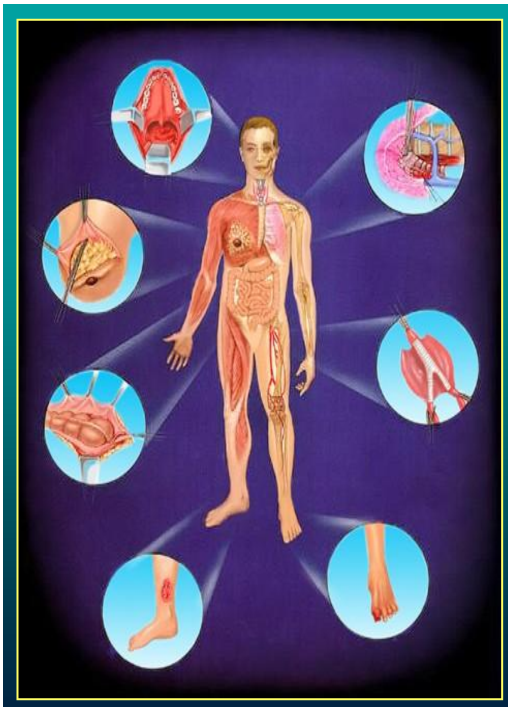

A Three Part Scenario: Using Evidence-Based Guidance to Overcome Barriers in Our Effort to Reduce the Risk of Surgical Site Infections

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MEDICAL COLLEGE OF WISCONSIN

1

Part 1
Do We Truly Understand the Risk of an SSI in the Surgical Patient Population

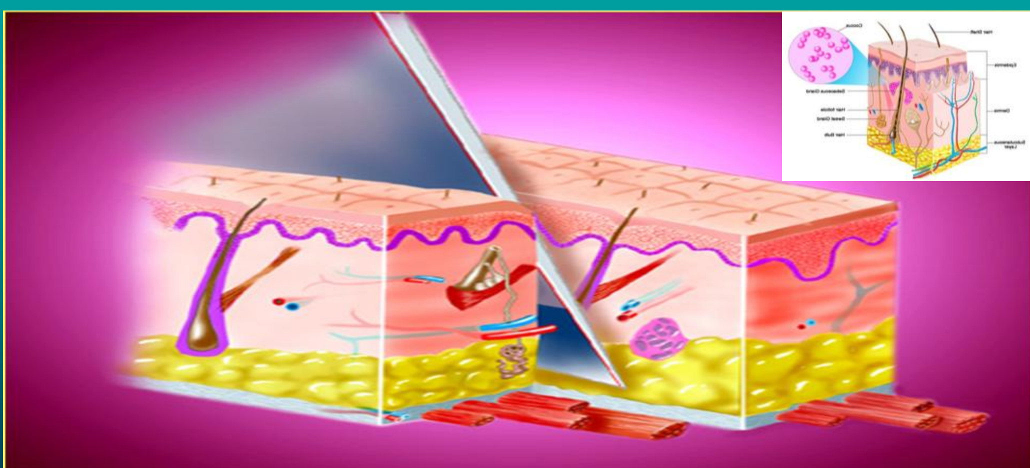
2

"Centuries of experience makes it clear that establishing the effectiveness of a clinical innovation is not sufficient to guarantee its uptake into routine use."

Bauer and Kirchner, Psychiatry Research Volume 283, January 2020, 112376

3

It's all about the surgical wound and comorbid risk



"All surgical wounds are contaminated to some degree at closure – the primary determinant of whether the contamination is established as a clinical infection is host (wound) defense"

Belda et al., JAMA 2005;294:2035-2042
Wiley AM, et al. Clin Orthop Relat Res 1979;139:150-155

4

SCIENCE TRANSLATIONAL MEDICINE | RESEARCH ARTICLE

SKIN MICROBIOME

Contribution of the patient microbiome to surgical site infection and antibiotic prophylaxis failure in spine surgery

Dustin R. Long[1]*, Chloe Bryson-Cahn[2], Adam Waalkes[3], Elizabeth A. Holmes[3], Kelsi Penewit[3], Celeste Tavolaro[4], Carlo Bellabarba[4], Fangyi Zhang[4,5], Jeannie D. Chan[2,6], Ferric C. Fang[3,7,8], John B. Lynch[2], Stephen J. Salipante[3]

Despite modern antiseptic techniques, surgical site infection (SSI) remains a leading complication of surgery. However, the origins of SSI and the high rates of antimicrobial resistance observed in these infections are poorly understood. Using instrumented spine surgery as a model of clean (class I) skin incision, we prospectively sampled preoperative microbiomes and postoperative SSI isolates in a cohort of 204 patients. Combining multiple forms of genomic analysis, we correlated the identity, anatomic distribution, and antimicrobial resistance profiles of SSI pathogens with those of preoperative strains obtained from the patient skin microbiome. We found that 86% of SSIs, comprising a broad range of bacterial species, originated endogenously from preoperative strains, with no evidence of common source infection among a superset of 1610 patients. Most SSI isolates (59%) were resistant to the prophylactic antibiotic administered during surgery, and their resistance phenotypes correlated with the patient's preoperative resistome ($P = 0.0002$). These findings indicate the need for SSI prevention strategies tailored to the preoperative microbiome and resistome present in individual patients.

Long DR, et al. Sci Transl Med 2024 Apr 10;16(742):eadk8222

JAMA Surgery | Review

Preventing Surgical Site Infections in the Era of Escalating Antibiotic Resistance and Antibiotic Stewardship

Dustin R. Long, MD; Adam Cifu, MD; Stephen J. Salipante, MD, PhD; Robert G. Sawyer, MD; Kaylie Machutta, BS; John C. Alverdy, MD

IMPORTANCE According to the Centers for Disease Control and Prevention and governing bodies within the American College of Surgeons, the administration of antibiotics as prophylaxis against infection prior to a planned elective procedure is, with rare exception, routinely recommended. The goal of "getting to zero" infections remains a high priority for policymakers, practitioners, and certainly for patients.

OBSERVATIONS Despite the many advances in surgical technique, skin decontamination, sterile procedure, and enhanced recovery programs, surgical site infections continue to adversely affect procedures as diverse as dental implant surgery, joint arthroplasty, and major abdominal surgery. Although surgical site infection rates are at historically low levels, progress has stalled in recent reporting periods and such infections remain disabling, costly, and occasionally lethal. Stakeholders in the field, including surgeons, infectious diseases specialists, and industry, advocate for strategies emphasizing greater levels of intraoperative sterility or broader-spectrum antibiotic coverage as the most appropriate path forward.

CONCLUSIONS AND RELEVANCE The current emphasis on ever-increasing levels of intraoperative sterility and extended-spectrum antibiotic use are not sustainable long-term solutions. Continuing to escalate these approaches may contribute to unintended consequences including antimicrobial resistance. Principles of antimicrobial stewardship and microbiome sciences can be applied to inform a more effective and sustainable approach to infection prevention in the field of surgery.

JAMA Surg. doi:10.1001/jamasurg.2024.0429
Published online June 26, 2024.

CME at jamacmelookup.com

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Long DR, et al. JAMA Surg. 2024;159:949-956

- Study results identify the patient microbiome as the primary reservoir for SSI.
- Most SSI isolates (59%) were resistant to the prophylactic antibiotic administered during surgery, and their resistance phenotypes correlated with the patient's preoperative resistome (*p=0.0002*).
- The anticipated global increase in colonization of healthy individuals with antimicrobial resistant organisms will be reflected in a rapidly changing microbial landscape within our hospitals and communities.
- These findings suggest that future efforts in infection prevention should enable, (1) more individualize and (2) patient-centered interventional strategies.

5

So, Where Do We Start?

6

"The practice of evidence-based medicine means integrating individual clinical expertise with the best external evidence from systematic reviews."

Sackett et al. Evidence-based medicine: what it is and what it isn't. BMJ 1996;312:71-72

7

What Do We Mean When We Talk About Risk?

8

Research

JAMA Surgery | Original Investigation

Risk Stratification for Surgical Site Infections in Colon Cancer

Ramzi Amri, MD, PhD; Anne M. Dinaux, BSc; Hiroko Kunitake, MD; Liliana G. Bordeianou, MD; David L. Berger, MD

Invited Commentary page 690

IMPORTANCE Surgical site infections (SSIs) feature prominently in surgical quality improvement and pay-for-performance measures. Multiple approaches are used to prevent or reduce SSIs, prompted by the heavy toll they take on patients and health care budgets. Surgery for colon cancer is not an exception.

OBJECTIVE To identify a risk stratification score based on baseline and operative characteristics.

DESIGN, SETTING, AND PARTICIPANTS This retrospective cohort study included all patients treated surgically for colon cancer at Massachusetts General Hospital from 2004 through 2014 (n = 1481).

MAIN OUTCOMES AND MEASURES The incidence of SSI stratified over baseline and perioperative factors was compared and compounded in a risk score.

RESULTS Among the 1481 participants, 90 (6.1%) had SSI. Median (IQR) age was 66.9 (55.9-78.1) years. Surgical site infection rates were significantly higher among people who smoked (7.4% vs 4.8%; $P = .04$), people who abused alcohol (10.6% vs 5.7%; $P = .04$), people with type 2 diabetics (8.8% vs 5.5%; $P = .046$), and obese patients (11.7% vs 4.0%; $P < .001$). Surgical site infection rates were also higher among patients with an operation duration longer than 140 minutes (7.5% vs 5.0%; $P = .05$) and in nonlaparoscopic approaches (clinically significant only, 6.7% vs 4.1%; $P = .07$). These risk factors were also associated with an increase in SSI rates as a compounded score ($P < .001$). Patients with 1 or fewer risk factors (n = 427) had an SSI rate of 2.3%, equivalent to a relative risk of 0.4 (95% CI, 0.16-0.57; $P < .001$); patients with 2 risk factors (n = 445) had a 5.2% SSI rate (relative risk, 0.78; 95% CI, 0.49-1.22; $P = .27$); patients with 3 factors (n = 384) had a 7.8% SSI rate (relative risk, 1.38; 95% CI, 0.91-2.11; $P = .13$); and patients with 4 or more risk factors (n = 198) had a 13.6% SSI rate (relative risk, 2.71; 95% CI, 1.77-4.12; $P < .001$).

CONCLUSIONS AND RELEVANCE This SSI risk assessment factor provides a simple tool using readily available characteristics to stratify patients by SSI risk and identify patients at risk during their postoperative admission. Thereby, it can be used to potentially focus frequent monitoring and more aggressive preventive efforts on high-risk patients.

JAMA Surg. 2017;152(7):686-690. doi:10.1001/jamasurg.2017.0505
Published online April 12, 2017.

Author Affiliations: Division of General and Gastrointestinal Surgery, Massachusetts General Hospital, Harvard Medical School, Boston.

Corresponding Author: David. L. Berger, MD, Massachusetts General Hospital, Wang 460 15 Parkman St, Boston, MA 02114 (dberger@mgh

JAMA Surg 2017;152:686-690

Risk Stratification

- **Patient who smoked (7.4% vs 4.8%; *p = 0.04*)**
- **Patients who abused alcohol (10.6% vs 5.7%; *p = 0.04*)**
- **Patients with type 2 diabetics (8.8% vs 5.5%; *p = 0.046*)**
- **Obese patients (11.7% vs 4.0%; *p< 0.001*)**
- **Surgical site infection rates higher when operative duration longer than 140 minutes (7.5% vs 5.0%; *p= 0.05*)**

These risk factors were also associated with an increase in SSI rates as a compounded score (*P < 0.001*).

- **Patients with 1 or fewer risk factors (n = 427) - SSI rate of 2.3%**
- **Patients with 2 risk factors (n = 445) – SSI rate 5.2%**
- **Patients with 3 factors (n = 384) had a 7.8% SSI rate**
- **Patients with 4 or more risk factors (n = 198) > 13.5%**

9

Three More Questions Worth Considering:

1. Does our 30-day (90-day with device) surveillance effectively capture the majority of SSIs?
2. What is the true cost of an SSI? The CDC estimates that the mean attributable cost associated with an SSI ranges from $10,443 to $25,546 – Are those numbers accurate?
3. What is the mechanistic basis of evidence-based interventions?

Berríos-Torres SI, Umscheid CA, Bratzler DW, et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017 [published correction appears in JAMA Surg. 2017;152(8):784-791. doi:10.1001/jamasurg.2017.0904

10

ORIGINAL CONTRIBUTION

Assessment of the Risk and Economic Burden of Surgical Site Infection Following Colorectal Surgery Using a US Longitudinal Database: Is There a Role for Innovative Antimicrobial Wound Closure Technology to Reduce the Risk of Infection?

David J. Leaper, D.Sc.[1] • Chantal E. Holy, Ph.D.[2] • Maureen Spencer, M.Ed.[3]
Abhishek Chitnis, Ph.D.[2] • Andrew Hogan, M.Sc.[4] • George W.J. Wright, Ph.D.[4]
Brian Po-Han Chen, Sc.M.[5] • Charles E. Edmiston, Jr, Ph.D.[6]

AQ1

BACKGROUND: Colorectal surgical procedures place substantial burden on health care systems because of the high complication risk, in particular, surgical site infections. Risk of postoperative colorectal surgical site infection is one of the highest of any surgical specialty.

OBJECTIVE: The purpose of this study was to determine the incidence, cost of infections after colorectal surgery, and potential economic benefit of using antimicrobial wound closure to improve patient outcomes.

DESIGN: Retrospective observational cohort analysis and probabilistic cost analysis were performed.

SETTINGS: The analysis utilized a database for colorectal patients in the United States between 2014 and 2018.

PATIENTS: A total of 107,665 patients underwent colorectal surgery.

MAIN OUTCOME MEASURES: Rate of infection was identified between 3 and 180 days postoperatively, infection risk factors, infection costs over 24 months postoperatively by payer type (commercial payers and Medicare), and potential costs avoided per patient by using an evidence-based innovative wound closure technology.

RESULTS: Surgical site infections were diagnosed postoperatively in 23.9% of patients (4.0% superficial incisional and 19.9% deep incisional/organ space). Risk factors significantly increased risk of deep incisional/organ-space infection and included selective patient comorbidities, age, payer type, and admission type. After 12 months, adjusted increased costs associated with infections ranged from $36,429 to $144,809 for commercial payers and $17,551 to $102,280 for Medicare, depending on surgical site infection type. Adjusted incremental costs continued to increase over a 24-month study period for both payers. Use of antimicrobial wound closure for colorectal surgery is projected to significantly reduce median payer costs by $809 to $1170 per patient compared with traditional wound closure.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text, and links to the digital files are provided in the HTML and PDF versions of this article on the journal's Web site (www.dcrjournal.com).

Funding/Support: Funding was provided by Ethicon, Inc.

Financial Disclosures: Drs Edmiston and Leaper, and M. Spencer are members of the Johnson and Johnson Speakers Bureau. M. Spencer is on the speaker's bureau for Ethicon. Drs Holy and Chitnis, and B.P.-H. Chen are employees of Johnson and Johnson, Inc. A. Hogan and Dr Wright are employees of CRG-Eversana Canada Inc, which was contracted by Ethicon, Inc, which provided funding to assist in the analysis and review of the manuscript.

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Dis Colon Rectum 2020 00 00–00
DOI: 10.1097/DCR.0000000000001799

Diseases of the Colon & Rectum Volume XX: X (2020)

1

- Infection Rate (107,665 Colorectal Patients): 23.9%
- 50% of infections diagnosed at 3-25 days while 75% of infections diagnosed by/after 2 months
- CDC-NHSN & ACS-NSQIP closes the books on colorectal surveillance at 30-days

Colorectal

- SSIs in patients undergoing colorectal surgery between 2014 and 2018

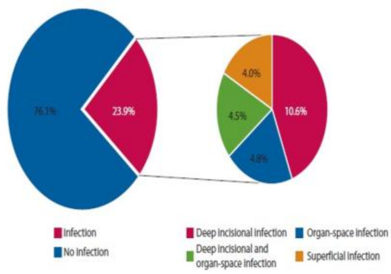

FIGURE 4. Surgical site infection rate at 6 months after the index colorectal surgery by infection type.

