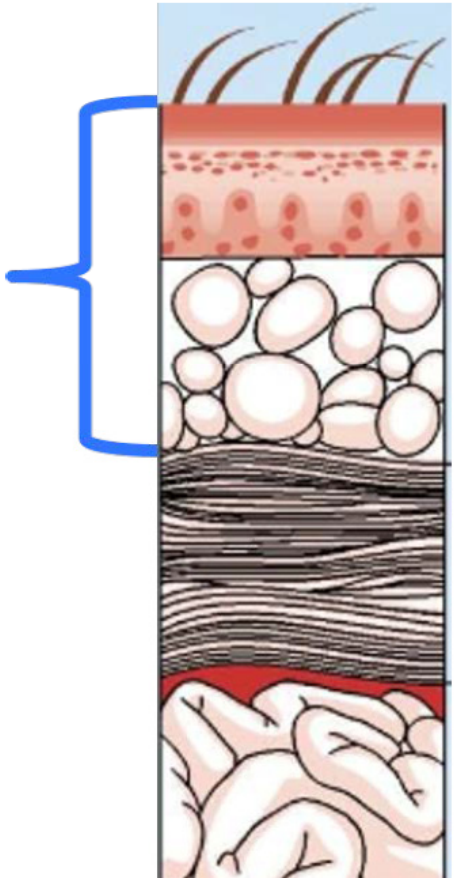
- Perioperative hyperglycemia
  —Perioperative serum glucose greater than or equal to 180–200 mg/dL
- Smoking
- Obesity (BMI ≥30 or BMI Prime* ≥1.2)
- Nutritional status
- Depth of subcutaneous tissue ≥3 cm
- Coexistent infection at a remote body site (eg, skin, urinary tract)
- Vaginal colonization with microorganisms (eg, Group B streptococcal infection, bacterial vaginosis)
- American Society of Anesthesiologists Physical Status†

Abbreviations: BMI, body mass index; MRSA, methicillin-resistant *Staphylococcus aureus*.

*Ratio of actual to upper limit BMI (currently defined as healthy BMI=25).

- MRSA status
- Immunodeficiency

Superficial Incisional SSI



Must meet the following criteria:

Infection occurs within 30 days after any NHSN operative procedure (where day 1 = the procedure date)

AND

involves only skin and subcutaneous tissue of the incision

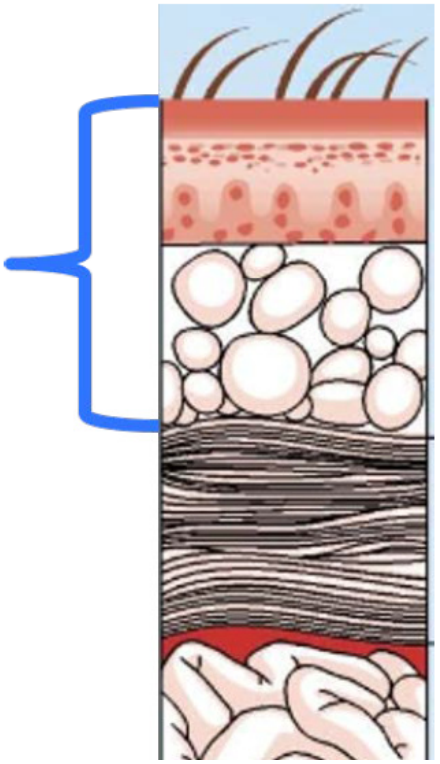
AND

patient has at least one of the following:

a. purulent drainage from the superficial incision.

b. organisms identified from an aseptically-obtained specimen from the superficial incision or subcutaneous tissue by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment (for example, not Active Surveillance Culture/Testing (ASC/AST).

Superficial Incisional SSI



c. superficial incision that is deliberately opened by a surgeon, attending physician** or other designee and culture or non-culture based testing is not performed

AND

patient has at least one of the following signs or symptoms: pain or tenderness; localized swelling; erythema; or heat.

d. diagnosis of a superficial incisional SSI by the surgeon or attending physician** or other designee.

Organ Space Infection

- Involves any part of the body deeper than the fascial/muscle layers that is opened or manipulated during the operative procedure
- AND at least one of the following:
  - a. purulent drainage from a drain that is placed into the organ/space
  - b. organism(s) identified from fluid or tissue in the organ/space
  - c. an abscess or other evidence of infection involving the organ/space that is detected on gross anatomical or histopathologic exam, or imaging test evidence suggestive of infection.

Purulence

- NHSN does not define purulent drainage as there is no standard, clinically agreed upon definition.

- Generally, thick/viscous, creamy/opaque fluid discharge with or without blood seen at the site or documentation of pus/purulence by a medical professional would be accepted evidence of purulent drainage.

- At this time NHSN does not use any gram stain results such as WBCs or Poly's to define purulence for the SSI protocol.

Microbiology

- Skin flora
- Anaerobes/Gram-negatives/enterococcus
- MRSA less common
- Bacterial vaginosis important for vaginal hysterectomy

Perioperative Antibiotic Prophylaxis

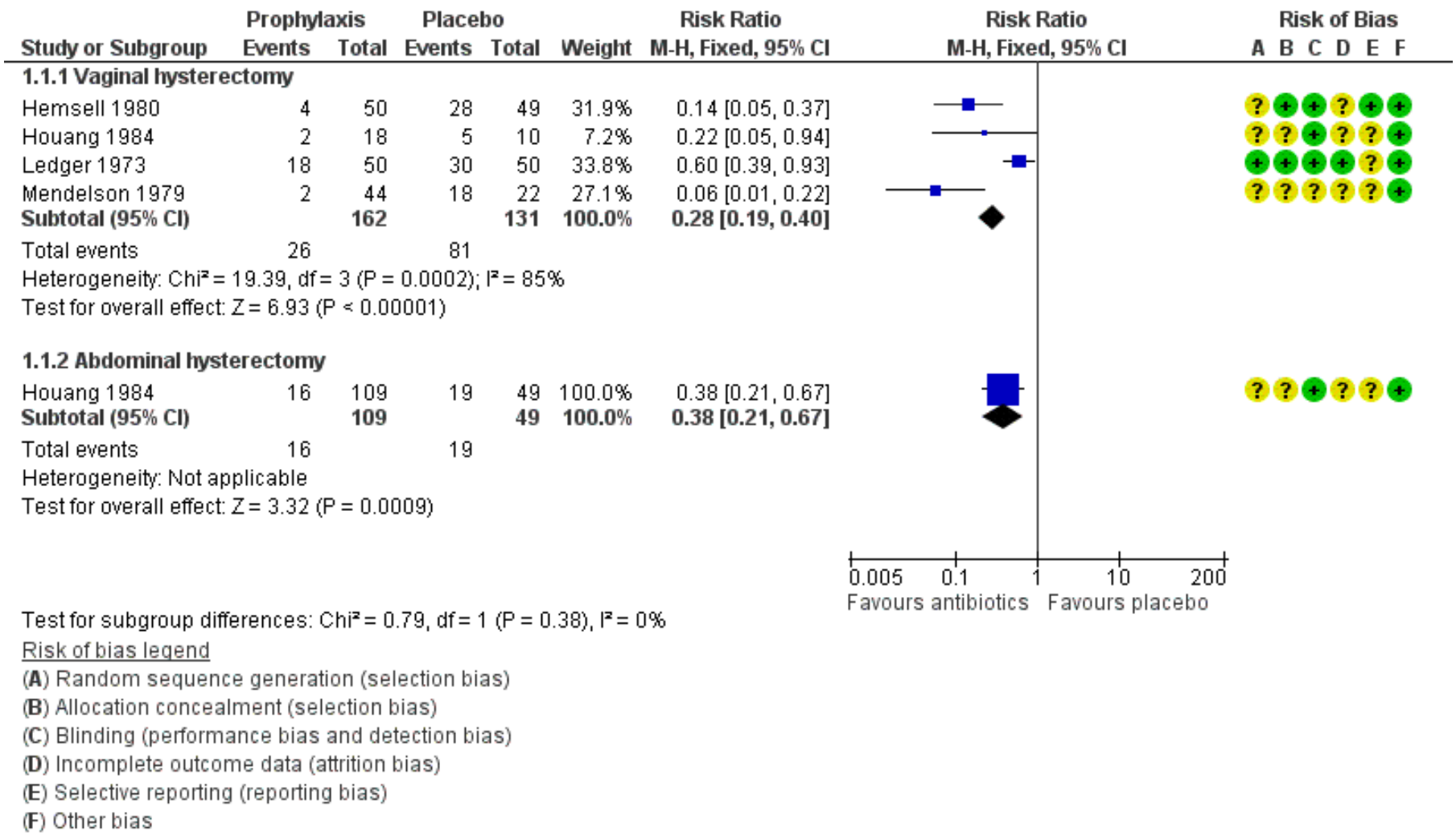
- National guidelines recommend abx prophylaxis for all types of hysterectomy
- Implementation and choice of antibiotic varies widely
- Single dose recommended
- Important considerations; weight, blood loss, allergies