Leaper et al. Dis Colon Rectum 2020;63:1628-1638

We Are Missing 30-35% of Colorectal Infections Due To Our Current Surveillance Strategies

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Cost of Superficial and Deep/Organ Space Colorectal SSIs

TABLE 3. Summary of SSI costs from the database analysis by infection type, payer, and time point

	Mean SSI cost (95% CI)			
Payers	*Deep incisional and organ-space*	*Deep incisional*	*Organ-space*	*Superficial*
Commercial payers				
6 months	$122,117 ($117,490–$127,007)	$43,490 ($42,120–$44,888)	$71,324 ($67,859–$74,904)	$28,866 ($26,690–$31,115)
12 months	$144,809 ($137,819–$152,062)	$52,628 ($50,633–$54,670)	$85,079 ($79,641–$90,747)	$36,429 ($33,085–$39,910)
24 months	$164,471 ($152,816–$176,759)	$64,563 ($61,143–$68,097)	$96,910 ($87,550–$106,844)	$44,281 ($38,538– $50,350)
Medicare				
6 months	$84,067 ($77,457–$91,069)	$25,387 ($22,884–$28,010)	$47,955 ($44,325–$51,764)	$16,026 ($12,884–$19,375)
12 months	$102,280 ($92,575–$112,670)	$32,456 ($28,832–$36,280)	$54,547 ($49,293–$60,111)	$17,551 ($13,040–$22,408)
24 months	$121,274 ($104,102–$140,169)	$45,771 ($38,679–$53,407)	$66,784 ($56,992–$77,402)	$20,758 ($12,538–$29,834)

SSI = surgical site infection.

Leaper DJ, Holy CE, Spencer M, Chitnis A, Hogan A, Wright GWJ, et al. Assessment of the Risk and Economic Burden of Surgical Site Infection Following Colorectal Surgery Using a US Longitudinal Database: Is There a Role for Innovative Antimicrobial Wound Closure Technology to Reduce the Risk of Infection? Diseases of the colon and rectum. 2020;63(12):1628-38.

12

Assessment of Risk and Economic Burden of Surgical Site Infection Post-Hysterectomy Using a US Longitudinal Database. Edmiston CE, Bond-Smith G, Chitnis AS, Holy CE, Spencer M, Chen BPH, Leaper D. Surgery 2022;17:1320-1330

Objective

This study evaluated the incidence, risk factors, and total payer cost associated with management of surgical site infections (SSIs) following hysterectomy using a nationwide longitudinal database.

Methods

Study design:
- Retrospective observational cohort analysis
- Data sources included IBM MarketScan Commercial, Multi-State Medicaid, and Medicare Supplemental Databases

Patient selection:
- 141,869 female patients undergoing hysterectomy in the US between January 2014 and March 2018.
- Patients were continuously enrolled for ≥ 12 months before and 6 months after procedure

Endpoints:
- Incidence of SSIs from day 3 to day 180 postoperatively*
- Infection costs of SSIs after hysterectomy by payer type over a 24-month follow-up period
- Risk factors for SSI

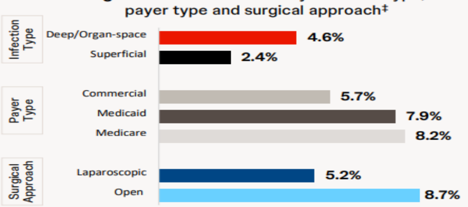
Results

Incidence of SSI – SSIs occurred in **7% of patients** within 6 months after hysterectomy. The incidence of SSI varies by infection type, payer type and surgical approach (**Figure 1**).[†,‡]

Costs – The economic burden of SSI after hysterectomy ranged from **$4,461 to $35,077** at 12 months and from **$7,941 to $44,436** at 24 months depending on payer type.

Risk factors – The top risk factors for deep/organ-space infection included **open vs laparoscopic approach, Medicaid vs commercial payer**, and **metastatic cancer.**

Figure 1: Incidence of SSI by infection type, payer type and surgical approach[‡]



13

Risk and Economic Burden of Surgical Site Infection Following Spinal Fusion in Adults. Edmiston CE, Leaper DL, Chitnis AS, Holy CE, Chen BP. Infection Control and Hospital Epidemiology 2022;24:1-8

Objective

This study evaluated the incidence, risk factors, and total payer costs associated with management of surgical site infections (SSIs) following spinal fusion surgery using a nationwide longitudinal database.

Methods

Study design:
- Retrospective observational cohort analysis
- Data sources included IBM MarketScan Commercial, Multi-State Medicaid, and Medicare Supplemental Databases

Patient selection:
- 210,019 adult patients undergoing spinal fusion surgery in the US between 2014 and 2018
- Patients were continuously enrolled for ≥ 12 months before and 6 months after procedure

Endpoints:
- Incidence of SSIs from day 3 to day 180 postoperatively*
- Infection costs of SSIs after spinal fusion surgery by payer type over a 24-month follow-up period
- Risk factors for SSI

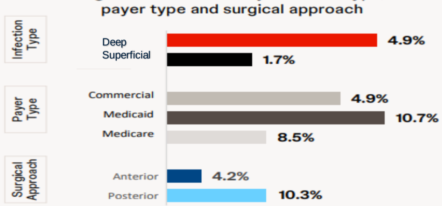
Results

Incidence of SSI – SSIs occurred in **6.6% of patients** within 6 months after spinal fusion surgery. The incidence of SSI varies by infection type, payer type and surgical approach (**Figure 1**).

Costs – The economic burden of SSI in spinal fusion surgery patients ranged from **$17,967 to $74,875** at 12 months and **$24,096 to $93,741** at 24 months depending on payer type.[†,‡]

Risk factors – The top risk factors for deep incisional infection included **surgical approach, emergency vs non-emergency admission,** and **payer type.**

Figure 1: Rate of SSI by infection type, payer type and surgical approach



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Longitudinal rates, risk factors, and cost of superficial and deep incisional surgical site infection (SSI) after primary and revision total hip arthroplasty: a US retrospective commercial claims database analysis. Edmiston CE, Spencer M, Gunja NJ, Holy CE, Ruppenkamp JW, Leaper DJ. Surg Infect 2023;24:366-375

Objective

This study was a longitudinal analysis of the time to infection, risk factors, and total payer costs associated with management of surgical site infections (SSIs) following total hip arthroplasty using a nationwide longitudinal database.

Methods

Study design:
- A retrospective observational cohort analysis
- Data sources included IBM MarketScan Commercial, Multi-State Medicaid, and Medicare Supplemental Databases

Patient selection:
- 20,468 adult patients undergoing primary or revision total hip arthroplasty (pTHA or rTHA) in the US between 2016 and 2018
- Patients were continuously enrolled for ≥ 12 months before and 180 days after the procedure

Endpoints:
- Incidence of SSIs within 180 days postoperatively*
- Infection costs of SSIs after THA at 6 and 12-months post-index procedure
- Risk factors for SSI

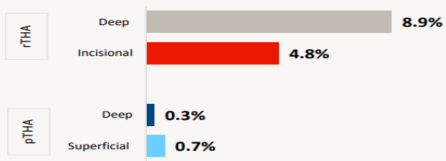
Results

Incidence of SSI – SSIs occurred in **0.97%** and **13.7%** of patients within 6 months of pTHA and rTHA surgery, respectively. The incidence of SSI varied by infection type and surgical approach (**Figure 1**).

Costs – The economic burden of SSI in pTHA and rTHA surgery patients ranged from **$21,434** to **$54,521** at 6 months and **$34,958** to **$76,472** at 12 months.‡

Risk factors – The top risk factors for SSI included **sex,** and **patient comorbidities.**

Figure 1: Rate of SSI by infection and surgery types.



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The CDCs Historical Costs of an SSI Doesn't Always Tell The Whole Story

These costs include the following:

Direct costs (e.g., surgery, rehab, …)

Indirect costs (e.g., lost wages, …)

Total Hip SSI in a 65-year-old female patient

Two-stage revision for periprosthetic infection

Initial costs $100,000 [1,2]

Lifetime costs $390,806[1]

SSI in the U.S. contribute to 400,000 extra patient days. This costs $10 Billion per year[3]

1. Parisi, T.J., J.F. Konopka, and H.S. Bedair, *What is the Long-term Economic Societal Effect of Periprosthetic Infections After THA? A Markov Analysis.* Clinical Orthopaedics and Related Research, 2017. 475(7): p. 1891-1900.
2. Bozic, K.J. and M.D. Ries, *The impact of infection after total hip arthroplasty on hospital and surgeon resource utilization.* J Bone Joint Surg Am, 2005. 87(8): p. 1746-51.
3. WHO. Global guidelines for prevention of surgical site infections. Accessed at https://www.who.int/infection-prevention/publications/ssi-guidelines/en/ on 11-6-19

16

Longitudinal rates, risk factors, and costs of superficial and deep incisional surgical site infection (SSI) after primary and revision total knee arthroplasty: A US retrospective claims database analysis. Edmiston CE, Spencer M, Gunja NJ, Holy CE, Ruppenkamp JW, Leaper DJ. Infection Control and Hospital Epidemiology, 2023;44:1587-1595

Objective

This study evaluated the incidence, risk factors, and all-cause incremental costs associated with management of surgical site infections (SSIs) following total knee arthroplasty using a nationwide longitudinal database.

Methods

Study design:
- A retrospective observational cohort analysis
- Data sources included IBM MarketScan Commercial, Multi-State Medicaid, and Medicare Supplemental Databases

Patient selection:
- 29,760 adult patients undergoing primary or revision total knee arthroplasty (pTKA or rTKA) in the US between 2016 and 2018
- Patients were continuously enrolled for ≥ 12 months before and 180 days after the procedure

Endpoints:
- Incidence of SSIs within 180 days postoperatively*
- Infection costs of SSIs after TKA at 6 and 12-months post-index procedure
- Risk factors for SSI

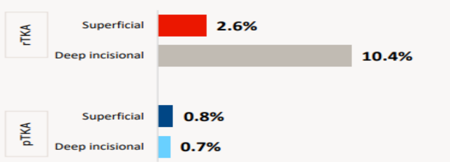
Results

Incidence of SSI – SSIs occurred in **1.47%** and **13.04%** of patients within 6 months of pTKA and rTKA surgery, respectively. The incidence of SSI varied by infection type and surgical approach (**Figure 1**).‡

Costs – The economic burden of SSI in pTKA and rTKA surgery patients ranged from **$14,298** to **$58,158** at 6 months and **$20,870** to **$59,491** at 12 months.‡

Risk factors – The top risk factors for deep incisional infection included **sex, age, payer type, patient comorbidities,** and **drug abuse.**

Figure 1: Rate of SSI by infection and surgery types.



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Part 2
The Evidence-based Pathway to Improving Clinical Outcomes

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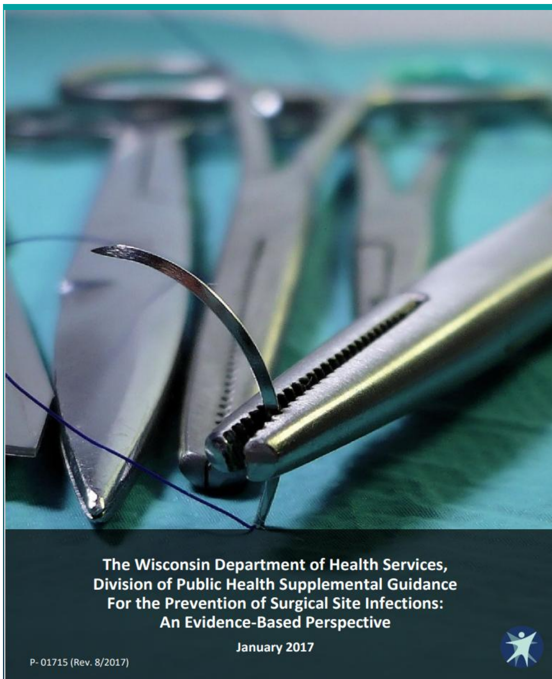

CLINICAL

Implementation of a Wisconsin Division of Public Health Surgical Site Infection Prevention Champion Initiative

Gwen Borlaug, MPH, CIC, FAPIC; Charles E. Edmiston, Jr, PhD, CIC, FIDSA, FSHEA, FAPIC

ABSTRACT
Approximately 900 surgical site infections (SSIs) were reported to the Wisconsin Division of Public Health annually from 2013 to 2015, representing the most prevalent reported health care-associated infection in the state. Personnel at the Wisconsin Division of Public Health launched an SSI prevention initiative in May 2015 using a surgical care champion to provide surgical team peer-to-peer guidance through voluntary, nonregulatory, fee-exempt onsite visits that included presentations regarding the evidence-based surgical care bundle, tours of the OR and central processing areas, and one-on-one discussions with surgeons. The surgical care champion visited 10 facilities from August to December 2015, and at those facilities, SSIs decreased from 83 in 2015 to 47 in 2016 and the overall SSI standardized infection ratio decreased by 45% from 1.61 to 0.88 (P = .002), suggesting a statewide SSI prevention champion model can help lead to improved patient outcomes.

Key words: *surgical champion, surgical care bundle, SSI prevention, peer collaboration, evidence-based practice.*

www.dhs.wisconsin.gov/publications/p01715.pdf

Borlaug G, Edmiston CE Jr. AORN J. 2018;107:570-578

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Wisconsin DPH SSI Guidelines

Selective elements of the surgical care bundle from evidence-based literature	
Appropriate antimicrobial prophylaxis	Antimicrobial (triclosan) sutures
Weigh-based dosing	Smoking cessation
Normothermia	Staphylococcal surveillance (Cardiothoracic and orthopedic procedures)
Supplemental O_2 (Colorectal procedures)	Oral Antibiotics + mechanical bowel preparation (Colorectal procedures)
Appropriate hair removal	Minimally invasive surgery
Use of wound edge protectors	Short duration surgery
Dedicated wound closure tray for fascial and skin	Glove change prior to fascial and skin closure
Preoperative 4% CHG shower or 2% CHG cleansing	Limit traffic in the operating room
70% alcohol with 2% CHG perioperative skin preparation	CHG cleansing of surgical wound
Keep sterile dressing intact for first 48 hours	

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Why a Supplemental Guideline

The evidence on which the HICPAC SSI Prevention Guidelines are based is limited to randomized controlled trials published prior to 2015. The supplemental guidance document incorporates current evidence-based data from well-designed laboratory studies, prospective cohort clinical studies, case-control studies, randomized controlled trials, systematic reviews, and meta-analyses which are necessary to provide surgical teams with the most recent and relevant SSI prevention strategies available. This guidance is intended to enhance, not replace, the HICPAC SSI Prevention Guidelines.

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Core Considerations: Interventions for All Surgical Procedures

Antimicrobial Prophylaxis

HICPAC SSI Prevention Guidelines	WDPH SSI Prevention Guidance
1. Administer preoperative antimicrobial agents only when indicated, based on published clinical practice guidelines (**Category 1B**).	1. No difference in guidance recommendation.
2. Administer the appropriate parenteral prophylactic antimicrobial agent prior to skin incision in all cesarean sections (**Category 1A**).	2. No difference in guidance recommendation.
3. No recommendation can be made regarding the safety and effectiveness of weight-based dosing of parenteral prophylactic agents to prevent surgical site infection (**No recommendation/unresolved issue**)	3. Follow the 2013 American Society of Health-System Pharmacists (ASHP) guidelines for antimicrobial prophylaxis in surgery.[12] Administer prophylactic antibiotic agents based on the patient's Body Mass Index (BMI) or the patient's weight in kilograms. For example, patients with a BMI <30 (or <120 kg) should receive 2 grams of a beta-lactam agent; patients with a BMI ≥ 30 (or ≥120 kg) should receive 3 grams.
4. No recommendation can be made regarding the safety and effectiveness of intraoperative re-dosing of parenteral prophylactic antimicrobial agents for the prevention of SSI (**No recommendation/unresolved issue**).	4. Base re-dosing of antibiotic agents on the drug half-life and duration of surgery.[12]
5. In clean and clean-contaminated procedures, do not administer additional prophylactic antimicrobial agent doses after the surgical incision is closed in the operating room, even in the presence of a drain (**Category IA**).	5. No difference in guidance recommendation.