Limitations of the literature

- Older randomized trials so some agents no longer in use or considered best practice
- Variable duration of abx prophylaxis
- Patient population with largely benign procedures

Cochrane Review of Abx prophylaxis in hysterectomy

- **Types of participants**
- Women of any age **without serious comorbidity (such as cancer)** undergoing an elective total or subtotal abdominal, vaginal, laparoscopic, or laparoscopically assisted hysterectomy, with or without oophorectomy, for a benign gynecological condition such as fibroids, endometriosis, uterovaginal prolapse, or heavy menstrual bleeding.



4. Forest plot of comparison: 1 Any antibiotic versus placebo, outcome: 1.1 Total postoperative infections - early and late.

Ayeleke RO, Mourad SM, Marjoribanks J, Calis KA, Jordan V. Antibiotic prophylaxis for elective hysterectomy. Cochrane Database of Systematic Reviews 2017, 6. Art. No.: CD004637. DOI: http://dx.doi.org/10.1002/14651858.CD004637.pub2

Table 2: Recommended Antibiotic Dosing and Redosing Intervals

Antibiotic	Recommended Dose	Half-Life (With Normal Renal Function)	Recommended Redosing Interval (From Initiation of Preoperative Dose)
Ampicillin	2 g	1–1.9 hrs	2 hrs
Cefazolin	2 g (*3 g for patients weighing > 120 kg*)	1.2–2.2 hrs	4 hrs
Aztreonam	2 g	1.3–2.4 hrs	4 hrs
Cefuroxime	1.5 g	1–2 hrs	4 hrs
Cefoxtaxime	1 g	0.9–1.7 hrs	3 hrs
Cefoxitin	2 g	0.7–1.1 hrs	2 hrs
Cefotetan	2 g	2.8–4.6 hrs	6 hrs
Ceftriaxone	2 g	5.4–10.9 hrs	N/A*
Ciprofloxicin	400 mg	3–7 hrs	N/A*
Clindamycin	900 mg	2–4 hrs	6 hrs
Gentamicin	5 mg/kg *based on dosing weight*† (single dose)	2–3 hrs	N/A†
Vancomycin	15 mg/kg	4.8 hrs	N/A*

What is the best agent for antibiotic prophylaxis if penicillin allergy?

Table 2. Antibiotic Prophylaxis Regimens in Patients With Immediate Hypersensitivity Reactions* to Penicillin

Agent	Dose	Half Life (h)	Interval to Repeat (h)
Clindamycin	900 mg	2–4	6
or			
Metronidazole	500 mg	6–8	NA†
PLUS‡			
Gentamicin	5 mg/kg§	2–3	NA†
or			
Aztreonam	2 g	1.3–2.4	4

*Anaphylaxis, urticaria, or bronchospasm. Patients with exfoliative dermatitis (Stevens–Johnson syndrome, toxic epidermal necrolysis) from β-lactam antibiotics should also not receive cephalosporins.

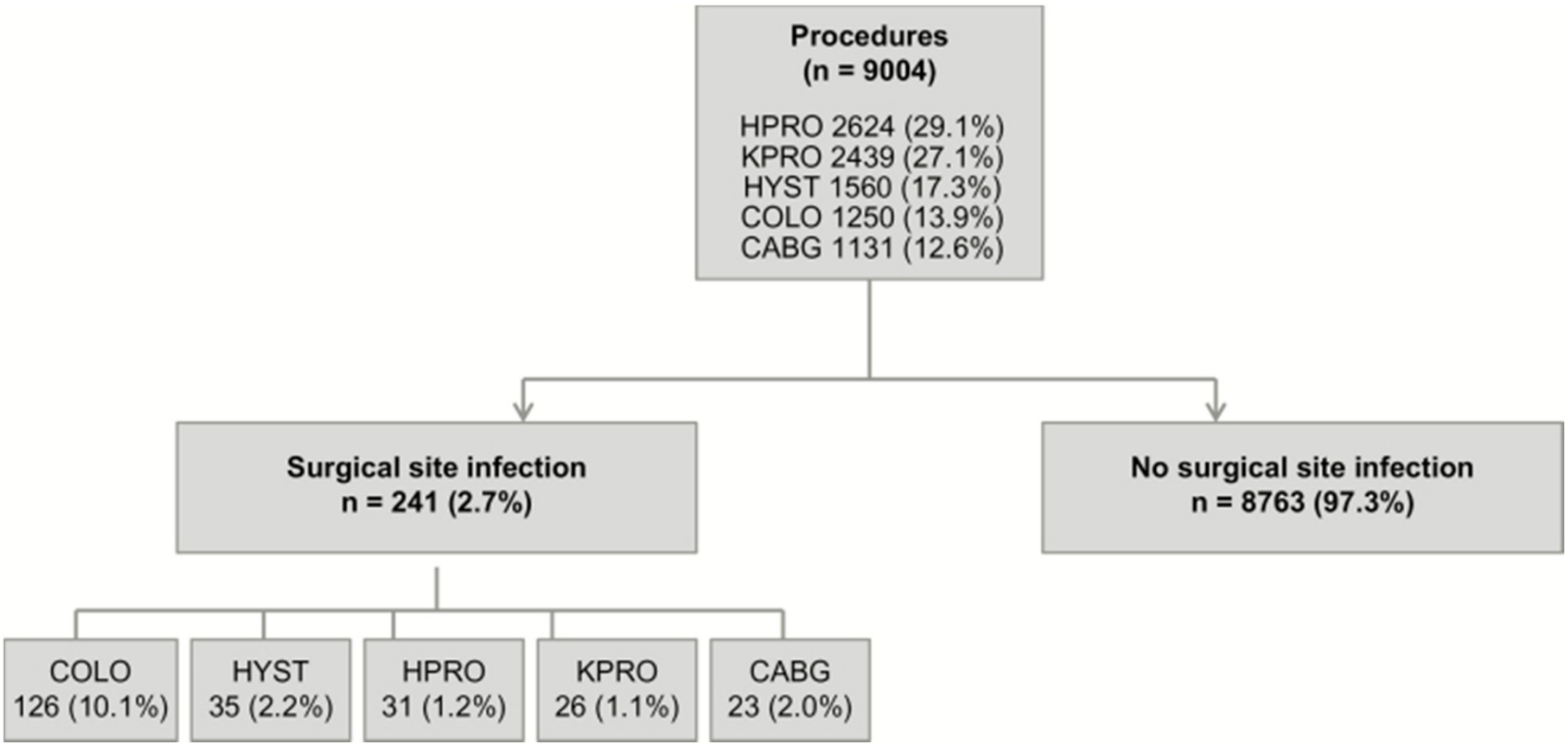
†No repeat administration is needed.