Glycemic Control

HICPAC SSI Prevention Guidelines	WDPH SSI Prevention Guidance
1. Implement perioperative glycemic control and blood glucose target levels of <200 mg/dl in diabetic and non-diabetic surgical patients (**Category 1A**).	1. Maintain a mean perioperative blood glucose level <200 mg/dl in diabetic and non-diabetic surgical patients.[18,19]
2. No recommendation can be made regarding the safety and effectiveness of lower or narrower blood glucose target levels and SSI (**No recommendation/unresolved issue**).	2. Avoid increased risk of hypoglycemic events and increased mortality associated with tight glycemic control (81 to 108 mg/dl).[20,21]
3. No recommendation can be made regarding hemoglobin A1C target levels and risk of SSI in diabetic and non-diabetic patients (**No recommendation/unresolved issue**).	3. Maintain hemoglobin A1C level <6.7. This has been shown to minimize postoperative infectious complications in surgical patients.[22,23]

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Antiseptic and Non-Parenteral Antimicrobial Prophylaxis

HICPAC SSI Prevention Guidelines	WDPH SSI Prevention Guidance
1. Perform intraoperative skin preparation with an alcohol-based antiseptic agent, unless contraindicated (**Category IA**).	1. Use 2% chlorhexidine gluconate (CHG) with 70% alcohol as the preferred intraoperative skin preparation agent. CHG is also a safe and effective antiseptic agent for obstetrical and gynecologic procedures.[33-36]
2. Advise patients to shower or bathe (full body) with either soap (antimicrobial or non-antimicrobial) or an antiseptic agent on at least the night before the operative day (**Category IB**).	2. Ensure that all patients undergoing elective surgical procedures involving skin incisions undergo a standardized preadmission shower/cleansing with 4% aqueous or 2% (cloth coated) CHG.
3. Randomized controlled trials suggest uncertain trade-offs between benefit and harm regarding the optimal timing of the preoperative shower or bath, the total number of soap or antiseptic agent applications, or the use of chlorhexidine gluconate washcloths for the prevention of SSI (**No recommendation/ unresolved issue**).	3. Standardize the preadmission shower or cleansing process according to the protocols below. Recent randomized controlled trials have documented that high skin surface concentrations of CHG can be obtained by standardization of the preadmission shower or cleansing process using 4% aqueous chlorhexidine gluconate (CHG) or 2% CHG coated on a disposable polyester cloth.[37,38] **4% Aqueous CHG Shower Protocol**[37] • Remind patients to perform the CHG shower regimen with a text message, email, or voicemail. • Provide patients with both oral and written instructions regarding the standardized CHG shower regimen. • Instruct patients to take two showers, one the evening before surgery, and one the morning of surgery. • Instruct patients to pause for one minute after applying the CHG and before rinsing. • Ensure patients use a total volume of 4 oz.

HICPAC SSI Prevention Guidelines	WDPH SSI Prevention Guidance
	• Instruct patients to use a total of 12 cloths per cleansing—6 cloths the night before surgery, and another 6 cloths the morning of surgery. Ensure patients understand they should use both sides of the cloth to maximize release of the CHG onto the skin.
4. Consider intraoperative irrigation of deep or subcutaneous tissues with aqueous iodophor solution for the prevention of SSI. Intra-peritoneal lavage with aqueous iodophor solution in contaminated or dirty abdominal procedures is not necessary (**Category II**).	4. Consider use of intraoperative irrigation with aqueous 0.05% CHG. Current laboratory and animal studies suggest that aqueous 0.05% CHG is an effective intraoperative wound irrigation solution for reducing the risk of SSI.[39-42]
5. No recommendation can be made regarding the safety and effectiveness of soaking prosthetic devices in antiseptic solutions prior to implantation for the prevention of SSI (**No recommendation/unresolved issue**).	5. No difference in guidance recommendation.
6. Use of plastic adhesive drapes with or without antimicrobial properties is not necessary for the prevention of SSI (**Category II**).	6. No difference in guidance recommendation.
7. Application of microbial sealant immediately after intraoperative skin preparation is not necessary for the prevention of SSI (**Category II**).	7. No difference in guidance recommendation.
8. Evidence from randomized controlled trials was insufficient to evaluate the trade-offs between benefit and harm of repeat application of antiseptic agents to the patient's skin immediately before closing the surgical incision to prevent SSIs (**No recommendation/unresolved issue**).	8. No difference in guidance recommendation.
9. Consider use of triclosan-coated sutures to prevent SSIs **(Category II).**	9. Use triclosan-coated antimicrobial sutures to close surgical wounds. All surgical wounds are contaminated at the time of closure. The risk of infection is related to

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Additional Considerations: Interventions for Prosthetic Joint Arthroplasty

HICPAC SSI Prevention Guidelines	WDPH SSI Prevention Guidance
1. Available evidence suggests uncertain trade-offs between benefit and harm of blood transfusions regarding the risk of SSI after prosthetic joint arthroplasty (**No recommendation/unresolved issue**).	1. No difference in guidance recommendation.
2. Do not withhold transfusion of necessary blood products from surgical patients as a means to prevent SSI (**Category IB**).	2. Balance the risk of complications from post-operative anemia with the potential increased risk of SSI following administration of blood products. Although some studies suggest that perioperative blood transfusion is associated with increased risk of SSI after selective pediatric and adult surgical procedures, this risk should be balanced with the undesirable complication of postoperative anemia.[63-70]
3. Available evidence suggests uncertain trade-offs between benefit and harm of systemic corticosteroid or other immunosuppressive therapy regarding the risk of SSI in prosthetic joint arthroplasty (**No recommendation/ unresolved issue**).	3. No difference in guidance recommendation.
4. Available evidence suggests uncertain trade-offs between benefit and harm of the use and timing of preoperative intra-articular corticosteroid injection regarding the incidence of SSI in prosthetic joint arthroplasty (**No recommendation/ unresolved issue**).	4. No difference in guidance recommendation. The concern that intra-articular steroid injection for postoperative pain management is a risk factor for SSI is at present controversial. However, the risk may be influenced by the presence of co-morbid risk factors; further studies are warranted.[71-73]
5. Available evidence suggests uncertain trade-offs between benefit and harm of venous	5. No difference in guidance recommendation.

HICPAC SSI Prevention Guidelines	WDPH SSI Prevention Guidance
7. In prosthetic joint arthroplasty, clean and clean-contaminated procedures, do not administer additional prophylactic antimicrobial agent doses after the surgical incision is closed in the operating room, even in the presence of a drain (**Category IA**).	7. No difference in guidance recommendation.
8. Available evidence suggests uncertain trade-offs between benefit and harm regarding cement modifications and the prevention of biofilm formation or SSI in prosthetic joint arthroplasty (**No recommendation/ unresolved issue**).	8. No difference in guidance recommendation.
9. Literature reviews did not identify studies evaluating prosthesis modifications for the prevention of biofilm formation or SSI in prosthetic joint arthroplasty (**No recommendation/unresolved issue**).	9. No difference in guidance recommendation.
10. Literature reviews did not identify studies evaluating vaccines for the prevention of biofilm formation or SSI in prosthetic joint arthroplasty (**No recommendation/unresolved issue**).	10. No difference in guidance recommendation.
11. Literature reviews did not identify studies evaluating biofilm control agents such as biofilm dispersants, quorum-sensing inhibitors, or novel antimicrobial agents for the prevention of biofilm formation or SSI in prosthetic joint arthroplasty (**No recommendation/unresolved issue**).	11. No difference in guidance recommendation.

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Documentation of Evidence-base Interventions

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OPINION

To Bathe or Not to Bathe With Chlorhexidine Gluconate: Is It Time to Take a Stand for Preadmission Bathing and Cleansing?

CHARLES E. EDMISTON JR, *PhD, MS, BS, CIC, FIDSA, FSHEA;*
OJAN ASSADIAN, *MD, DTM&H;* **MAUREEN SPENCER,** *MEd, BSN, CIC;*
RUSSELL N. OLMSTED, *MPH, BS, CIC;* **SUE BARNES,** *BSN, RN, CIC;*
DAVID LEAPER, *MD, ChM, FRCS, FACS, FLS*

Many health care facilities have incorporated an antiseptic skin cleansing protocol, often referred to as preoperative bathing and cleansing, to reduce the endogenous microbial burden on the skin of patients undergoing elective surgery, with the aim of reducing the risk of surgical site infections (SSIs). According to a recent study by Injean et al,[1] 91% of all facilities that perform coronary artery bypass surgery in California have a standardized preoperative bathing and cleansing protocol for patients. Historically, this practice has been endorsed by national and international organizations, such as the Hospital Infection Control Practice Advisory Committee and the Centers for Disease Control and Prevention,[2] the Association for Professionals in Infection Control and Epidemiology (APIC),[3] AORN,[4] the Institute for Healthcare Improvement (IHI),[5] and the National Institute for Health and Care Excellence (NICE),[6] which recommend bathing and/or cleansing with an antiseptic agent before surgery as a component of a broader strategy to reduce SSIs. The 2008 Society for Healthcare Epidemiology of America (SHEA)/Infectious Diseases Society of America (IDSA)/Surgical Infection Society (SIS) strategies to prevent SSIs in acute care hospitals declined to recommend a specific application policy regarding selection of an antiseptic agent for preoperative bathing but acknowledged that the (maximal) antiseptic benefits of chlorhexidine gluconate (CHG) are dependent on achieving adequate skin surface concentrations.[7]

Findings in reports published in the past 10 years have identified SSIs to be the most common health care–associated infection (HAI) and the most expensive in terms of resource utilization.[8,9] This provides a strong business case for health care institutions to invest in targeted, evidence-based, interventional strategies that reduce the risk of postoperative complications. In addition, because the microbial flora of the skin, especially staphylococci, provides a prominent reservoir of pathogens that cause SSIs,[7,10] focused interventions aimed at mitigating this reservoir in preoperative patients represent a logical and effective risk reduction strategy.

THE YIN AND YANG OF PREADMISSION BATHING: A RATIONAL CONSIDERATION OF BENEFIT

Despite the prevalent clinical practice of preoperative bathing with CHG, clinicians are now confronted with a possible shift in both CDC and AORN recommendations. The current proposed draft recommendations for preoperative showering or cleansing are summarized in Table 1. The 2015 AORN "Guideline for preoperative patient skin antisepsis"[11] and the CDC draft guideline[12] both have expanded their recommendations for perioperative skin antisepsis from using CHG products to also using other cleansing products (eg, antimicrobial or nonantimicrobial soap, other unspecified skin antiseptics). These expanded recommendations marginalize the practice of

http://dx.doi.org/10.1016/j.aorn.2015.02.008

Edmiston et al. AORN 2015;100:590-601

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Maximizing Skin Surface Concentrations of CHG: Embracing a Standardize Process Utilizing a Phamacokinetic Perspective (Dose, Timing, Duration)

Research

Original Investigation

Evidence for a Standardized Preadmission Showering Regimen to Achieve Maximal Antiseptic Skin Surface Concentrations of Chlorhexidine Gluconate, 4%, in Surgical Patients

Charles E. Edmiston Jr, PhD; Cheong J. Lee, MD; Candace J. Krepel, MS; Maureen Spencer, MEd; David Leaper, MD; Kellie R. Brown, MD; Brian D. Lewis, MD; Peter J. Rossi, MD; Michael J. Malinowski, MD; Gary R. Seabrook, MD

Invited Commentary

IMPORTANCE To reduce the amount of skin surface bacteria for patients undergoing elective surgery, selective health care facilities have instituted a preadmission antiseptic skin cleansing protocol using chlorhexidine gluconate. A Cochrane Collaborative review suggests that existing data do not justify preoperative skin cleansing as a strategy to reduce surgical site infection.

Edmiston CE Jr, Lee CJ, Krepel CJ, et al. JAMA Surg. 2015;150:1027-1033.

4% Aqueous CHG

- Dose - 4-ozs. for each shower
- Timing - 1-minute pause before rinsing (4% CHG)
- Duration - TWO SHOWERS (CLEANSINGS) – NIGHT BEFORE/MORNING OF SURGERY
- An SMS, text or voicemail reminder to shower
- A standardized regimen – instructions – Oral and written

CHG conc ≥1000 µg/ml

STANDARDIZATION OF THE 4% Chlorhexidine Gluconate (CHG) PREADMISSION SHOWER

Include the following components in preadmission CHG shower regimens, as part of a comprehensive surgical site infection prevention program.

1. Use electronic alert systems (text messaging, emails, voice mails) to remind patients to complete the shower regimen.
2. Emphasize the importance of the shower regimen, and give patients both oral and written instructions.
3. Provide the CHG product free of charge to patients.
4. Define a precise amount of CHG (one 4 oz. bottle) to be used for each shower.
5. Instruct patients to take a 60-second pause (time-out) after application of the CHG before rinsing.
6. Direct patients to wear loose-fitting garments following each CHG shower, and to avoid using lotions, creams, emollients, or perfume.

Source: Edmiston CE, Cheong JL, Krepel CJ, et al. Evidence for a standardized preadmission showering regimen to achieve maximal antiseptic skin surface concentrations of chlorhexidine gluconate, 4%, in surgical patients. JAMA Surg. 2015;150:1027-33.

Wisconsin Division of Public Health
HAI Prevention Program

https://www.dhs.wisconsin.gov/hai/index.htm

Wisconsin Department of Health Services

P-00749 (12/2015)

STANDARDIZATION OF THE 4% Chlorhexidine Gluconate (CHG) PREADMISSION SHOWER . www.dhs.wisconsin.gov/publications /p0/p00749.pdf. Published 2015.

Remember the devil is always in the details

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Review

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Prevention of Orthopedic Prosthetic Infections Using Evidence-Based Surgical Site Infection Care Bundles: A Narrative Review

Charles E. Edmiston, Jr.[1] and David John Leaper[2]

Abstract

Background: The number of primary/revision total joint replacements (TJR) are expected to increase substantially with an aging population and increasing prevalence of comorbid conditions. The 30-day re-admission rate, in all orthopedic specialties, is 5.4% (range, 4.8%–6.0%). A recent publication has documented that the surgical site infection (SSI) infection rate associated with revision total knee (rTKR, 15.6%) and revision total hip (rTHR, 8.6%) arthroplasties are four to seven times the rate of the primary procedures (2.1%–2.2%). These orthopedic infections prolong hospital stays, double re-admissions, and increase healthcare costs by a factor of 300%.
Methods: A search of PubMed/MEDLINE, EMBASE and the Cochrane Library publications, which reported the infection risk after TKR and THR, was undertaken (January 1, 1995 to December 31, 2021). The search also included documentation of evidence-based practices that lead to improved post-operative outcomes.
Results: The evidence-based approach to reducing the risk of SSI was grouped into pre-operative, peri-operative, and post-operative periods. Surgical care bundles have existed within other surgical disciplines for more than 20 years, although their use is relatively new in peri-operative orthopedic surgical care. Pre-admission chlorhexidine gluconate (CHG) showers/cleansing, staphylococcal decolonization, maintenance of normothermia, wound irrigation, antimicrobial suture wound closure, and post-operative wound care has been shown to improve clinical outcome in randomized controlled studies and meta-analyses.
Conclusions: Evidence-based infection prevention care bundles have improved clinical outcomes in all surgical disciplines. The significant post-operative morbidity, mortality, and healthcare cost, associated with SSIs after TJR can be reduced by introduction of evidence-based pre-operative, intra-operative, and post-operative interventions.