Allergy to beta-lactam and implications

- Appropriate use of perioperative antibiotics can decrease the incidence of SSIs.
- A beta-lactam antibiotic is the preferred perioperative antibiotic.
- For the 10% of patients who report a prior penicillin allergy, non–beta-lactam antibiotics (eg, clindamycin, vancomycin) are given.
- However, 90%–99% of patients with a reported penicillin allergy are not truly allergic (ie, there is no immediate hypersensitivity) and <3% of patients with an allergy to penicillin will also react to cefazolin.

Clin Infect Dis. 2018 Feb 1; 66(3): 329–336.
Published online 2017 Oct 9. doi: 10.1093/cid/cix794
PMCID: PMC5850334
PMID: 29361015
The Impact of a Reported Penicillin Allergy on Surgical Site Infection Risk
Kimberly G Blumenthal,[1,2,3,4] Erin E Ryan,[5,6] Yu Li,[1,2] Hang Lee,[4,7] James L Kuhlen,[8] and Erica S Shenoy[2,4]

Allergy to beta-lactam and implications



Hypersensitivity Reactions,[a] n = 718 (68.9%)

Rash[b]	346 (37.5)
Urticaria[b]	166 (18.0)
Angioedema or swelling[b]	82 (8.9)
Anaphylaxis[b]	42 (4.6)
Itching[b]	41 (4.5)
Shortness of breath[b]	19 (2.1)
Flushing[b]	12 (1.3)
Hypotension[b]	5 (0.5)
Acute interstitial nephritis[c]	2 (0.2)
Blister[c]	2 (0.2)
Stevens-Johnson syndrome or toxic epidermal necrolysis[c]	1 (0.1)

Reactions Identified for the 922 Patients Reporting Penicillin Allergy (n = 1042)

[a]Twenty-one patients had both hypersensitivity reactions and side effects to penicillin.

[b]Reactions amenable to penicillin allergy evaluation (ie, penicillin skin testing and/or test dose challenges).

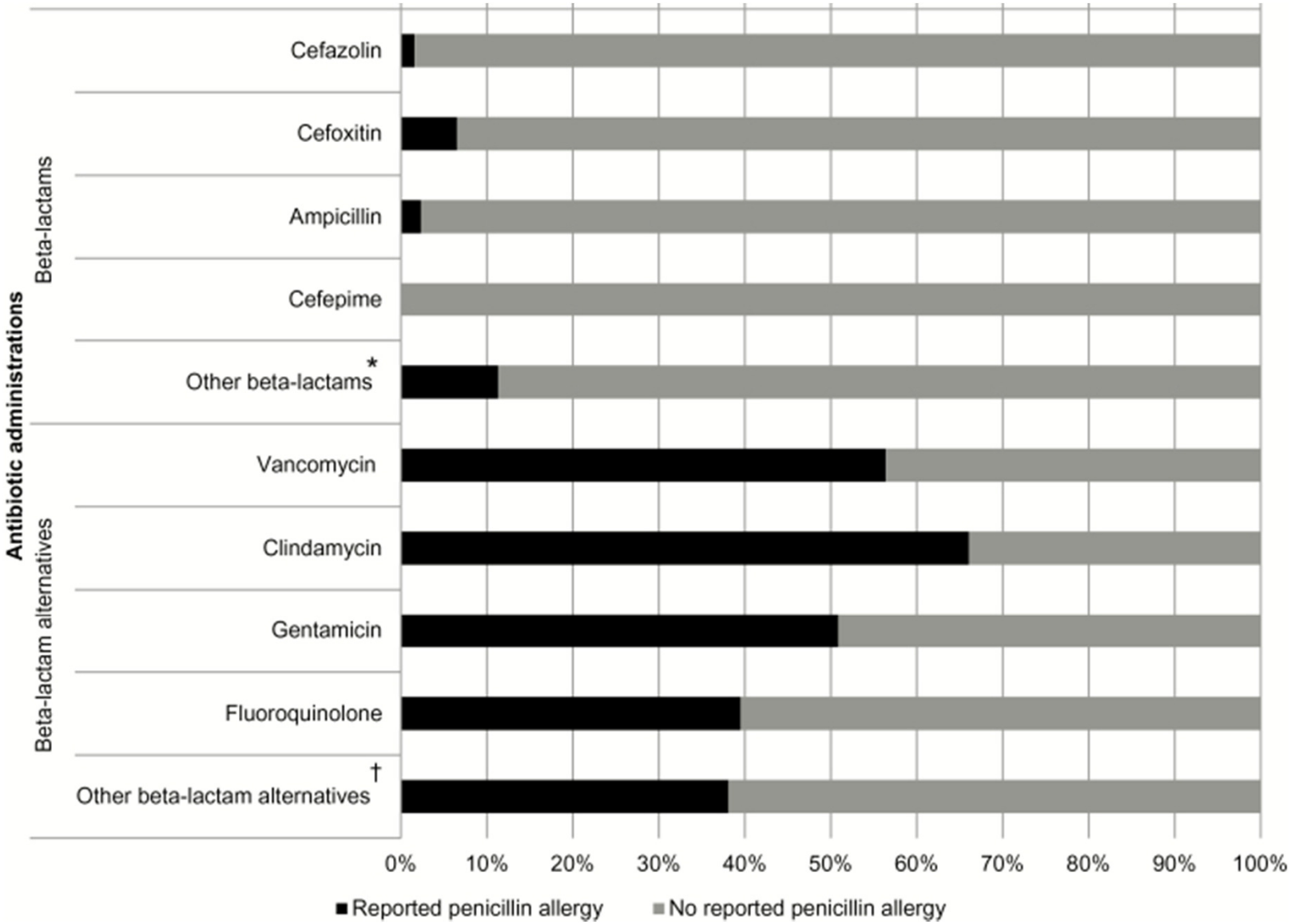
[c]Reactions that are potential contraindications to beta-lactam antibiotic administrations.