Keywords: arthroplasty; comorbid risk; evidence-based interventions; evidence-based SSI prevention bundle; peri-prosthetic infection

More than 600,000 knee and nearly 300,000 hip replacement procedures are undertaken annually in the United States [1–4]. The number of primary and revision total joint replacement (TJR) are expected to increase by 2030 with an aging population and an increasing prevalence of arthritis and comorbid conditions [5,6]. The number of TJRs may reach 572,000 primary hip replacements, 3.48 million primary knee replacements, 90,000 revision hip replacements, and 250,000 revision knee procedures [3]. The reported incidence of SSI ranges from 0.5% to 8% after both primary and revision TJR [4,6,7]. Factors shown to be associated with an increased risk include patient demographics, comorbid

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Table 1. Standardization of the Pre-Admission Shower (4% CHG)

Standardized pre-admission shower protocol includes the following components:

1. Use electronic alert systems (text messaging, e-mails, voice mails) to remind the patient to complete the shower regimen.
2. Emphasize to the patient the importance of the shower regimen and provide the patient with both oral and written instructions.
3. Provide two 4-ounce bottles of 4% CHG to the patient.
4. Tell the patient to use one complete 4-ounce bottle per shower.
5. Instruct the patient to take a 60-second pause (time-out) after application of the CHG before rinsing it off. This will enhance the skin-surface concentration of CHG.
6. Direct patients to wear loose-fitting garments after each CHG shower and to avoid using lotions, creams, emollients, or perfume.

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JAMA Surgery | Original Investigation

Morbidity After Mechanical Bowel Preparation and Oral Antibiotics Prior to Rectal Resection
The MOBILE2 Randomized Clinical Trial

Laura Koskenvuo, MD, PhD; Pipsa Lunkka, MD; Pirita Varpe, MD, PhD; Marja Hyöty, MD, PhD; Reetta Satokari, PhD; Carola Haapamäki, MD, PhD; Anna Lepistö, MD, PhD; Ville Sallinen, MD, PhD

IMPORTANCE Surgical site infections (SSIs)—especially anastomotic dehiscence—are major contributors to morbidity and mortality after rectal resection. The role of mechanical and oral antibiotics bowel preparation (MOABP) in preventing complications of rectal resection is currently disputed.

OBJECTIVE To assess whether MOABP reduces overall complications and SSIs after elective rectal resection compared with mechanical bowel preparation (MBP) plus placebo.

DESIGN, SETTING, AND PARTICIPANTS This multicenter, double-blind, placebo-controlled randomized clinical trial was conducted at 3 university hospitals in Finland between March 18, 2020, and October 10, 2022. Patients aged 18 years and older undergoing elective resection with primary anastomosis of a rectal tumor 15 cm or less from the anal verge on magnetic resonance imaging were eligible for inclusion. Outcomes were analyzed using a modified intention-to-treat principle, which included all patients who were randomly allocated to and underwent elective rectal resection with an anastomosis.

INTERVENTIONS Patients were stratified according to tumor distance from the anal verge and neoadjuvant treatment given and randomized in a 1:1 ratio to receive MOABP with an oral regimen of neomycin and metronidazole (n = 277) or MBP plus matching placebo tablets (n = 288). All study medications were taken the day before surgery, and all patients received intravenous antibiotics approximately 30 minutes before surgery.

MAIN OUTCOMES AND MEASURES The primary outcome was overall cumulative postoperative complications measured using the Comprehensive Complication Index. Key secondary outcomes were SSI and anastomotic dehiscence within 30 days after surgery.

RESULTS In all, 565 patients were included in the analysis, with 288 in the MBP plus placebo group (median [IQR] age, 69 [62-74] years; 190 males [66.0%]) and 277 in the MOABP group (median [IQR] age, 70 [62-75] years; 158 males [57.0%]). Patients in the MOABP group experienced fewer overall postoperative complications (median [IQR] Comprehensive Complication Index, 0 [0-8.66] vs 8.66 [0-20.92]; Wilcoxon effect size, 0.146; $P < .001$), fewer SSIs (23 patients [8.3%] vs 48 patients [16.7%]; odds ratio, 0.45 [95% CI, 0.27-0.77]), and fewer anastomotic dehiscences (16 patients [5.8%] vs 39 patients [13.5%]; odds ratio, 0.39 [95% CI, 0.21-0.72]) compared with patients in the MBP plus placebo group.

CONCLUSIONS AND RELEVANCE Findings of this randomized clinical trial indicate that MOABP reduced overall postoperative complications as well as rates of SSIs and anastomotic dehiscences in patients undergoing elective rectal resection compared with MBP plus placebo. Based on these findings, MOABP should be considered as standard treatment in patients undergoing elective rectal resection.

Visual Abstract
Invited Commentary
Multimedia
Supplemental content

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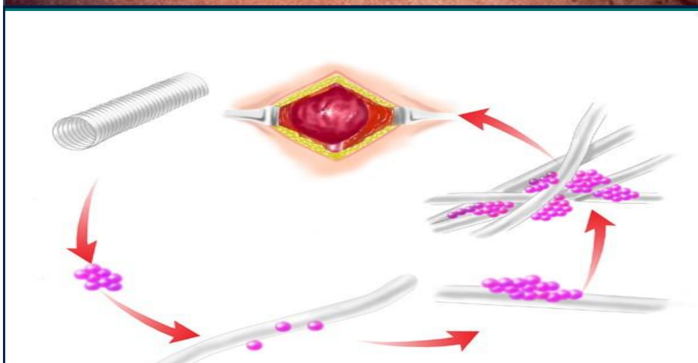

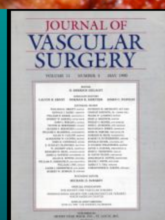

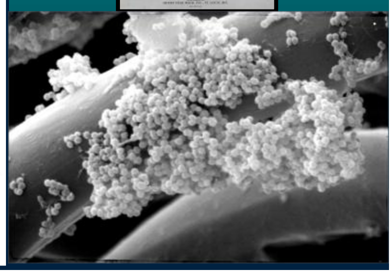

Edmiston et al. J Vascular Surgery 1990;11:629-634

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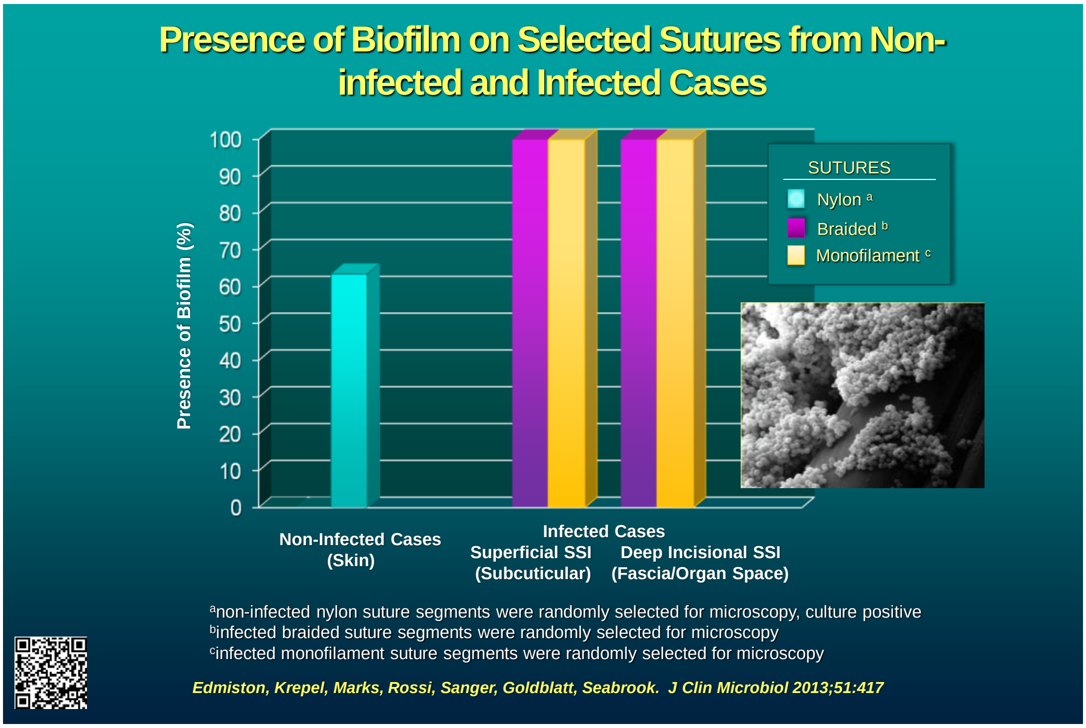
Presence of Biofilm on Selected Sutures from Non-infected and Infected Cases
Presence of Biofilm (%)
100
90
80
70
60
50
40
30
20
10
0
SUTURES
Nylon a
Braided b
Monofilament c
Non-Infected Cases (Skin)
Infected Cases
Superficial SSI (Subcuticular)
Deep Incisional SSI (Fascia/Organ Space)
anon-infected nylon suture segments were randomly selected for microscopy, culture positive
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Edmiston, Krepel, Marks, Rossi, Sanger, Goldblatt, Seabrook. J Clin Microbiol 2013;51:417

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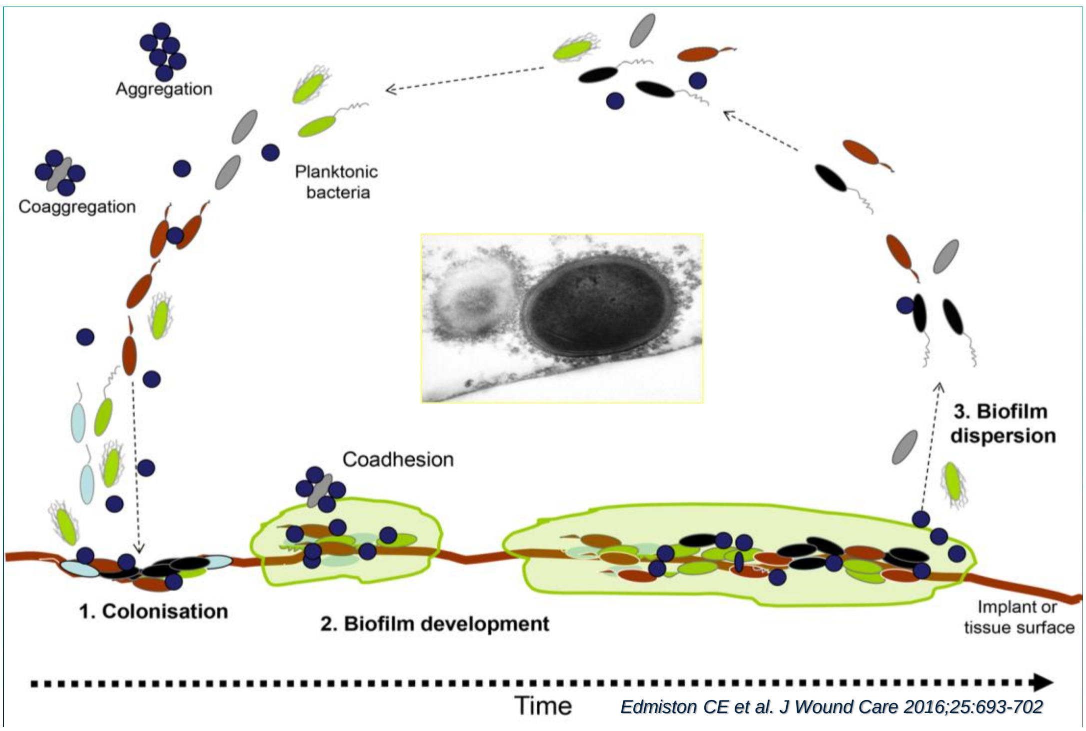
Aggregation
Coaggregation
Planktonic bacteria
Coadhesion
3. Biofilm dispersion
1. Colonisation
2. Biofilm development
Implant or tissue surface
Time
Edmiston CE et al. J Wound Care 2016;25:693-702

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Guideline Elements	WHO 2016	ACS 2016	CDC 2017	Wisconsin 2016	SHEA 2023
Normothermia	Maintain normothermia	Maintain normothermia	Maintain normothermia	Maintain normothermia - FAW reduces incidence of SSI	For procedures not requiring hypothermia, maintain normothermia (temperature > 35.5°C)
Wound Irrigation	No recommendation	Intraoperative irrigation recommended - povidone iodine	No recommendation	Intraoperative irrigation recommended - CHG	Perform intraoperative antiseptic wound lavage.
Antimicrobial Prophylaxis	Short durational	Short durational	Short durational	Short durational – Follow ASHP weight-based dosing	Administer antimicrobial prophylaxis according to evidence-based standards and guidelines
Glycemic Control	Recommended	Recommended	Highly beneficial	Highly beneficial HA1c ≤6.7	Control blood-glucose level during the immediate postoperative period for all patients.
Perioperative Oxygenation	Recommended	Administer increased FIO_2 during surgery after extubation, immediate postop period	Recommended	Recommended – Strongest evidence in colorectal surgery	Supplemental oxygen is most effective when combined with additional strategies to improve tissue oxygenation
Preadmission Showers	Advised patients to bathe or shower with soap	Advise patients to bathe or shower with soap or antiseptic agent –at least night before surgery	Advise patients to bathe/shower with CHG	Two standardized shower/cleansing with CHG 4% or 2% CHG polyester cloths before/morning (surgery)	Adequate levels of CHG must be achieved and maintained on the skin.
Antimicrobial Sutures	Use antimicrobial sutures independent of type of surgery	Consider use of triclosan-coated sutures for prevention of SSI	Recommended for clean and clean-contaminated abdominal procedures	The use of triclosan sutures represents 1a clinical evidence	Use antiseptic-impregnated sutures as a strategy to prevent SSI.
Colorectal surgery: oral and mechanical bowel prep and wound protectors	Use preoperative oral antibiotics combined with mechanical bowel preparation (MBP) Use of wound protector (WP) devices in clean-contaminated, contaminated and dirty abdominal surgical procedure	Combination mechanical and antibiotic (po) preparation is recommended for all elective colectomies. Use of an impervious plastic wound protector can prevent SSI in open abdominal surgery	No recommendation for either measure	Include preoperative oral antibiotics in combination with mechanical bowel preparations (OA-MBP) as a safe and effective adjunctive strategy for reducing the risk of infection following colorectal surgery. Use wound edge protectors	Use a combination of parenteral and oral antimicrobial prophylaxis prior to elective colorectal surgery Use impervious plastic wound protectors for gastrointestinal and biliary tract surgery

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FOCAL Considerations Outside of NHSN Guidelines

Biofilm - mediated infections exhibit resistance to host defenses and often contribute to an excessive or inappropriate local inflammatory response. This leads to complement activation and formation of immune complexes, which in turn lead to tissue injury. Unfortunately, the incidence of biofilm- associated SSIs is likely to increase because of the expanding use of implanted medical devices.

Surgical Care Bundles have been documented to reduce the risk of SSIs and improve surgical outcomes, compliance shortcomings have been reported in the literature. These findings suggest that healthcare institutions are challenged to fully adopt standardized guidelines and should embrace an implementation science approach to ensure that all surgical patients are afforded the opportunity to receive the best possible evidence-based interventions to mitigate the risk of postoperative infection.

The field of dissemination and implementation (D and I) science bridges the gap between public health, clinical research and evidence-based practice. D and I focuses on what helps and what hinders the uptake, effective implementation, and sustainability of evidence-based programs within the clinical practice environment.

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Evidence-Based Interventions	Class	Mechanism of Intervention
Normothermia	1A	Less bleeding / preserve immune function in wound bed / enhanced wound healing
Perioperative antimicrobial prophylaxis – "Weight-Based"	1A	Tissue antisepsis / intraoperative conc > MIC^{90} wound pathogens
Glycemic control	1A	Preserve granulocytic immune function / enhance wound healing
Antimicrobial (triclosan) coated sutures (fascia / subcuticular closure)	1A	Mitigate nidus of wound contamination / local tissue antisepsis / minimize the risk of biofilm formation
Preadmission CHG shower / cleansing	High-1A	Skin antisepsis / reduce microbial skin bioburden
Perioperative skin-prep – 2% CHG / 70% alcohol	1A	Skin antisepsis / reduce microbial skin bioburden
Separate wound closure tray	Moderate	Mitigate instrument contamination
Glove change prior to fascia / subcuticular closure	Moderate	Disrupt cross-contamination across tissue planes

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Evidence-Based Interventions	Class	Mechanistic Benefits
Supplemental oxygen – Colorectal	Moderate to High	Enhanced tissue oxygenation and immune fuction / host-metabolic benefits
Oral antibiotics / Mechanical bowel prep – Colorectal	1A	Reduce bioburden (protease-producing bacteria) within bowel lumen and brush border surface
Wound edge protector – Colorectal, Vascular, OB/GYN	Moderate	Intraoperative wound antisepsis-minimizing wound contamination
Staphylococcal decolonization – Orthopedic and CT	1A	Mitigate *S. aureus* and MRSA pathogenicity
Smoking cessation – Orthopedic, Neuro, CT - likely all surgical procedures	High to 1A	Preserve angiogenesis /reduce risk of dehiscence / enhance wound healing
Intraoperative irrigation of the surgical wound with 0.05% chlorhexidine gluconate	Moderate	Mitigate wound contamination prior to closure
OR traffic control – minimize door openings	Low to Moderate	Reduce OR air bioburden

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The Absolute Weakest Link

ORIGINAL ARTICLE

Surgical site infection: poor compliance with guidelines and care bundles

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Key words
Care bundles; Compliance; Guidelines; Surgical site infection

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Leaper DJ, Tanner J, Kiernan M, Assadian O, Edmiston CE Jr. Surgical site infection: poor compliance with guidelines and care bundles. Int Wound J 2014; doi: 10.1111/iwj.12243

Abstract

Surgical site infections (SSIs) are probably the most preventable of the health care-associated infections. Despite the widespread international introduction of level I evidence-based guidelines for the prevention of SSIs, such as that of the National Institute for Clinical Excellence (NICE) in the UK and the surgical care improvement project (SCIP) of the USA, SSI rates have not measurably fallen. The care bundle approach is an accepted method of packaging best, evidence-based measures into routine care for all patients and, common to many guidelines for the prevention of SSI, includes methods for preoperative removal of hair (where appropriate), rational antibiotic prophylaxis, avoidance of perioperative hypothermia, management of perioperative blood glucose and effective skin preparation. Reasons for poor compliance with care bundles are not clear and have not matched the wide uptake and perceived benefit of the WHO 'Safe Surgery Saves Lives' checklist. Recommendations include the need for further research and continuous updating of guidelines; comprehensive surveillance, using validated definitions that facilitate benchmarking of anonymised surgeon-specific SSI rates; assurance that incorporation of checklists and care bundles has taken place; the development of effective communication strategies for all health care providers and those who commission services and comprehensive information for patients.

Leaper et al. Int Wound J. 2014 Feb 25. doi: 10.1111/iwj.12243

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Validating the Clinical Efficacy of Selective Interventions of the Surgical Care Bundle

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Developing an argument for bundled interventions to reduce surgical site infection in colorectal surgery

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Background. *Surgical site infection (SSI) remains a costly and morbid complication after colectomy. The primary objective of this study was to investigate whether a group of perioperative care measures previously shown to be associated with reduced SSI would have an additive effect in SSI reduction. If so, this would support the use of an "SSI prevention bundle" as a quality improvement intervention.*
Methods. *Data from 24 hospitals participating in the Michigan Surgical Quality Collaborative were included in the study. The main outcome measure was SSI. Hierarchical logistic regression was used to account for clustering of patients within hospitals.*
Results. *In total, 4,085 operations fulfilled inclusion criteria for the study (Current Procedural Terminology codes 44140, 44160, 44204, and 44205). A "bundle score" was assigned to each operation, based on the number of perioperative care measures followed (appropriate Surgical Care Improvement Project-2 antibiotics, postoperative normothermia, oral antibiotics with bowel preparation, perioperative glycemic control, minimally invasive surgery, and short operative duration). There was a strong stepwise inverse association between bundle score and incidence of SSI. Patients who received all 6 bundle elements had risk-adjusted SSI rates of 2.0% (95% confidence interval [CI], 7.9–0.5%), whereas patients who received only 1 bundle measure had SSI rates of 17.5% (95% CI, 27.1–10.8%).*
Conclusion. *This multi-institutional study shows that patients who received all 6 perioperative care measures attained a very low, risk-adjusted SSI rate of 2.0%. These results suggest the promise of an SSI reduction intervention for quality improvement; however, prospective research are required to confirm this finding. (Surgery 2014;155:602-6.)*

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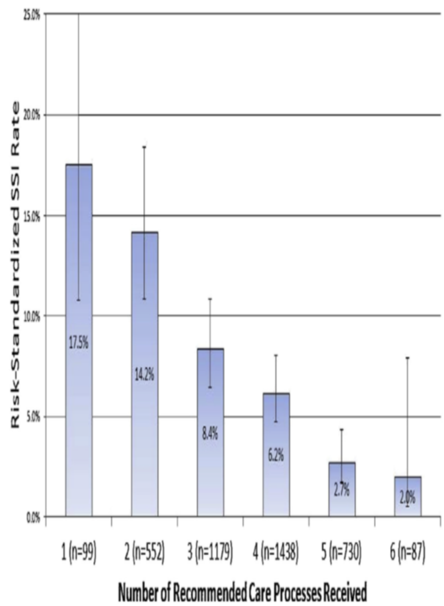

Waits et al. Surgery 2014;155:602

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ORIGINAL CONTRIBUTION

An Effective Bundled Approach Reduces Surgical Site Infections in a High-Outlier Colorectal Unit

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BACKGROUND: Surgical site infections are the most common hospital-acquired infection after colorectal surgery, increasing morbidity, mortality, and hospital costs.

OBJECTIVE: The purpose of this study was to investigate the impact of preventive measures on colorectal surgical site infection rates in a high-volume institution that performs inherent high-risk procedures.

DESIGN: This was a prospective cohort study.

SETTINGS: The study was conducted at a high-volume, specialized colorectal surgery department.

PATIENTS: The Prospective Surgical Site Infection Prevention Bundle Project included 14 preoperative, intraoperative, and postoperative measures to reduce surgical site infection occurrence after colorectal surgery. Surgical site infections within 30 days of the index operation were examined for patients during the 1-year period after the surgical site infection prevention bundle was implemented. The data collection and outcomes for this period were compared with the year immediately before the implementation of bundle elements. All of the patients who underwent elective colorectal surgery by a total of 17 surgeons were included. The following procedures were excluded from the analysis to obtain a homogeneous patient population: ileostomy closure and anorectal and enterocutaneous fistula repair.

MAIN OUTCOME MEASURES: Surgical site infection occurring within 30 days of the index operation was measured. Surgical site infection–related outcomes after implementation of the bundle (bundle February 2014 to February 2015) were compared with same period a year before the implementation of bundle elements (prebundle February 2013 to February 2014).

RESULTS: Between 2013 and 2015, 2250 abdominal colorectal surgical procedures were performed, including 986 (43.8%) during the prebundle period and 1264 (56.2%) after the bundle project. Patient characteristics and comorbidities were similar in both periods. Compliance with preventive measures ranged between 75% and 99% during the bundle period. The overall surgical site infection rate decreased from 11.8% prebundle to 6.6% at the bundle period ($P < 0.001$). Although a decrease for all types of surgical site infections was observed after the bundle implementation, a significant reduction was achieved in the organ-space subgroup (5.5%–1.7%; $P < 0.001$).

LIMITATION: We were unable to predict the specific contributions the constituent bundle interventions made to the surgical site infection reduction.

CONCLUSIONS: The prospective Surgical Site Infection Prevention Bundle Project resulted in a substantial decline in surgical site infection rates in our department. Collaborative and enduring efforts among multiple providers are critical to achieve a sustained reduction See **Video Abstract** at http://links.lww.com/

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Presented at the meeting of the Surgical Infection Society, Palm Beach, FL, May 18 to 21, 2016.

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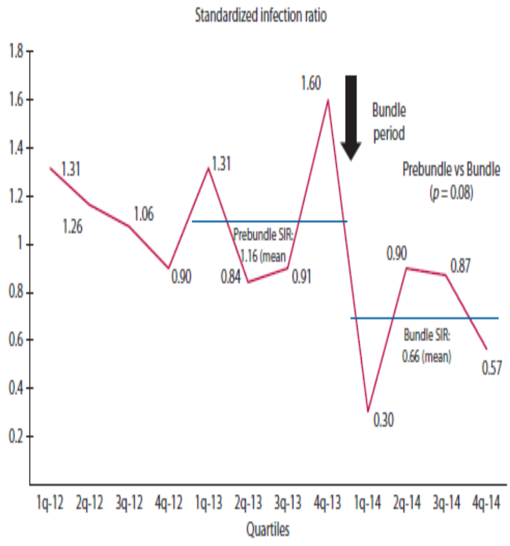

Dis Colon Rectum 2018; 61: 89–98

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Do surgical care bundles reduce the risk of surgical site infections in patients undergoing colorectal surgery? A systematic review and cohort meta-analysis of 8,515 patients

Judith Tanner, PhD,[a] Wendy Padley, MSc,[b] Ojan Assadian, MD,[c] David Leaper, MD,[c] Martin Kiernan, MPH,[d] *and* Charles Edmiston, PhD,[e] *Nottingham, Leicester, Huddersfield, and London, UK, and Milwaukee, WI*

Background. *Care bundles are a strategy that can be used to reduce the risk of surgical site infection (SSI), but individual studies of care bundles report conflicting outcomes. This study assesses the effectiveness of care bundles to reduce SSI among patients undergoing colorectal surgery.*
Methods. *We performed a systematic review and meta-analysis of randomized controlled trials, quasi-experimental studies, and cohort studies of care bundles to reduce SSI. The search strategy included database and clinical trials register searches from 2012 until June 2014, searching reference lists of retrieved studies and contacting study authors to obtain missing data. The Downs and Black checklist was used to assess the quality of all studies. Raw data were used to calculate pooled relative risk (RR) estimates using Cochrane Review Manager. The* I^2 *statistic and funnel plots were performed to identify publication bias. Sensitivity analysis was carried out to examine the influence of individual data sets on pooled RRs.*
Results. *Sixteen studies were included in the analysis, with 13 providing sufficient data for a meta-analysis. Most study bundles included core interventions such as antibiotic administration, appropriate hair removal, glycemic control, and normothermia. The SSI rate in the bundle group was 7.0% (328/4,649) compared with 15.1% (585/3,866) in a standard care group. The pooled effect of 13 studies with a total sample of 8,515 patients shows that surgical care bundles have a clinically important impact on reducing the risk of SSI compared to standard care with a CI of 0.55 (0.39–0.77; P = .0005).*
Conclusion. *The systematic review and meta-analysis documents that use of an evidence-based, surgical care bundle in patients undergoing colorectal surgery significantly reduced the risk of SSI. (Surgery 2015;158:66-77.)*

From the School of Health Sciences,[a] University of Nottingham, Nottingham; Faculty of Health and Life Sciences,[b] De Montfort University, Leicester; Institute of Skin Integrity and Infection Prevention,[c] University of Huddersfield, Huddersfield; Richard Wells Research Centre,[d] University of West London, London, UK; and Department of Surgery,[e] Medical College of Wisconsin, Milwaukee, WI

Tanner J et al. Surgery 2015;158:66-77

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REVIEW ARTICLE

Bundles Prevent Surgical Site Infections After Colorectal Surgery: Meta-analysis and Systematic Review

Aleksander Zywot[1,2] · Christine S.M. Lau[1,2] · H. Stephen Fletcher[1] · Subroto Paul[1]

Received: 29 December 2016 / Accepted: 23 May 2017 / Published online: 15 June 2017

Abstract
Introduction Colorectal surgeries (CRS) have one of the highest rates of surgical site infections (SSIs) with rates 15 to >30%. Prevention "bundles" or sets of evidence-based interventions are structured ways to improve patient outcomes. The aim sof this study is to evaluate CRS SSI prevention bundles, bundle components, and implementation and compliance strategies.
Methods A meta-analysis of studies with pre- and post-implementation data was conducted to assess the impact of bundles on SSI rates (superficial, deep, and organ/space). Subgroup analysis of bundle components identified optimal bundle designs.
Results Thirty-five studies (51,413 patients) were identified and 23 (17,557 patients) were included in the meta-analysis. A SSI risk reduction of 40% ($p < 0.001$) was noted with 44% for superficial SSI ($p < 0.001$) and 34% for organ/space ($p = 0.048$). Bundles with sterile closure trays (58.6 vs 33.1%), MBP with oral antibiotics (55.4 vs 31.8%), and pre-closure glove changes (56.9 vs 28.5%) had significantly greater SSI risk reduction.
Conclusion Bundles can effectively reduce the risk of SSIs after CRS, by fostering a cohesive environment, standardization, and reduction in operative variance. If implemented successfully and complied with, bundles can become vital to improving patients' surgical quality of care.

Keywords Surgical site infection · SSI · Bundle · Colorectal

which ranges from 15.1 to over 30%.[2–7] In 2014, the Joint

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Original Research

Using Bundled Interventions to Reduce Surgical Site Infection After Major Gynecologic Cancer Surgery

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OBJECTIVE: To investigate whether implementing a bundle, defined as a set of evidence-based practices performed collectively, can reduce 30-day surgical site infections.

METHODS: Baseline surgical site infection rates were determined retrospectively for cases of open uterine cancer, ovarian cancer without bowel resection, and ovarian cancer with bowel resection between January 1, 2010, and December 31, 2012, at an academic center. A perioperative bundle was prospectively implemented during the intervention period (August 1, 2013, to September 30, 2014). Prior established elements were: patient education, 4% chlorhexidine gluconate shower before surgery, antibiotic administration, 2% chlorhexidine gluconate and 70% isopropyl alcohol coverage of incisional area, and cefazolin redosing 3–4 hours after incision. New elements initiated were: sterile closing tray and staff glove change for fascia and skin closure, dressing removal at 24–48 hours, dismissal with 4% chlorhexidine gluconate, and follow-up nursing phone call. Surgical site infection rates were examined using control charts, compared between periods using χ^2 or Fisher exact test, and validated against the American College of Surgeons National Surgical Quality Improvement Program decile ranking.

RESULTS: The overall 30-day surgical site infection rate was 38 of 635 (6.0%) among all cases in the preintervention period, with 11 superficial (1.7%), two deep (0.3%), and 25 organ or space infections (3.9%). In the intervention period, the overall rate was 2 of 190 (1.1%), with two organ or space infections (1.1%). Overall, the relative risk reduction in surgical site infection was 82.4% (P=.01). The surgical site infection relative risk reduction was 77.6% among ovarian cancer with bowel resection, 79.3% among ovarian cancer without bowel resection, and 100% among uterine cancer. The American College of Surgeons National Surgical Quality Improvement Program decile ranking improved from the 10th decile to first decile; risk-adjusted odds ratio for surgical site infection decreased from 1.6 (95% confidence interval 1.0–2.6) to 0.6 (0.3–1.1).