Side Effects and Intolerances, n = 89 (8.5%)

- Gastrointestinal symptoms
- 51 (5.5)
- Renal damage
- 2 (0.2)
- Headache
- 4 (0.4)
- Fever
- 2 (0.2)
- Mental status change
- 4 (0.4)
- Musculoskeletal symptoms
- 7 (0.8)
- Other adverse reactions
- 19 (2.1)
- Unknown Reactions, n = 235 (25.5%)[b]

Impact of a Reported Penicillin Allergy on Surgical Site Infection

Adjustment	Odds ratio (95% confidence interval)	*P* value
None (univariable)	1.36 (.94–1.97)	.10
Surgery type	1.45 (1.00–2.12)	.051
Surgery type, age, sex, and race	1.49 (1.02–2.18)	.04
Surgery type, age, sex, race, American Society of Anesthesiologists class, procedure duration, and wound class	1.51 (1.02–2.22)	.04


Antibiotic administrations
Beta-lactams
Beta-lactam alternatives
Cefazolin
Cefoxitin
Ampicillin
Cefepime
Other beta-lactams *
Vancomycin
Clindamycin
Gentamicin
Fluoroquinolone
Other beta-lactam alternatives †
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Reported penicillin allergy
No reported penicillin allergy

INTERNATIONAL JOURNAL OF GYNECOLOGICAL CANCER

Guidelines for perioperative care in gynecologic/oncology: Enhanced Recovery After Surgery (ERAS) Society recommendations—2019 update

Gregg Nelson,[1] Jamie Bakkum-Gamez,[2] Eleftheria Kalogera,[3] Gretchen Glaser,[4] Alon Altman,[5] Larissa A Meyer,[6] Jolyn S Taylor,[7] Maria Iniesta,[6] Javier Lasala,[8] Gabriel Mena,[8] Michael Scott,[9] Chelsia Gillis,[10] Kevin Elias,[11] Lena Wijk,[12] Jeffrey Huang,[13] Jonas Nygren,[14] Olle Ljungqvist,[15] Pedro T Ramirez,[16] Sean C Dowdy[17]

- **Routine pre-operative bowel preparation should not be used before minimally invasive gynecologic surgery**.
- Its use is **similarly discouraged before open laparotomy in gynecologic surgery/gynecologic oncology,** especially within an established ERAS pathway.
- Surgeons who feel bowel preparation is necessary should limit its use to patients in which a colon resection is planned.
- In these cases the use of oral antibiotics alone should be considered or combined with mechanical bowel preparation.
- High quality data from the colorectal literature have shown that **mechanical bowel preparation alone does not decrease post-operative morbidity and should thus be abandoned**.
- Evidence level: moderate
- Recommendation grade: strong

Chlorhexidine bathing

Contents lists available at ScienceDirect

American Journal of Infection Control

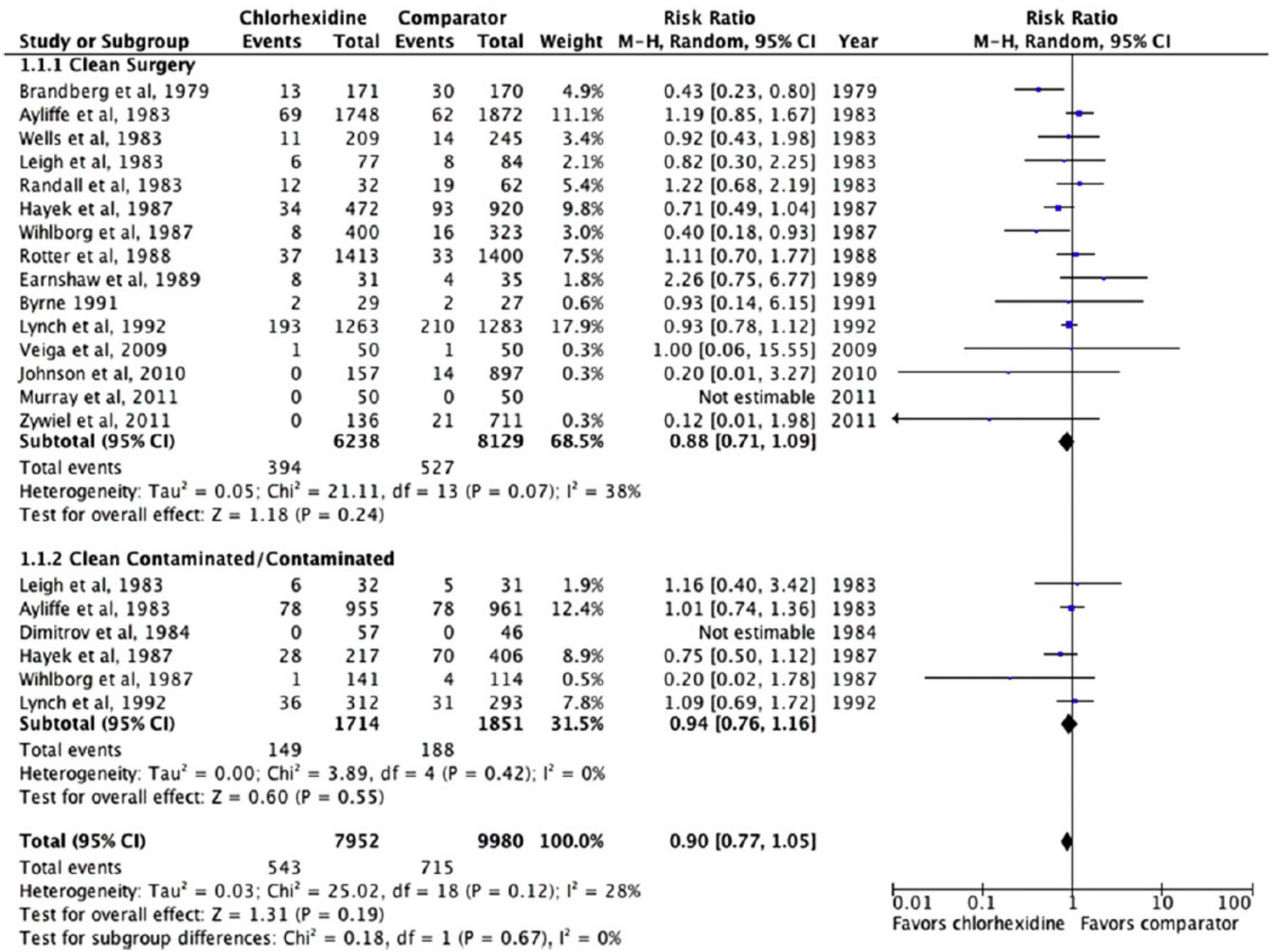
journal homepage: www.ajicjournal.org

Review article

Preoperative chlorhexidine shower or bath for prevention of surgical site infection: A meta-analysis

Maciej Piotr Chlebicki MD [a], Nasia Safdar MD, PhD [b,c,d,*], John Charles O'Horo MD [e], Dennis G. Maki MD [b,c]

[a] *Department of Infectious Diseases, Singapore General Hospital, Singapore*
[b] *Section of Infectious Diseases, Department of Medicine, University of Wisconsin Medical School, Madison, WI*
[c] *Infection Control Department, University of Wisconsin Hospital and Clinics, Madison, WI*
[d] *William S. Middleton Memorial Veterans Hospital, Madison, WI*
[e] *Department of Graduate Medical Education, Aurora Healthcare, Milwaukee, WI*