CONCLUSION: Implementation of an evidence-based surgical site infection reduction bundle was associated with substantial reductions in surgical site infection in high-risk cancer procedures.
(Obstet Gynecol 2016;127:1135–44)

DOI: 10.1097/AOG.0000000000001449

From the Department of Obstetrics and Gynecology, Division of Gynecologic Surgery, the Division of Healthcare Policy and Research, Infection Prevention and Control, the Department of Nursing, the Surgery Research Office, the Division of Biomedical Statistics and Informatics, and the Department of General Surgery, Division of Colorectal Surgery, Mayo Clinic, and Mayo Medical School, Mayo Clinic, Minnesota.

Presented at the American College of Surgeons National Surgical Quality Improvement Program Annual Meeting, July 25–28, 2015, Chicago, Illinois.

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Johnson et al. Obstet Gynecol 2016;127:1135-1144

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Review

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Prevention of Orthopedic Prosthetic Infections Using Evidence-Based Surgical Site Infection Care Bundles: A Narrative Review

Charles E. Edmiston, Jr.[1] and David John Leaper[2]

Abstract

Background: The number of primary/revision total joint replacements (TJR) are expected to increase substantially with an aging population and increasing prevalence of comorbid conditions. The 30-day re-admission rate, in all orthopedic specialties, is 5.4% (range, 4.8%–6.0%). A recent publication has documented that the surgical site infection (SSI) infection rate associated with revision total knee (rTKR, 15.6%) and revision total hip (rTHR, 8.6%) arthroplasties are four to seven times the rate of the primary procedures (2.1%–2.2%). These orthopedic infections prolong hospital stays, double re-admissions, and increase healthcare costs by a factor of 300%.
Methods: A search of PubMed/MEDLINE, EMBASE and the Cochrane Library publications, which reported the infection risk after TKR and THR, was undertaken (January 1, 1995 to December 31, 2021). The search also included documentation of evidence-based practices that lead to improved post-operative outcomes.
Results: The evidence-based approach to reducing the risk of SSI was grouped into pre-operative, peri-operative, and post-operative periods. Surgical care bundles have existed within other surgical disciplines for more than 20 years, although their use is relatively new in peri-operative orthopedic surgical care. Pre-admission chlorhexidine gluconate (CHG) showers/cleansing, staphylococcal decolonization, maintenance of normothermia, wound irrigation, antimicrobial suture wound closure, and post-operative wound care has been shown to improve clinical outcome in randomized controlled studies and meta-analyses.
Conclusions: Evidence-based infection prevention care bundles have improved clinical outcomes in all surgical disciplines. The significant post-operative morbidity, mortality, and healthcare cost, associated with SSIs after TJR can be reduced by introduction of evidence-based pre-operative, intra-operative, and post-operative interventions.

Keywords: arthroplasty; comorbid risk; evidence-based interventions; evidence-based SSI prevention bundle; peri-prosthetic infection

More than 600,000 knee and nearly 300,000 hip replacement procedures are undertaken annually in the United States [1–4]. The number of primary and revision total joint replacement (TJR) are expected to increase by 2030 with an aging population and an increasing prevalence of arthritis and comorbid conditions [5,6]. The number of TJRs may reach 572,000 primary hip replacements, 3.48 million primary knee replacements, 90,000 revision hip replacements, and 250,000 revision knee procedures [3]. The reported incidence of SSI ranges from 0.5% to 8% after both primary and revision TJR [4,6,7]. Factors shown to be associated with an increased risk include patient demographics, comorbid

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REVIEW ARTICLE

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What Is The Cumulative Evidence That Surgical Care Bundles Reduce the Risk of SSIs?

Literature Review

The Impact of Care Bundles on the Incidence of Surgical Site Infections: A Systematic Review

Pinar Avsar, PhD, MSc, BSc, RGN; Declan Patton, PhD, MSc, PGDipEd, PGCRM, BNS(Hons), RNT, RPN; Aicha Sayeh, PhD; Karen Ousey, PhD, RGN, FHEA, CMgr MCMI; Joanna Blackburn, PhD, MSc, BSc; Tom O'Connor, EdD, MSc Ad Nursing, PG Dip Ed, BSc, Dip Nur, RNT, RGN; and Zena Moore, PhD, MSc, FFNMRCSI, PG Dip, Dip First Line Management, RGN

ABSTRACT

OBJECTIVE: This systematic review assesses the effects of care bundles on the incidence of surgical site infections (SSIs).

DATA SOURCES: The search was conducted between February and May 2021, using PubMed, CINAHL, SCOPUS, Cochrane, and EMBASE databases.

STUDY SELECTION: Studies were included if they used systematic review methodology, were in English, used a quantitative design, and explored the use of care bundles for SSI prevention. A total of 35 studies met the inclusion criteria, and 26 provided data conducive to meta-analysis.

DATA EXTRACTION: Data were extracted using a predesigned extraction tool, and analysis was undertaken using RevMan (Cochrane, London, UK). Quality appraisal was undertaken using evidence-based librarianship.

DATA SYNTHESIS: The mean sample size was 7,982 (median, 840) participants. There was a statistically significant difference in SSI incidence in favor of using a care bundle (SSI incidence 4%, 703/17,549 in the care bundle group vs 7%, 1,157/17,162 in the usual care group). The odds ratio was 0.55 (95% confidence interval, 0.41–0.73; P < .0001), suggesting that there is a 45% reduction in the odds of SSI development for the care bundle group. The mean validity score for all studies was 84% (SD, 0.04%).

CONCLUSIONS: The results indicate that implementing care bundles reduced SSI incidence. However, because there was clinically important variation in the composition of and compliance with care bundles, additional research with standardized care bundles is needed to confirm this finding.

KEYWORDS: care bundle, health, surgical site infection, systematic review, well-being

ADV SKIN WOUND CARE 2022;35:386–93.

INTRODUCTION

Surgical site infection (SSI) is a common healthcare-acquired infection,[1] and can vary in severity from superficial, involving the skin only, to more serious infection involving deeper tissue, organs, or implanted material.[2] Although SSI rates vary depending on the type of surgery and the degree of contamination, the World Health Organization found that, overall, 11% of patients who undergo surgery develop an SSI.[3] According to the annual epidemiologic report by the European Centre for Disease Prevention and Control,[4] SSI incidence varies from 0.5% to 10.1%, depending on the type of surgical procedure.

Surgical site infections negatively impact patients' physical and mental health, and SSI is a leading cause of patient discomfort, resulting in longer inpatient stays, higher costs to the healthcare system, and increased mortality.[5–7] Patients with an SSI may also experience delayed wound healing, becoming more vulnerable to secondary complications, such as bacteremia.[8,9] One systematic review determined that the cost per day of hospitalization rose from €350 to €1,140 with SSI development.

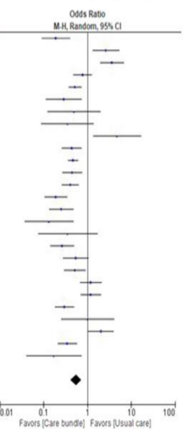
A considerable decrease in SSI rates can be achieved by using evidence-based measures such as care bundles, which can improve patient safety and quality of life.[10] A care bundle is a small, straightforward set of evidence-based practices or interventions (usually three to five). Care bundles enhance clinical outcomes through consistent use of reliable interventions that define a standard of care, enable adequate and efficient treatment, and control infections.[10] They improve patient outcomes when performed collectively and consistently.[11]

A large body of literature has used systematic review methodology to explore SSI incidence and prevention care bundles in relation to a specific type of surgery, primarily cesarean delivery or colorectal surgery.[12,13] No previous study has investigated the elements of SSI

Figure 2. FOREST PLOT OF CARE BUNDLE VERSUS USUAL CARE AND ODDS RATIO OF SURGICAL SITE INFECTION

Study or Subgroup	Care bundle Events	Care bundle Total	Usual care Events	Usual care Total	Weight	Odds Ratio M-H, Random, 95% CI
Agarwal 2019	8	216	105	624	3.8%	0.19 [0.09, 0.40]
Albert 2019	26	212	13	258	3.9%	2.63 [1.32, 5.27]
Bagga 2020	43	3504	13	3829	4.1%	3.65 [1.96, 6.79]
Bert a 2017	31	1785	34	1529	4.4%	0.78 [0.48, 1.27]
Bert b 2017	60	1785	96	1529	4.7%	0.52 [0.37, 0.72]
Bolte 2020	6	364	19	346	3.3%	0.29 [0.11, 0.73]
Bull 2011	3	275	6	275	2.3%	0.49 [0.12, 2.00]
Burgess 2020	3	81	8	81	2.4%	0.35 [0.09, 1.37]
Chien 2014	14	1010	3	1010	2.6%	4.72 [1.35, 16.47]
Davidson 2020	20	1867	52	2147	4.3%	0.44 [0.26, 0.73]
Dean 2020	137	1332	131	666	4.8%	0.47 [0.36, 0.61]
Hajirawala 2020	47	301	34	116	4.3%	0.45 [0.27, 0.74]
Hoang 2019	43	915	47	436	4.5%	0.41 [0.27, 0.63]
Jiménez-Martínez 2020	14	422	91	595	4.2%	0.19 [0.11, 0.34]
Keenan 2011	12	213	66	346	4.0%	0.25 [0.13, 0.48]
Lippitt 2014	3	128	14	91	2.5%	0.13 [0.04, 0.47]
Liu 2017	2	113	9	186	2.1%	0.35 [0.08, 1.67]
Luffiyya 2017	13	195	91	430	4.1%	0.27 [0.14, 0.49]
Park 2020	20	1087	16	480	3.9%	0.54 [0.28, 1.06]
Pe´rez-Blanco 2015	20	124	59	218	4.2%	0.52 [0.29, 0.91]
Phelan 2020	29	99	42	163	4.2%	1.19 [0.68, 2.08]
Tanner 2016	46	166	31	127	4.3%	1.19 [0.70, 2.01]
Tufts 2019	26	193	79	231	4.4%	0.30 [0.18, 0.49]
Uzuka 2017	3	68	7	161	2.3%	1.02 [0.25, 4.05]
Wassef 2020	47	177	14	93	4.0%	2.04 [1.06, 3.94]
Weiser 2018	25	616	49	454	4.4%	0.35 [0.21, 0.58]
Yamada 2018	2	301	28	741	2.2%	0.17 [0.04, 0.72]
Total (95% CI)		17549		17162	100.0%	0.55 [0.41, 0.73]
Total events	703		1157			

Heterogeneity: $Tau^2 = 0.44$; $Chi^2 = 155.50$, df = 26 ($P < 0.00001$); $I^2 = 83\%$
Test for overall effect: Z = 4.07 ($P < 0.0001$)



Avsar P, et al. The Impact of Care Bundles on the Incidence of Surgical Site Infections: A Systematic Review. Adv Skin Wound Care 2022;35:386–93

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Is There An Ideal Surgical Care Bundle For Selective Surgical Procedures?

CLINICAL

Implementation of a Wisconsin Division of Public Health Surgical Site Infection Prevention Champion Initiative

Gwen Borlaug, MPH, CIC, FAPIC; Charles E. Edmiston, Jr, PhD, CIC, FIDSA, FSHEA, FAPIC

ABSTRACT

Approximately 900 surgical site infections (SSIs) were reported to the Wisconsin Division of Public Health annually from 2013 to 2015, representing the most prevalent reported health care–associated infection in the state. Personnel at the Wisconsin Division of Public Health launched an SSI prevention initiative in May 2015 using a surgical care champion to provide surgical team peer-to-peer guidance through voluntary, nonregulatory, fee-exempt onsite visits that included presentations regarding the evidence-based surgical care bundle, tours of the OR and central processing areas, and one-on-one discussions with surgeons. The surgical care champion visited 10 facilities from August to December 2015, and at those facilities, SSIs decreased from 83 in 2015 to 47 in 2016 and the overall SSI standardized infection ratio decreased by 45% from 1.61 to 0.88 (P = .002), suggesting a statewide SSI prevention champion model can help lead to improved patient outcomes.

Key words: *surgical champion, surgical care bundle, SSI prevention, peer collaboration, evidence-based practice.*

Borlaug G, Edmiston CE Jr. Implementation of a Wisconsin Division of Public Health Surgical Site Infection Prevention Champion Initiative. AORN J. 2018;107:570-578.

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Building an Effective Surgical Care Bundle

Baseline Evidence-Based Interventions – Designated High-1A*

- Normothermia – 1A
- Perioperative antimicrobial prophylaxis – Weight-based – 1A
- Antimicrobial (triclosan) coated sutures (fascia / subcuticular closure) – 1A
- Preadmission CHG shower/cleansing – Standardized regimen – 1A
- Perioperative antisepsis – 2% CHG/ 70% alcohol – 1A
- Glycemic control – 1A
- Separate wound closure tray – Moderate
- Glove change prior to fascia/subcuticular closure – Moderate
- Smoking cessation – High

Inclusive Evidence-Based Intervention for Consideration in 2019*

- Supplemental oxygen – Colorectal – 1A
- Oral antibiotics / Mechanical bowel prep – Colorectal – 1A
- Wound edge protector – Colorectal – 1A
- Staphylococcal decolonization – Orthopedic / CT - 1A
- Irrigation with 0.05% CHG - Moderate
- OR traffic control – Device-related procedures – Low

** Published level of evidence*

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Gilhooly et al. Implementation Science (2019) 14:47
https://doi.org/10.1186/s13012-019-0894-2

Implementation Science

SYSTEMATIC REVIEW Open Access

Barriers and facilitators to the successful development, implementation and evaluation of care bundles in acute care in hospital: a scoping review

D. Gilhooly[1*], S. A. Green[2,3], C. McCann[1], N. Black[3] and S. R. Moonesinghe[4,5]

Abstract

Background: Care bundles are small sets of evidence-based recommendations, designed to support the implementation of evidence-based best clinical practice. However, there is variation in the design and implementation of care bundles, which may impact on the fidelity of delivery and subsequently their clinical effectiveness.

Methods: A scoping review was carried out using the Arksey and O'Malley framework to identify the literature reporting on the design, implementation and evaluation of care bundles. The Embase, CINAHL, Cochrane and Ovid MEDLINE databases were searched for manuscripts published between 2001 and November 2017; hand-searching of references and citations was also undertaken. Data were initially assessed using a quality assessment tool, the Downs and Black checklist, prior to further analysis and narrative synthesis. Implementation strategies were classified using the Expert Recommendations for Implementing Change (ERIC) criteria.

Results: Twenty-eight thousand six hundred ninety-two publications were screened and 348 articles retrieved in full text. Ninety-nine peer-reviewed quantitative publications were included for data extraction. These consisted of one randomised crossover trial, one randomised cluster trial, one case-control study, 20 prospective cohort studies and 76 non-parallel cohort studies. Twenty-three percent of studies were classified as poor based on Downs and Black checklist, and reporting of implementation strategies lacked structure.
Negative associations were found between the number of elements in a bundle and compliance (Spearman's rho = − 0.47, non-parallel cohort and − 0.65, prospective cohort studies), and between the complexity of elements and compliance ($p < 0.001$, chi-squared = 23.05). Implementation strategies associated with improved compliance included evaluative and iterative approaches, development of stakeholder relationships and education and training strategies.

Conclusion: Care bundles with a small number of simple elements have better compliance rates. Standardised reporting of implementation strategies may help to implement care bundles into clinical practice with high fidelity.

Trial Registration: This review was registered on the PROSPERO database: CRD 42015029963 in December 2015.

Keywords: Care bundles, Evidence-based care, Implementation, Quality improvement, Improvement science, Healthcare improvement, Evaluation, Intervention design

The Vulnerability of the Surgical Care Strategy: More Is Better, Right – Or Is Compliance Better?

The investigators evaluated 99 peer-reviewed clinical studies and found a significant inverse (negative) association between the number of evidence-based interventions and compliance to a surgical care bundle p<0.02).

Gilhooly D, et al. Implementation Science 2019;14:47

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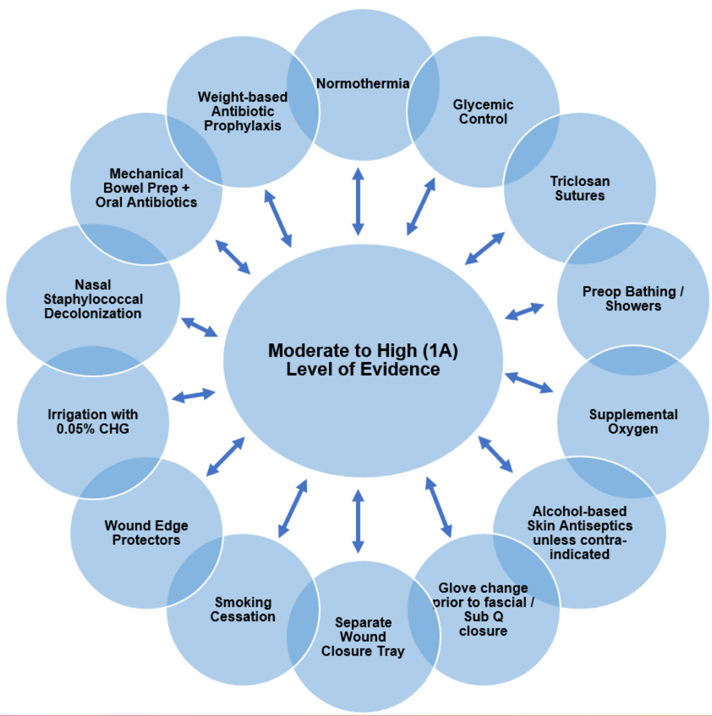
Selecting A Patient Centric Evidence-Based (EB) Surgical Care Bundle



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Infection Control & Hospital Epidemiology (2023), 1–26
doi:10.1017/ice.2023.67

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SHEA

SHEA/IDSA/APIC Practice Recommendation

Strategies to prevent surgical site infections in acute-care hospitals: 2022 Update

Michael S. Calderwood MD, MPH[1,a], Deverick J. Anderson MD, MPH[2,a], Dale W. Bratzler DO, MPH[3], E. Patchen Dellinger MD[4], Sylvia Garcia-Houchins RN, MBA, CIC[5], Lisa L. Maragakis MD, MPH[6], Ann-Christine Nyquist MD, MSPH[7], Kiran M. Perkins MD, MPH[8], Michael Anne Preas RN, MS, CIC[9], Lisa Saiman MD, MPH[10], Joshua K. Schaffzin MD, PhD[11], Marin Schweizer PhD[12], Deborah S. Yokoe MD, MPH[13] and Keith S. Kaye MD, MPH[14,b]

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Abstract and purpose

The intent of this document is to highlight practical recommendations in a concise format designed to assist acute-care hospitals in implementing and prioritizing their surgical site infection (SSI) prevention efforts. This document updates the *Strategies to Prevent Surgical Site Infections in Acute Care Hospitals* published in 2014.[1] This expert guidance document is sponsored by the Society for Healthcare Epidemiology of America (SHEA). It is the product of a collaborative effort led by SHEA, the Infectious Diseases Society of America (IDSA), the Association for Professionals in Infection Control and Epidemiology (APIC), the American Hospital Association (AHA), and The Joint Commission, with major contributions from representatives of a number of organizations and societies with content expertise.

(Received 20 March 2023; accepted 21 March 2023)

Summary of major changes

This section lists major changes from the *Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update*,[1] including recommendations that have been added, removed, or altered. Recommendations are categorized as essential practices that should be adopted by all acute-care hospitals (in 2014 these were "basic practices," renamed to highlight their importance as a foundation for hospitals' healthcare-associated infection (HAI) prevention programs) or additional approaches that can be considered for use in locations and/or populations within hospitals when SSIs are not controlled after implementation of essential practices (in 2014 these were called "special approaches"). See Table 1 for a complete summary of recommendations contained in this document.

Essential practices

- Modified recommendation to administer prophylaxis according to evidence-based standards and guidelines to emphasize that antimicrobial prophylaxis should be discontinued at the time of surgical closure in the operating room.
- The use of parenteral and oral antibiotics prior to elective colorectal surgery is now considered an essential practice. This recommendation was included in the 2014 document but was a sub-bullet recommendation. This recommendation was elevated to its own recommendation for increased emphasis.
- Reclassified decolonization of surgical patients with an anti-staphylococcal agent for cardiothoracic and orthopedic procedures from an Additional Approach to an Essential Practice.
- The use of vaginal preparation with an antiseptic solution prior to cesarean delivery and hysterectomy was added as an essential practice.

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OPEN

CLINICAL PRACTICE GUIDELINES

Clinical Practice Guidelines for Enhanced Recovery After Colon and Rectal Surgery From the American Society of Colon and Rectal Surgeons and the Society of American Gastrointestinal and Endoscopic Surgeons

Jennifer L. Irani, M.D.[1] • Traci L. Hedrick, M.D.[2]
Timothy E. Miller, M.D.[3] • Lawrence Lee, M.D., Ph.D.[4]
Emily Steinhagen, M.D.[5] • Benjamin D. Shogan, M.D.[6]
Joel E. Goldberg, M.D.[7] • Daniel L. Feingold, M.D.[8] Amy L. Lightner, M.D.[9]
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7 Department of Surgery, Section of Colorectal Surgery, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts
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10 Division of Colon and Rectal Surgery, University of Cincinnati College of Medicine, Cincinnati, Ohio

The American Society of Colon and Rectal Surgeons (ASCRS) and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) are dedicated to ensuring high-quality innovative patient care for surgical patients by advancing the science, prevention, and management of disorders and diseases of the colon, rectum, and anus as well as advancing minimally invasive surgery. The ASCRS and SAGES society members involved in the creation of these guidelines were chosen because they have demonstrated expertise in the specialty of colon and rectal surgery and enhanced recovery. This consensus document was created to lead international efforts in defining quality care for conditions related to the colon, rectum, and anus and develop clinical practice guidelines based on the best available evidence. Although not proscriptive, these guidelines provide information based on which decisions can be made and do not dictate a specific form of treatment. These guidelines are intended for use by all practitioners, health care workers, and patients who desire information on the management of the conditions addressed by the topics covered in these guidelines. These guidelines should not be deemed

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This publication was approved by both the ASCRS and SAGES executive council and then peer-reviewed by the *Diseases of the Colon & Rectum* and *Surgical Endoscopy And Other Interventional Techniques*. The articles are identical except for minor stylistic and spelling differences in keeping with each journal's style. Either citation can be used when citing this article. In order to encourage its wide dissemination, this article is freely accessible on *Surgical Endoscopy And Other Interventional Techniques* and *Diseases of the Colon & Rectum* journal web sites.

Jennifer L. Irani and Traci L. Hedrick are co-first authors.

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SHEA

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to identify gaps, improve performance, measure compliance, assess impacts of interventions, and provide feedback.[216]

2. **Consider use of negative-pressure dressings in patients who may benefit.** (Quality of Evidence: MODERATE)
   a. Negative-pressure dressings placed over closed incisions are thought to work by reducing fluid accumulation in the wound. Recent systematic reviews have demonstrated a significant reduction in SSI with their use.[217-219]
   b. These dressings have been particularly noted to reduce SSIs in patients who have undergone abdominal surgery[220,221] and joint arthroplasty,[222,223] although not all studies have shown benefit[224] and some indicate benefit only in a subset of procedures such as revision arthroplasty.[222]
   c. Guidance is lacking regarding which patients most benefit from the use of negative-pres sure dressings, with some evidence that the benefit increases with age and body mass index.[225]
   d. Negative-pressure dressings seem most successful at reducing superficial SSIs,[226] but some risk of blistering has been observed.[222] These blisters could lead to breaks in the skin that might increase risk of infection.
   e. It is important to assess the ability of the patient to manage a negative-pressure dressing, particularly if used in the ambulatory setting.
   f. Cost-effectiveness studies of negative-pressure dressings are needed.
3. **Observe and review practices in the preoperative clinic, postanesthesia care unit, surgical intensive care unit, and/or surgical ward.** (Quality of evidence: MODERATE)
   a. Perform direct observation audits of hand-hygiene practices among all HCP with direct patient contact.[213]
   b. Evaluate wound care practices.[227]
   c. Perform direct observation audits of environmental cleaning practices.
   d. Provide feedback and review infection control measures with HCP in these perioperative care settings.
4. **Use antiseptic-impregnated sutures as a strategy to prevent SSI.** (Quality of evidence: MODERATE)
   a. Human volunteer studies involving foreign bodies have demonstrated that the presence of surgical sutures decreases the inoculum required to cause an SSI from 10^6 to 10^2 organisms.[228]

Calderwood MS, et al Infect Control Hosp Epidemiol 2023 May;44(5):695-720

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"The Mother of all Surgical Care Bundles"

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A Good Idea Can Only Get Better

Clinical Review & Education

JAMA Surgery | Review

Enhanced Recovery After Surgery

A Review

ADULT: PERIOPERATIVE MANAGEMENT

One-year results from the first US-based enhanced recovery after cardiac surgery (ERAS Cardiac) program

Judson B. Williams, MD, MHS,[a,b] Gina McConnell, RN,[a] J. Erin Allender, PharmD,[a] Patricia Woltz, PhD, RN,[a] Kathy Kane, MS, RN,[a] Peter K. Smith, MD,[b] Daniel T. Engelman, MD,[c] and William T. Bradford, MD[a]

ABSTRACT

Objective: Our enhanced recovery after cardiac surgery (ERAS Cardiac) program is an evidence-based interdisciplinary process, which has not previously been systematically applied to cardiac surgery in the United States.

Methods: The Knowledge-to-Action Framework synthesized evidence-based enhanced recovery interventions and implementation of a designated ERAS Cardiac program. Standardized processes included (1) preoperative patient education, (2) carbohydrate loading 2 hours before general anesthesia, (3) multimodal opioid-sparing analgesia, (4) goal-directed perioperative insulin infusion, and (5) a rigorous bowel regimen. All cardiac anesthesiologists and surgeons agreed to follow the standardized pathway for adult cardiac surgery cases. The 1-year outcomes were compared between the 9 months pre- and post-ERAS Cardiac implementation using prospectively collected, retrospectively reviewed data.

Results: Comparing the pre- (N = 489) with the post- (N = 443) ERAS Cardiac groups, median postoperative length of stay was decreased from 7 to 6 days ($P < .01$). Total intensive care unit hours were decreased from a mean of 43 to 28 hours ($P < .01$). The incidence of gastrointestinal complications was 6.8% pre-ERAS versus 3.6% post-ERAS implementation ($P < .05$). Opioid use was reduced by a mean of 8 mg of morphine equivalents per patient in the first 24 hours postoperatively ($P < .01$). Reintubation rate and intensive care unit readmission rate were reduced by 1.2% and 1.5%, respectively (P = not significant). The incidence of hyperglycemic episodes was no different after ERAS Cardiac initiation. Patient satisfaction was 86.3% pre-ERAS versus 91.8% post-ERAS Cardiac implementation and work culture domain scores revealed increases in satisfaction across all measured indices, including patient focus, culture, and engagement.

Conclusions: Initial clinical and survey data after the first year of a system-wide ERAS Cardiac program were associated with significantly improved perioperative outcomes. We believe this value-based approach to cardiac surgery can consistently result in earlier recovery, cost reductions, and increased patient/staff satisfaction. (J Thorac Cardiovasc Surg 2019;157:1881-8)

Central Message

The study reports on systematic application of enhanced recovery principals to a US cardiac surgery program with reduced opioid use and LOS, and improved patient and staff satisfaction.

Perspective

Our ERAS Cardiac program is an evidence-based interdisciplinary process that has not previously been systematically applied to cardiac surgery in the United States. We believe this value-based approach to cardiac surgery can consistently result in earlier recovery, cost reductions, and increased patient/staff satisfaction.

See Commentary page 1889.

Our enhanced recovery after cardiac surgery (ERAS Cardiac) program is an evidence-based interdisciplinary process that has not previously been systematically applied to cardiac surgery in the United States. In many surgical disciplines, specialty-specific enhanced recovery guidelines serve as a resource for individual institutions to implement high-quality, evidence-based, perioperative care in standardized clinical pathways.[1-3] Feasibility studies have been

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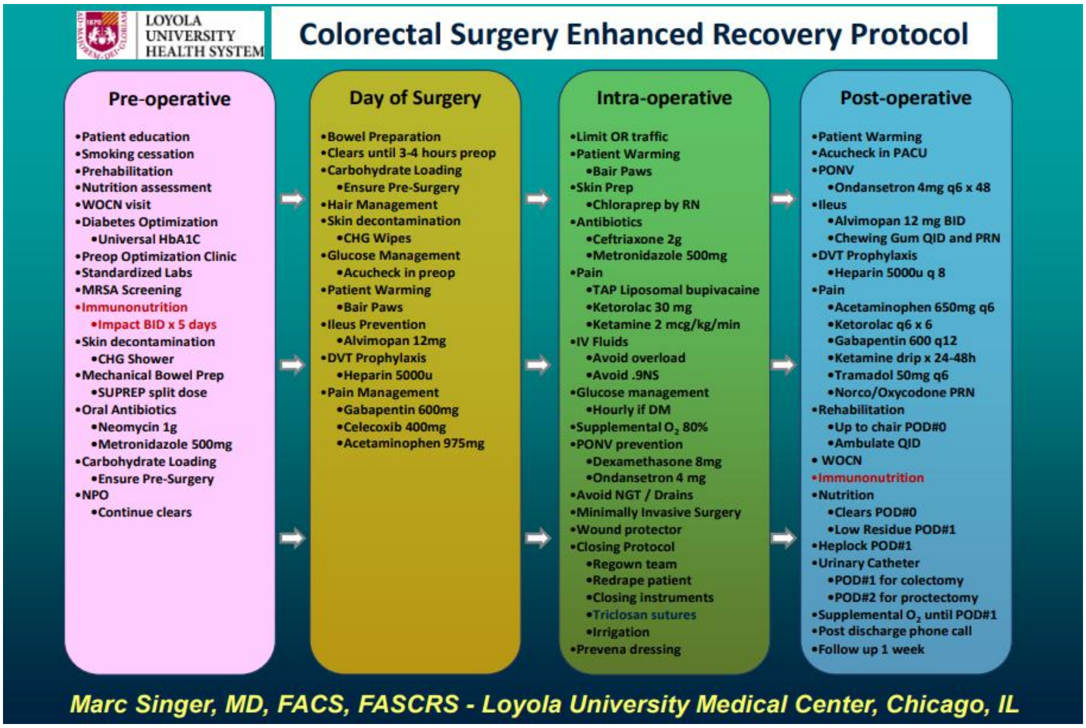

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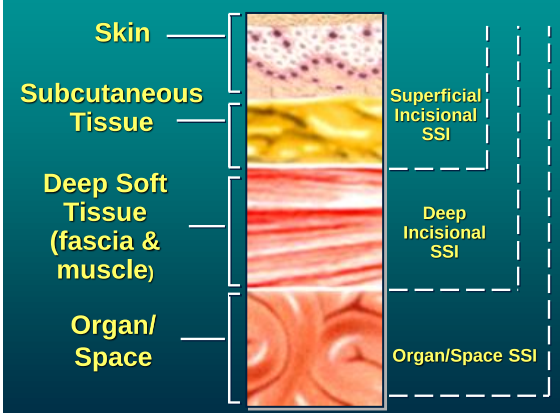
Part 3
Surgical Stewardship (Champion) – How Does That Happen?