Chlorhexidine
Comparator
Risk Ratio
Risk Ratio
Study or Subgroup
Events
Total
Events
Total
Weight
M-H, Random, 95% CI
Year
M-H, Random, 95% CI
1.1.1 Clean Surgery
Brandberg et al, 1979 13 171 30 170 4.9% 0.43 [0.23, 0.80] 1979
Ayliffe et al, 1983 69 1748 62 1872 11.1% 1.19 [0.85, 1.67] 1983
Wells et al, 1983 11 209 14 245 3.4% 0.92 [0.43, 1.98] 1983
Leigh et al, 1983 6 77 8 84 2.1% 0.82 [0.30, 2.25] 1983
Randall et al, 1983 12 32 19 62 5.4% 1.22 [0.68, 2.19] 1983
Hayek et al, 1987 34 472 93 920 9.8% 0.71 [0.49, 1.04] 1987
Wihlborg et al, 1987 8 400 16 323 3.0% 0.40 [0.18, 0.93] 1987
Rotter et al, 1988 37 1413 33 1400 7.5% 1.11 [0.70, 1.77] 1988
Earnshaw et al, 1989 8 31 4 35 1.8% 2.26 [0.75, 6.77] 1989
Byrne 1991 2 29 2 27 0.6% 0.93 [0.14, 6.15] 1991
Lynch et al, 1992 193 1263 210 1283 17.9% 0.93 [0.78, 1.12] 1992
Veiga et al, 2009 1 50 1 50 0.3% 1.00 [0.06, 15.55] 2009
Johnson et al, 2010 0 157 14 897 0.3% 0.20 [0.01, 3.27] 2010
Murray et al, 2011 0 50 0 50 Not estimable 2011
Zywiel et al, 2011 0 136 21 711 0.3% 0.12 [0.01, 1.98] 2011
Subtotal (95% CI) 6238 8129 68.5% 0.88 [0.71, 1.09]
Total events 394 527
Heterogeneity: Tau² = 0.05; Chi² = 21.11, df = 13 (P = 0.07); I² = 38%
Test for overall effect: Z = 1.18 (P = 0.24)
1.1.2 Clean Contaminated/Contaminated
Leigh et al, 1983 6 32 5 31 1.9% 1.16 [0.40, 3.42] 1983
Ayliffe et al, 1983 78 955 78 961 12.4% 1.01 [0.74, 1.36] 1983
Dimitrov et al, 1984 0 57 0 46 Not estimable 1984
Hayek et al, 1987 28 217 70 406 8.9% 0.75 [0.50, 1.12] 1987
Wihlborg et al, 1987 1 141 4 114 0.5% 0.20 [0.02, 1.78] 1987
Lynch et al, 1992 36 312 31 293 7.8% 1.09 [0.69, 1.72] 1992
Subtotal (95% CI) 1714 1851 31.5% 0.94 [0.76, 1.16]
Total events 149 188
Heterogeneity: Tau² = 0.00; Chi² = 3.89, df = 4 (P = 0.42); I² = 0%
Test for overall effect: Z = 0.60 (P = 0.55)
Total (95% CI) 7952 9980 100.0% 0.90 [0.77, 1.05]
Total events 543 715
Heterogeneity: Tau² = 0.03; Chi² = 25.02, df = 18 (P = 0.12); I² = 28%
Test for overall effect: Z = 1.31 (P = 0.19)
Test for subgroup differences: Chi² = 0.18, df = 1 (P = 0.67), I² = 0%
0.01
0.1
1
10
100
Favors chlorhexidine
Favors comparator

Cutaneous antisepsis

Original Research

Chlorhexidine-Alcohol Compared With Povidone-Iodine for Preoperative Topical Antisepsis for Abdominal Hysterectomy

Shitanshu Uppal, MBBS, Ali Bazzi, MD, R. Kevin Reynolds, MD, John Harris, MD, MSc, Mark D. Pearlman, MD, Darrell A. Campbell, MD, and Daniel M. Morgan, MD

Table 3. Surgical Site Infection (Any): Unmatched and Propensity Score-Matched Cohorts

	Unmatched Cohort			Propensity Score-Matched Cohort		
Primary Outcome	Chlorhexidine-Alcohol (n=3,005)	Povidone-Iodine (n=1,254)	*P*	Chlorhexidine-Alcohol (n=808)	Povidone-Iodine (n=845)	*P*
Surgical site infection (any)						
No	2,926 (97.4)	1,209 (96.4)	0.09	796 (98.5)	805 (95.3)	<.001
Yes	79 (2.6)	45 (3.6)		12 (1.5)	40 (4.7)	

Data are n (%) unless otherwise specified.

Vaginal antisepsis

American Journal of Infection Control 44 (2016) 996-8

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American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Safety and tolerability of chlorhexidine gluconate (2%) as a vaginal operative preparation in patients undergoing gynecologic surgery

Ahmed Al-Niaimi MD [a], Laurel W. Rice MD [a], Uppal Shitanshu MD [b], Bonnie Garvens MD [a], Megan Fitzgerald NP [a], Sara Zerbel MS [a], Nasia Safdar MD, PhD [a,c,*]

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[b] Universtity of Michigan, Ann Arbor, MI
[c] William S. Middleton Memorial Veterans Hospital, Madison, WI

Table 1
Patient characteristics

Characteristic	Group 1: PI (n = 64)	Group 2: CHG (n = 53)	*P* value
Age, mean (y)	53	56	.48
BMI, mean (kg/m^2)	38	36	.53
Pathology			
Benign	14	12	.37
Malignant	50	41	.32
Surgery			
Hysterectomy (laparoscopic/abdominal)	47	42	.61
Hysterectomy (vaginal)	6	5	.51
No hysterectomy (laparoscopic BSO/USO/others)	9	6	.79
Preexisting choric vulvar disease	3	2	.43

NOTE. Values are the number of patients or as otherwise indicated.
BMI, body mass index; *BSO*, bilateral salpingo-oophorectomy; *CHG*, chlorhexidine gluconate; *PI*, povidone-iodine; *USO*, unilateral salpingo-oophorectomy.

Table 2
Reports of vaginal irritation

Vaginal irritation score	Patient reports on postoperative day 1	
	Group 1: Povidone-iodine vaginal preparation (n = 64)	Group 2: 2% CHG vaginal preparation (n = 53)
0 = No vaginal itching or burning	60 (93.75%)	53 (100%)
1 = Mild vaginal itching or burning	3 (4.69%)	0 (0%)
2 = Mild to moderate vaginal itching or burning	0 (0%)	0 (0%)
3 = Moderate vaginal itching or burning	1 (1.56%)	0 (0%)
4 = Moderate to severe vaginal itching or burning	0 (0%)	0 (0%)
5 = Severe vaginal itching or burning	0 (0%)	0 (0%)

NOTE. Values are n (%).
CHG, chlorhexidine gluconate.

Normothermia

JOGNN

EXPERT OPINION

Consensus Bundle on Prevention of Surgical Site Infections After Major Gynecologic Surgery

Joseph E. Pellegrini, Paloma Toledo, David E. Soper, William C. Bradford, Deborah A. Cruz, Barbara S. Levy, and Lauren A. Lemieux

Correspondence
Joseph E. Pellegrini, PhD, CRNA, University of Maryland School of

ABSTRACT

Surgical site infections are the most common complications of surgery in the United States. Of surgeries in women of reproductive age, hysterectomy is one of the most frequently performed, second only to cesarean birth. Therefore,

Normothermia

- Extrapolated from the colorectal surgical literature
- Active rewarming vs not-reduces SSI
- Passive vs active methods of normothermia
- Ambient air temperature issues

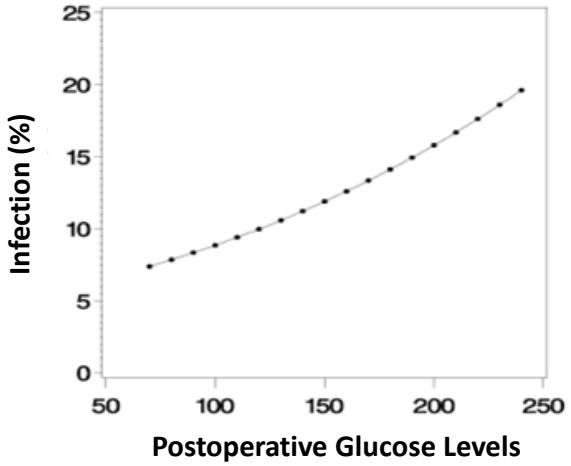
Hyperglycemia and Infection

Background

- Hyperglycemia is common in hospitalized patients
- 38% of medical and surgical patients had hyperglycemia
  - 26% diabetic
  - 12% nondiabetic
- In cardiac surgery, degree of postoperative hyperglycemia correlates with SSI, adopted as SCIP measures

Goal

Glucose <180mg/dl in all hospitalized patients



Postoperative hyperglycemia is associated with an increased risk of SSI in general surgery patients.