54

What Are The Major Barriers to Improving Surgical Patient Outcome



- Poor compliance – Complacency (laxity) and lack of documentation
- Lack of shared goals and priorities
- Poor communication – systemic disconnect
- Less than robust institutional commitment – Failure to standardized evidence-based initiative across the institution

"When They Say It's Never About the Money – It's Always About The Money"

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Defining Surgical Stewardship

Surgical Stewardship is focused upon the optimization of the patient's outcomes. This can be achieved through the adoption of a culture where optimal perioperative care and evidence-based practices are utilized – every day, everywhere, by everyone.

Advocacy
Advocate for improvement
Provide reassurance

Education
Develop innovative education that will drive change

Implementing
Best / ideal practices
Evidenced-based practice
National / International guidelines

Measure
Results & outcomes

Publish
Share your results
Publish your results

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News & Analysis

Medical News & Perspectives

It Takes an Average of 17 Years for Evidence to Change Practice—the Burgeoning Field of Implementation Science Seeks to Speed Things Up

Rita Rubin, MA

Colorectal cancer screening with an at-home stool test is more convenient than with a colonoscopy, but an abnormal result on the former still requires a follow-up with the latter.

However, studies have shown that in safety-net health care systems, only around half of patients with an abnormal at-home stool test result get a follow-up colonoscopy within a year, University of Washington gastroenterologist Rachel Issaka, MD, MAS, noted in an interview with *JAMA*.

Medical News website

Issaka, not surprisingly, would like to raise that proportion. To accomplish her goal, she needed to find out why people were skipping their follow-up colonoscopy and what might help change their behavior and, possibly, save their life.

So she turned to the relatively new field of implementation science.

Put simply, "implementation science is really trying to close that gap between what we know and what we do," Issaka explained. Or, as the National Cancer Institute's David Chambers, DPhil, described his field, "implementation science is about bringing the best possible care to everyone."

Chasm might be a better word to describe the gap between research and practice. A frequently cited estimate puts that gap at 17 years on average, and even then, only 1 in 5 evidence-based interventions make it to routine clinical practice.

"To some degree, the interventions do vary greatly in terms of their complexity," Chambers acknowledged in an interview. "Some interventions may be easier to administer."

In historically marginalized populations, the evidence-to-practice gap is often even more yawning, said general internist Nathalie Moise, MD, MS, director of implementation science research at Columbia University's Center for Behavioral Cardiovascular Health.

"The hope of implementation science is that we can synthesize what works for whom and for where and for what disease and close that 17-year gap," Moise told *JAMA*.

Implementing and "Deimplementing"

Clinical psychologist Rinad Beidas, PhD, was puzzled when she saw children with anxiety who weren't receiving the standard treatment of cognitive behavioral therapy. "Why aren't clinicians in the community using evidence-based practices?"

But her "light bulb moment" came after the death of someone close to her by suicide with a firearm and the birth of her son, Beidas recalled in an interview. She was surprised that her child's pediatrician never asked whether she had a firearm in her home and, if so, how it was stored, even though the American Academy of Pediatrics recommended that pediatricians do so.

Her personal experience led Beidas to become the principal investigator for the ASPIRE trial, which stands for Adolescent and Child Suicide Prevention in Routine Clinical Encounters.

The aim of the trial is to determine the most effective way to implement a National Institute of Mental Health–funded, evidence-based firearm storage program in pediatric primary care. Pediatricians are supposed to deliver the program, which is endorsed by the American Academy of Pediatrics, during well-child visits. Families receive counseling about preventing children from handling firearms without a parent's permission and are offered a free cable lock for safe storage.

ASPIRE is just one example of how implementation science has been developing steadily in recent years, said Beidas, chair of the Department of Medical Social

jama.com JAMA Published online April 5, 2023 E1

"Knowing what to do, does not ensure, doing what we know,"

Rubin, R. JAMA.COM – Online April 5, 2023

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DISSEMINATION AND CLINICAL IMPLEMENTATION SCIENCE (D&I)

D&I bridges the gap between public health, clinical research, and everyday practice by providing a knowledge base about how health information, interventions, and new clinical practices and policies are translated for public health and health care service in specific settings

D&I explores new and innovative approaches, such as behavior change, engaging leaders, and adapting culture

D&I focuses on the social and behavioral aspects of moving discoveries from an experimental environment into widespread everyday practice

D&I focuses on what helps and what hinders the uptake, effective implementation, and sustainability of evidence-based programs in clinical practice

Gilmartin H, Hessels A, et al. Dissemination and implementation science for infection prevention: A primer. AJIC 47 (2019) 688–692

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Effectiveness versus Uptake: The Challenges of Implementing Evidence-Based Strategies to Reduce Surgical Site Infection in Patients with Colon Surgeries

PREMIER STUDY:
EFFECTIVENESS VS UPTAKE: THE CHALLENGES OF IMPLEMENTING EVIDENCE-BASED STRATEGIES TO REDUCE SURGICAL SITE INFECTION IN PATIENTS WITH COLON SURGERIES

Studied Elements from Guidelines	Abbreviation	Where published*
Administering a weight-dependent dose of preoperative intravenous (IV) antimicrobial agents	IV antibiotics	WHO, ACS, CDC
Using triclosan-coated sutures at the deep layer, organ layer, and superficial layer	Triclosan sutures	WHO, ACS, CDC
Controlling a patient's blood glucose at or below 200 mg/dl perioperatively	Blood glucose	WHO, ACS, CDC
Maintaining the patient's body temperature above 36.5 degrees Celsius once under care	Body temp	ACS, CDC
Placing the patient on oxygen beginning in the preoperative period until at least 2 hours after waking in the post-operative period (delivered with nasal cannula at a minimum of 3 L/min)	Oxygenation	WHO, ACS, CDC
Application of a topical skin antiseptic: 2% CHG/70% Isopropyl alcohol (ChloraPrep); or 4% Aqueous CHG (generic); or Aqueous povidone iodine (generic); or 74% Isopropyl alcohol/iodine povacrylex (Duraprep) or Para-chloro-meta-xylenol (PCMX)	Skin prep	WHO, ACS, CDC
Ordering mechanical bowel prep and oral antibiotics before surgery	MBP + oral ATBs	WHO, ACS

Camperlengo L, Spencer M, Graves P, Danker W, Edmiston CE Jr. Effectiveness versus Uptake: The Challenges of Implementing Evidence-Based Strategies to Reduce Surgical Site Infection in Patients with Colon Surgeries. Surg Infect 2023 May;24(4):382-389

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RESULTS: COMPONENTS OBSERVED

		Element Met						
	Total number of observed cases	Skin Prep n (%)	IV Antibiotics n (%)	Triclosan Sutures n (%)	Blood glucose n (%)	Body temp n (%)	Order pre-op MBP + oral ATBs n (%)	Oxygen n (%)
Site one	319	319 (100)	305 (95.6)	176 (55.2)	263 (82.4)	40 (12.5)	122 (38.2)	3 (0.9)
Site two	277	276 (99.6)	277 (100)	277 (100)	243 (87.7)	171 (61.7)	18 (6.5)	61 (22.0)
Site three	262	261 (99.6)	253 (96.6)	212 (80.9)	49 (18.7)	30 (12.9)	18 (6.9)	16 (6.1)
Aggregate Sum	858	856 (99.8)	835 (97.3)	650 (75.8)	555 (64.9)	443 (51.6)	158 (18.4)	80 (9.3)

DOMINANT THEME: LACK OF DOCUMENTATION

"I interviewed the surgeon regarding that question, whether the patient was put on oxygen from three hours up until at least two hours after waking in post-up. Lots of times, the surgeons do not know the answer. So, they advised me to reach out to anesthesia and I also tried to find information in Epic. It looks like it's not well documented and that's one of the challenges that we are having right now."
– Site 2 Study Coordinator

DOMINANT THEME: LACK OF DOCUMENTATION

"Finding the mechanical bowel prep. To do that, we checked the operative note while we're looking at it for other elements. If it's not there - and it usually isn't - then we look for a medication order. And then we look in the pre-op paperwork and the nursing notes to see if it was documented there. No matter what happens, this especially feels like a point that we could bring to our quality improvement people and say that we need to be documenting this better."
-Study Coordinator Site 2

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Prospective Observational Study of Seven Guideline Practices in Planned Colon Surgeries

Elements	Element Met (n)	Element Met (%)
Skin Prep	856	99.8
IV Antibiotics	835	97.3
Triclosan Sutures	650	75.8
Blood Glucose	555	64.9
Body Temperature	443	51.6
Mechanical Bowel Prep + Oral Antibiotics	158	18.4
Oxygenation	80	9.3
Total of observed cases	858	

Camperlengo L, Spencer M, Graves P, Danker W, Edmiston C. Effectiveness vs Uptake: The Challenges of Implementing Evidence-Based Strategies to Reduce Surgical Site Infection in Patients with Colon Surgeries. Surgical infections. 2023 (Accepted).

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Focusing Upon Implementing All Guideline Element

Element	% Element Met	Guideline Recommendation	Implementation Strategies
Blood Glucose	64.9	Policy/protocol should include documentation of: • Implement perioperative glycemic control and blood glucose target levels of <200 mg/dl in diabetic and non-diabetic surgical patients.	• Include documentation of perioperative glycemic control into the Electronic Medical Record (EMR) • Conduct education campaign with surgeons, PA, NP's, and staff • Conduct a quality assessment of a cohort of surgical procedures to determine current compliance with practice issues • Conduct focused education for outliers

Camperlengo L, Spencer M, Graves P, Danker W, Edmiston C. Effectiveness vs Uptake: The Challenges of Implementing Evidence-Based Strategies to Reduce Surgical Site Infection in Patients with Colon Surgeries Surgical infections. 2023 (Accepted).

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Focusing Upon Implementing All Guideline Elements

Element	% Element Met	Guideline Recommendation	Implementation Strategies
Body Temperature	51.6	Policy/protocol includes documentation of: • Body temperature measurement should be standardized • Maintain perioperative normothermia at >36.0^{C} or 36.5^{C}	• Standardize use of temperature measurement devices • Use facility approved warming devices preoperatively, intraoperatively, and in the post anesthesia care unit • Use warmed fluids intra-operatively • Apply hats and booties preoperatively • Conduct education campaign on normothermia with preop staff, anesthesia, and PACU • Include documentation of body temperature into the Electronic Medical Record (EMR) • Monitor engineering controls to maintain the operating room temperature within recommended parameters

Camperlengo L, Spencer M, Graves P, Danker W, Edmiston C. Effectiveness vs Uptake: The Challenges of Implementing Evidence-Based Strategies to Reduce Surgical Site Infection in Patients with Colon Surgeries Surgical infections. 2023 (Accepted).

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Focusing Upon Implementing All Guideline Elements

Element	% Element Met	Guideline Recommendation	Implementation Strategies
Oral Antibiotics + Mechanical Bowel Prep	18.4	Policy/protocol includes: • Preoperative oral antibiotics in combination with mechanical bowel preparations (OA-MBP) as a safe and effective adjunctive strategy for reducing the risk of infection following colorectal surgery.[1-5] • Current peer-reviewed evidence indicates that OA-MBP should be part of a comprehensive colorectal surgical care bundle.[1-6]	• Develop standardized order sets within the EMR • Review the process for patient education to perform the bowel prep prior to surgery • Conduct an observational study of a cohort of surgical procedures to determine the preoperative oral antibiotics in combination with mechanical bowel preparations. • Conduct education campaign with surgeons, PA, NP's, and nursing • Document in the EMR that MBP + oral ATBs be given/taken prior to surgery

Camperlengo L, Spencer M, Graves P, Danker W, Edmiston C. Effectiveness vs Uptake: The Challenges of Implementing Evidence-Based Strategies to Reduce Surgical Site Infection in Patients with Colon Surgeries. Surgical infections. 2023 (Accepted).

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Focusing Upon Implementing All Guideline Elements

Element	% Element Met	Guideline Recommendation	Implementation Strategies
Oxygenation	9.3	• Oxygen supplementation (80% FiO2) during the perioperative period has been documented to reduce the risk of SSI in patients undergoing colorectal surgeries is controversial.[1,2] • Documentation of administration supplemental oxygen (80% FiO2) after surgery performed under general anesthesia. (ACS)	• Assess current institutional policies on supplemental oxygenation after general anesthesia and revise if necessary • Conduct a quality assessment of a cohort of surgical procedures to determine current compliance • Conduct staff training (If compliance is low) with anesthesia, PACU, and receiving nursing units. • Include documentation of supplemental oxygenation into the Electronic Medical Record (EMR)

- Camperlengo L, Spencer M, Graves P, Danker W, Edmiston C. Effectiveness vs Uptake: The Challenges of Implementing Evidence-Based Strategies to Reduce Surgical Site Infection in Patients with Colon Surgeries. Surgical infections. 2023 (Accepted).

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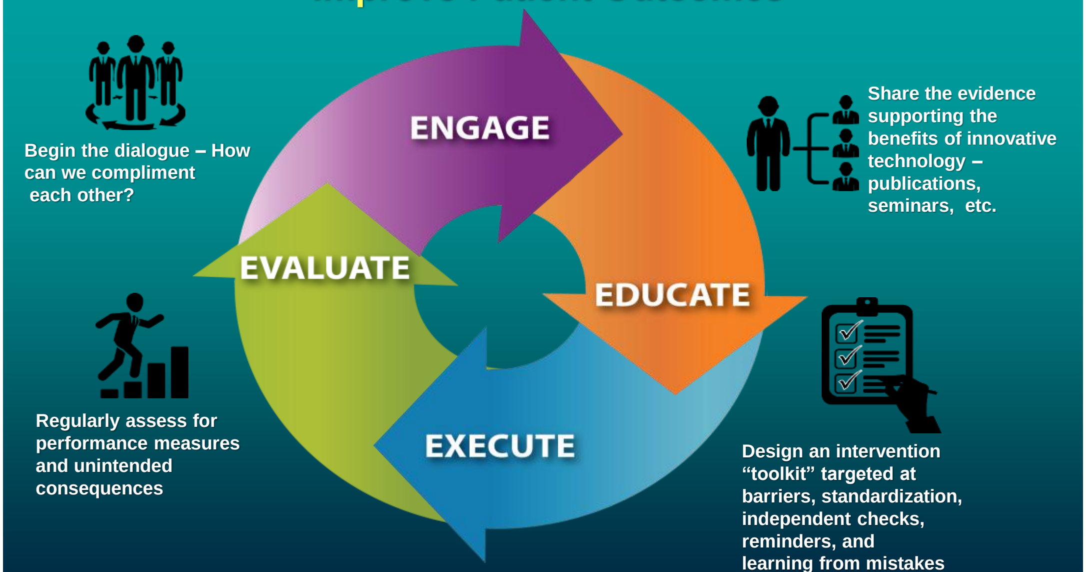
A Collegial Partnership in an Evidence-Based Space to Improve Patient Outcomes



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Anderson DJ, et al, Infect Control Hosp Epidemiol. 2014;35:605-627

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In Conclusion – What Have We Learned From Our Efforts to Improve Surgical Patient Outcomes Using Evidence-Based Practice?

- The efficacy of an evidence-based strategy to reduce the risk of SSI requires institutional compliance (quality) in which all healthcare professionals are engaged in the process and clear documentation of effort.
- The institution must have sufficient "skin in the game."
- All co-morbid pre, intra and postoperative risk must be considered when developing an effective mitigation strategy
- The cost of mitigation is always minuscule compared to the human and fiscal cost of a surgical site infection – In the case of wound closure: > 31 RCT/MA documented triclosan (coated/impregnated) sutures as an effective 1A evidence-based risk-reduction strategy

Poor Compliance Goes Hand-in-Hand With Insufficient Institutional Commitment

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Remember - Regardless of What Kind Of Skin You Might Have In The Game - The Patients Are Not There For Us – We Should Always Be There For The Patients

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Thank You

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