Slide from AHRQ: Building your SSI bundle

MRSA Status

- Not a common cause of infection post hysterectomy
- Decolonization with mupirocin/chg
- Unclear if routine screening is necessary in all patients but history of MRSA should prompt decolonization

https://www.technologynetworks.com/immunology/posters/mrsa-screening-for-surgical-site-infection-prevention-prior-to-hysterectomy-at-a-cancer-center-301663

Surgical Technique

- Hemostasis
- Tissue damage
- Training/volume
- Wound closure
- Post operative dressing standardization

Audit and Feedback

Surgical Site Infection Prevention: A Qualitative Analysis of an Individualized Audit and Feedback Model

Carolyn Nessim, MD, FRCSC, Cécile M Bensimon, MA, PhD, Brigette Hales, MSc,
Claude Laflamme, MD, MHSc, FRCPC, Darlene Fenech, MD, MSc, FRCSC, Andy Smith, MD, MSc, FRCSC, FACS

BACKGROUND: Surgical site infection (SSI) adversely affects patient outcomes and health care costs, so prevention of SSI has garnered much attention worldwide. Surgical site infection is recognized as an important quality indicator of patient care and safety. The purpose of this study was to use qualitative research methods to evaluate staff perceptions of the utility and impact of individualized audit and feedback (AF) data on SSI-related process metrics for their individual practice, as well as on overall communication and teamwork as they relate to SSI prevention.

STUDY DESIGN: This study was performed in a tertiary care center, based on patients treated in the colorectal and hepatic-pancreatic-biliary surgical oncology services. Eighteen clinicians were interviewed. Analysis of interviews via comparative analysis techniques and coding strategies were

Audit and Feedback

Table 2. Themes Identified and Illustrative Quotes

Theme	Illustrative quote
Impact on individual practice	"[…] a reminder that you have to continually maintain your skills" "It's good to get feedback; it certainly helps to remind you to take care of those little details that sometimes you can forget" "We all have a blind spot [and] you like to think you're doing well, but to have some objective measure of how you're performing … is valuable because your perception of how you're doing may not be totally accurate," thus creating opportunities to "improve what kind of job you do."
Recognition of the integral role of anesthesia	"I always looked at [it] as a surgeon's issue; that's their domain, it's something that they do … I am certainly much more aware of it now and look at my responsibility much differently than I used to." "Part of the challenge [was] to be changed in my thinking — it's a surgical site infection — what's that got to do with anesthesia, you know? I think to have it reinforced that three of the biggest factors that we can do to prevent this … quite frankly, I do all three of those things … it forced me to accept more ownership of this [because] I can have a significant effect on this." "After the patients leave the recovery room, we don't know the outcome … It's good [to] have some kind of feedback as to what the longer term outcome is and [know that] part of what we do actually does affect the outcome."

Audit and Feedback

Shared responsibility via interprofessional collaboration and communication	"Once upon a time, things were very clear — that's your responsibility or it's yours — but that's extremely blurred. [If] somebody gets an infection and the anesthesiologist didn't hang the antibiotics before the skin cut, well, whose fault is that ultimately? Is it the surgeon because he's the one that deals with wound infections and complications? Was it the anesthesiologist because the surgeon scrubbed and can't be [the one to] give the antibiotics? It's not so simple anymore. And that's why I think we need to constantly be doing things to foster a general culture of team approach." "If we have a clear improvement, which I think we do, then that's one thing that can enhance the practice [by seeing that the team is] obviously making an impact." "It has to be a collaborative effort," which can only be done with "more communication" where "[we are] constantly doing things to foster a sense of free and open communication."
Surgeon accountability	"I think it's more the surgeon's responsibility then, say, the anesthesiologist's responsibility because [the surgeon is] the one who has the primary relationship with the patient." "I tend to think the surgeon is the captain of the ship."

Tobacco and Perioperative Outcomes

ANESTHESIOLOGY (/)
Trusted Evidence: Discovery to Practice

Perioperative Medicine | April 2011

Smoking and Perioperative Outcomes

Alparslan Turan, M.D. *
Edward J. Mascha, Ph.D. †
Dmitry Roberman, M.S. ‡
Patricia L. Turner, M.D. §
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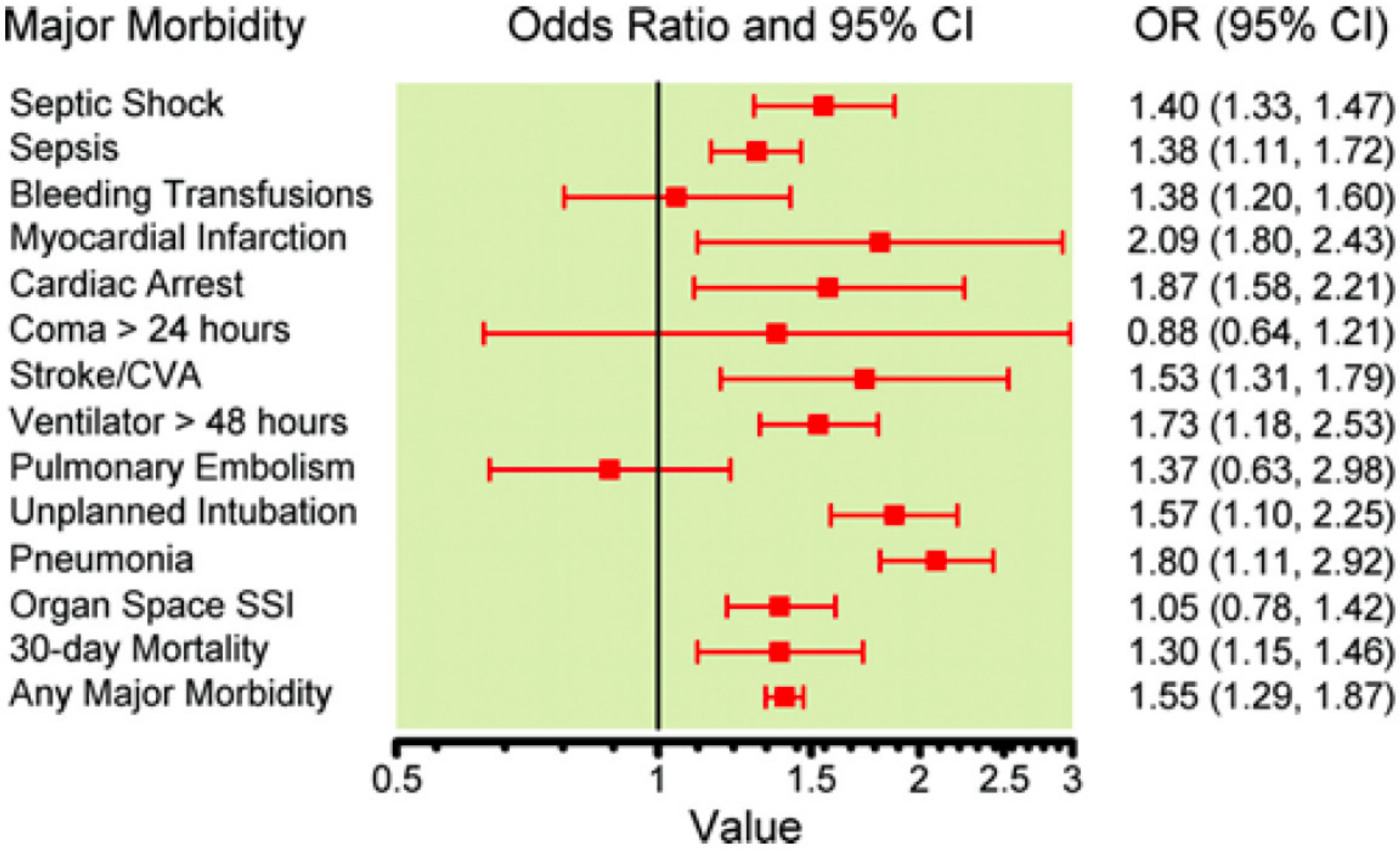

Major Morbidity
Odds Ratio and 95% CI
OR (95% CI)
Septic Shock
Sepsis
Bleeding Transfusions
Myocardial Infarction
Cardiac Arrest
Coma > 24 hours
Stroke/CVA
Ventilator > 48 hours
Pulmonary Embolism
Unplanned Intubation
Pneumonia
Organ Space SSI
30-day Mortality
Any Major Morbidity
1.40 (1.33, 1.47)
1.38 (1.11, 1.72)
1.38 (1.20, 1.60)
2.09 (1.80, 2.43)
1.87 (1.58, 2.21)
0.88 (0.64, 1.21)
1.53 (1.31, 1.79)
1.73 (1.18, 2.53)
1.37 (0.63, 2.98)
1.57 (1.10, 2.25)
1.80 (1.11, 2.92)
1.05 (0.78, 1.42)
1.30 (1.15, 1.46)
1.55 (1.29, 1.87)
0.5
1
1.5
2
2.5
3
Value

Communication for Preventing SSI

■ CLINICAL INVESTIGATIONS

Anesthesiology 2006; 105:877–84

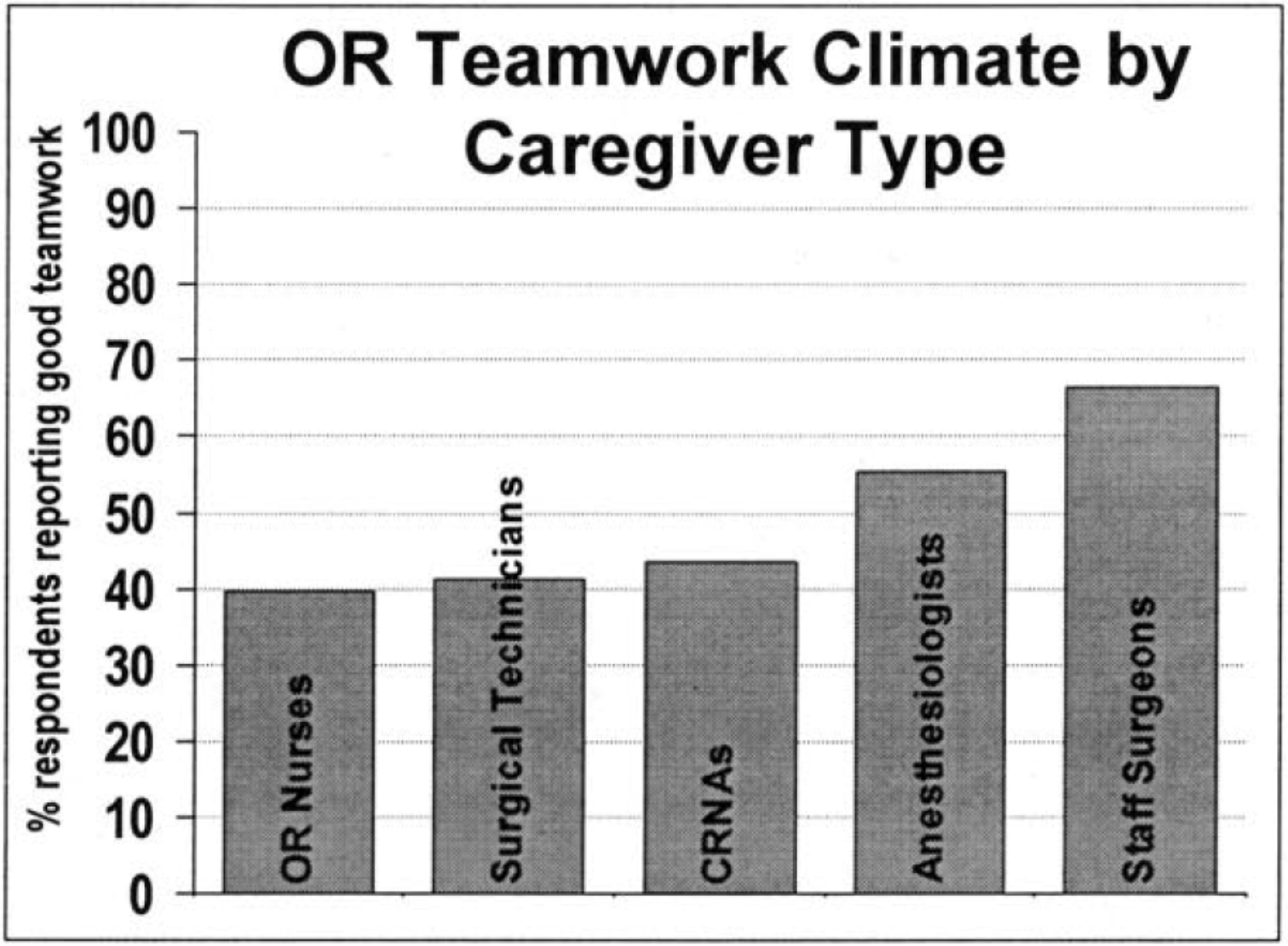
Teamwork in the Operating Room

Frontline Perspectives among Hospitals and Operating Room Personnel

J. Bryan Sexton, Ph.D., Martin A. Makary, M.D., M.P.H.,† Anthony R. Tersigni, Ed.D.,‡ David Pryor, M.D.,§ Ann Hendrich, M.S., F.A.A.N.,‖ Eric J. Thomas, M.D., M.P.H.,# Christine G. Holzmueller, B.L.A.,** Andrew P. Knight, M.A.,†† Yun Wu, M.A.S.,‡‡ Peter J. Pronovost, M.D., Ph.D.§§*

Background: **The Joint Commission on Accreditation of Healthcare Organizations is proposing that hospitals measure**

Conclusions: **Rigorous assessment of teamwork climate is possible using this psychometrically sound teamwork climate**


OR Teamwork Climate by Caregiver Type
% respondents reporting good teamwork
100
90
80
70
60
50
40
30
20
10
0
OR Nurses
Surgical Technicians
CRNAs
Anesthesiologists
Staff Surgeons

OR Traffic

Contents lists available at ScienceDirect

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journal homepage: www.ajicjournal.org

Major article

Traffic flow in the operating room: An explorative and descriptive study on air quality during orthopedic trauma implant surgery

Annette Erichsen Andersson RN [a,b,*], Ingrid Bergh RN, PhD [c], Jón Karlsson MD, PhD [d,e], Bengt I. Eriksson MD, PhD [d,e], Kerstin Nilsson RN, PhD [a]

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OR Traffic

Table 3
Reasons for traffic flow

Necessary door openings*	n	Semi-necessary door openings	n	Unnecessary door openings	n
Expert consultations (eg, help needed from senior surgeons, expert nurses, or anesthesiologists)	40	Surgical team members entering after incision or leaving before closure	76	Logistic reasons planning next or other operation	30
Instruments or other material needed	137	Lunch and coffee breaks	108	Social visits	45
				No detectable reasons	93
Total	177		184		168
					529

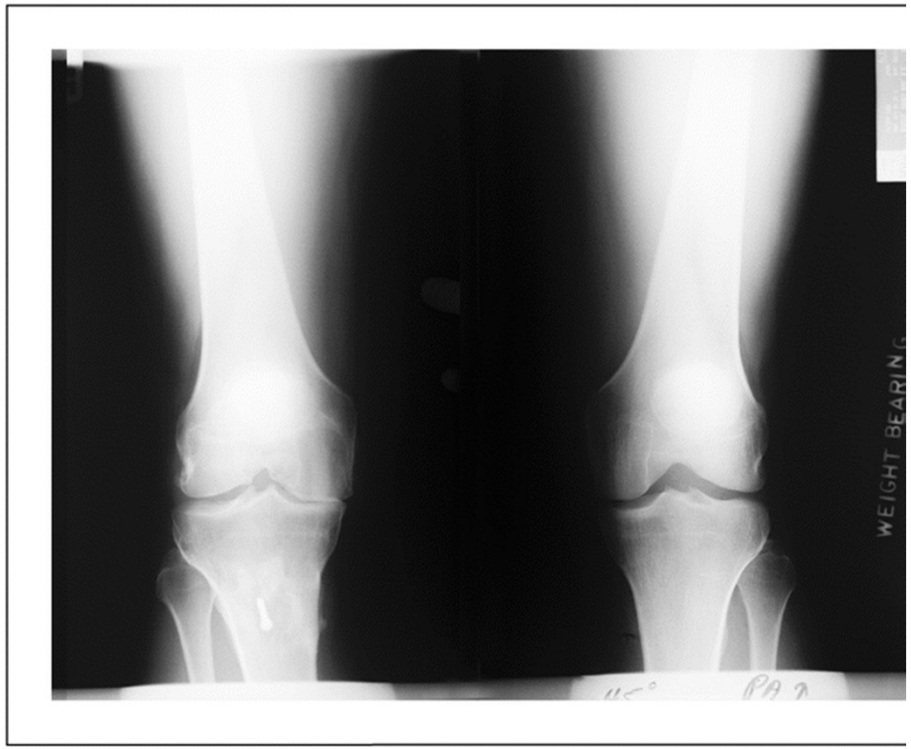
*The need assessed in relation to patient safety and ongoing procedure.

OR Traffic

- Canadian hospital with high rates of SSI following orthopedic procedures
- Manual counting showed 32 to 72 door openings in a 75 minute case
- Reasons were: chart review, break, instrument and new people
- Interventions: record reason why one is entering the door if not core person, phone rather than in person entry, collect all instruments ahead of time to be ready
- OR openings dropped from 70 to 3 per case; SSI were reduced as well

https://www.facs.org/media/press-releases/2016/nsqip-ssi-071816

Don Berwick's Knee-How to Prevent Complications and Extrapolation to Hysterectomy



Bundles for Reducing SSI Post Hysterectomy

Gynecology: *Clinical Practice and Quality*

Decreased Surgical Site Infection Rate in Hysterectomy

Effect of a Gynecology-Specific Bundle

Sarah E. Andiman, MD, Xiao Xu, PhD, John M. Boyce, MD, Elizabeth M. Ludwig, BA, Heidi R. W. Rillstone, RN, Vrunda B. Desai, MD, and Linda L. Fan, MD

Table 3. Multivariable Regression Analysis for the Association Between Prevention Bundle and Surgical Site Infection

		Unadjusted Analysis			Adjusted Analysis		
Variable	n	OR	95% CI	*P*	OR	95% CI	*P*
Bundle implementation							
Post–full bundle implementation	747	0.97	0.96–0.99	.002	0.46	0.25–0.82	.01
Pre–full bundle implementation	1,352	Reference			Reference		
Surgical route							
Open	967	Reference			Reference		
Traditional laparoscopic	228	0.97	0.95–0.99	.04	0.58	0.24–1.39	.22
Robot-assisted laparoscopic	861	0.97	0.95–0.98	<.001	0.33	0.19–0.59	<.001
Laparoscopic-assisted vaginal	43	0.97	0.92–1.03	.23	0.59	0.08–4.52	.61
BMI (kg/m^2)							
Less than 24.9	537	Reference			Reference		
25–29.9	581	1.01	0.99–1.03	.34	1.50	0.70–3.23	.29
30–34.9	430	1.02	0.99–1.04	.11	1.97	0.91–4.28	.09
35–39.9	276	1.02	0.99–1.04	.25	1.84	0.77–4.42	.17
40 or greater	275	1.05	1.02–1.08	<.001	3.81	1.77–8.20	.001

OR, odds ratio; BMI, body mass index.

The indicator for post–full bundle implementation was forced into the model. The model considered patient age, BMI, surgical route, indicator for bowel involvement, indicator for cancer diagnosis, and indicator for diagnosis of type 2 diabetes mellitus as candidate explanatory variables and used a backward stepwise selection process (cutoff *P* value=.05) to determine variables retained in the final model. The final model included the indicator for post–full bundle implementation, surgical route, and BMI.

Table 4. Multivariable Regression Analysis for the Association Between Individual Prevention Bundle Components and Surgical Site Infection

Bundle Component	Adjusted OR	95% CI	*P*
Component #7 (direct feedback) vs components #1–6	0.45	0.18–1.15	.097
Component #6 (antibiotic standardization) vs components #1–5	1.43	0.57–3.63	.45
Component #5 (maintenance of intraoperative normothermia) vs components #1–4	0.59	0.32–1.09	.09

OR, odds ratio.

This analysis was based on a multivariable logistic regression model adjusting for different bundle component implementation periods (ie, time period when components #1–4 were implemented, time period when component #5 was added, time period when component #6 was added, and time period when component #7 was added) as well as patient body mass index and surgical route. By alternating each of the first three time periods as the reference group in analysis and comparing it with the next adjacent time period, we assessed the incremental effect of the additional bundle component on surgical site infection.

Framework for SSI Reduction

Readiness (Facility)

- Establish standard preoperative care instructions and education for women undergoing major gynecologic surgery
- Establish a system that delineates responsibility for every member of the surgical team
- Establish standards for temperature regulation:
  - Ambient operating room temperature
  - Patient normothermia

Readiness

- Standardize the selection and timing of administration of prophylactic antibiotics
- Standardize the timing of discontinuation of prophylactic antibiotics
- Establish standard on appropriate skin preparation

Recognition and Prevention (Every Patient)

- Assess patient risk preoperatively for surgical site infection:
  - Blood glucose level
  - Body mass index
  - Immunodeficiency
  - Methicillin-resistant Staphylococcus aureus status
  - Nutritional status
  - Smoking status

Response (Every Case)

- Develop intraoperative “Timeouts” to address antibiotic dosage, timing, prophylaxis issues, and patient-specific issues
- Reassess patient risk for surgical site infection based on length of surgery, potential bowel incision, vaginal contamination, and amount of blood loss
- Provide postoperative care instructions and education

Reporting and Systems Learning (Every Facility)

- Establish a culture of huddles for high-risk patients
- Create system to analyze and report surgical site infection data
- Monitor outcomes and process metrics

Reporting and Systems Learning (Every Facility)

- Actively collect and share physician-specific surgical site infection data with all surgeons as part of their ongoing professional practice evaluation

- Standardize a process to actively monitor and collect surgical site infection data with postdischarge follow-up