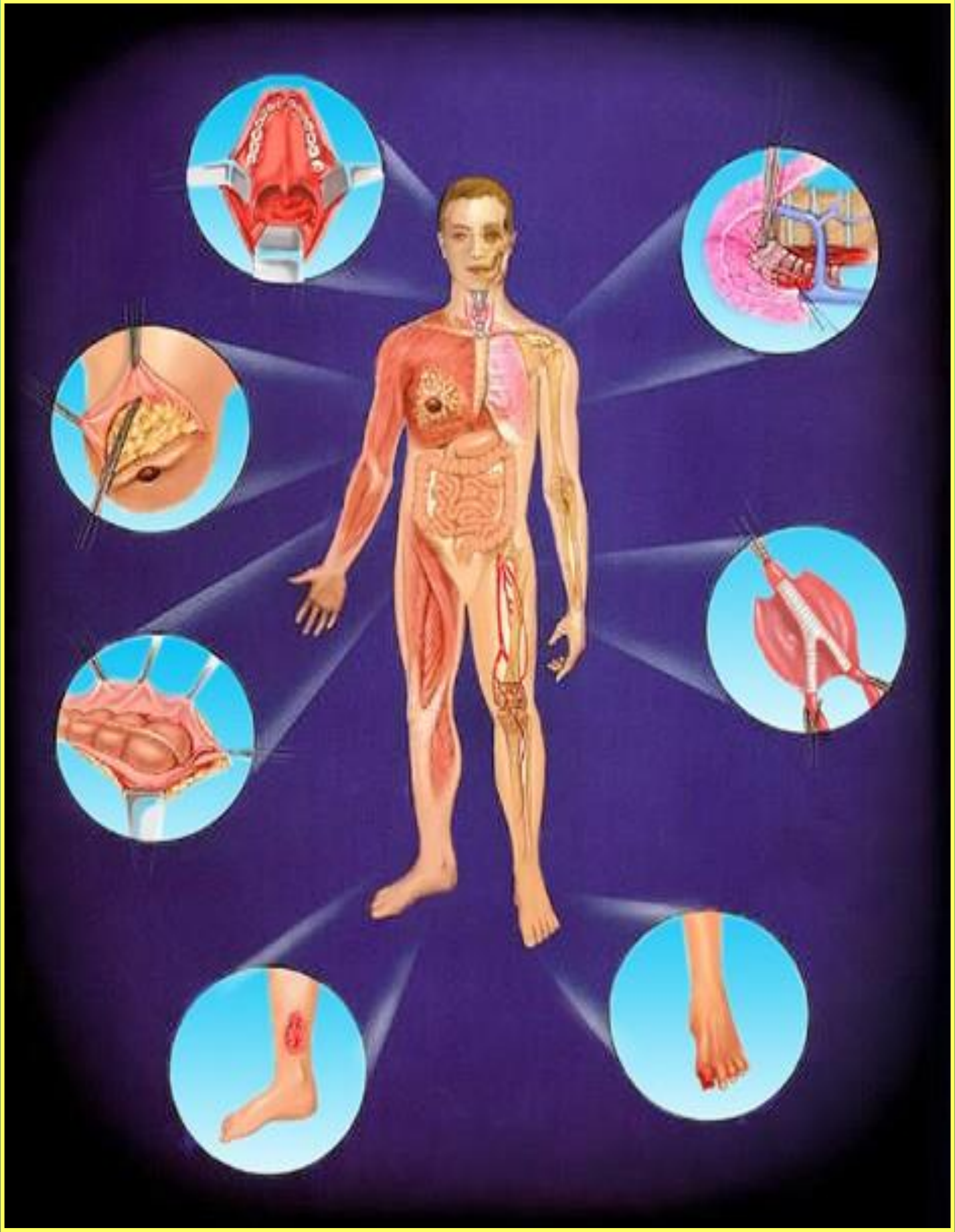

Reducing the Risk of Surgical Site Infections: Using Evidence-Based Practices to Improve Patient Outcome

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MEDICAL COLLEGE OF WISCONSIN

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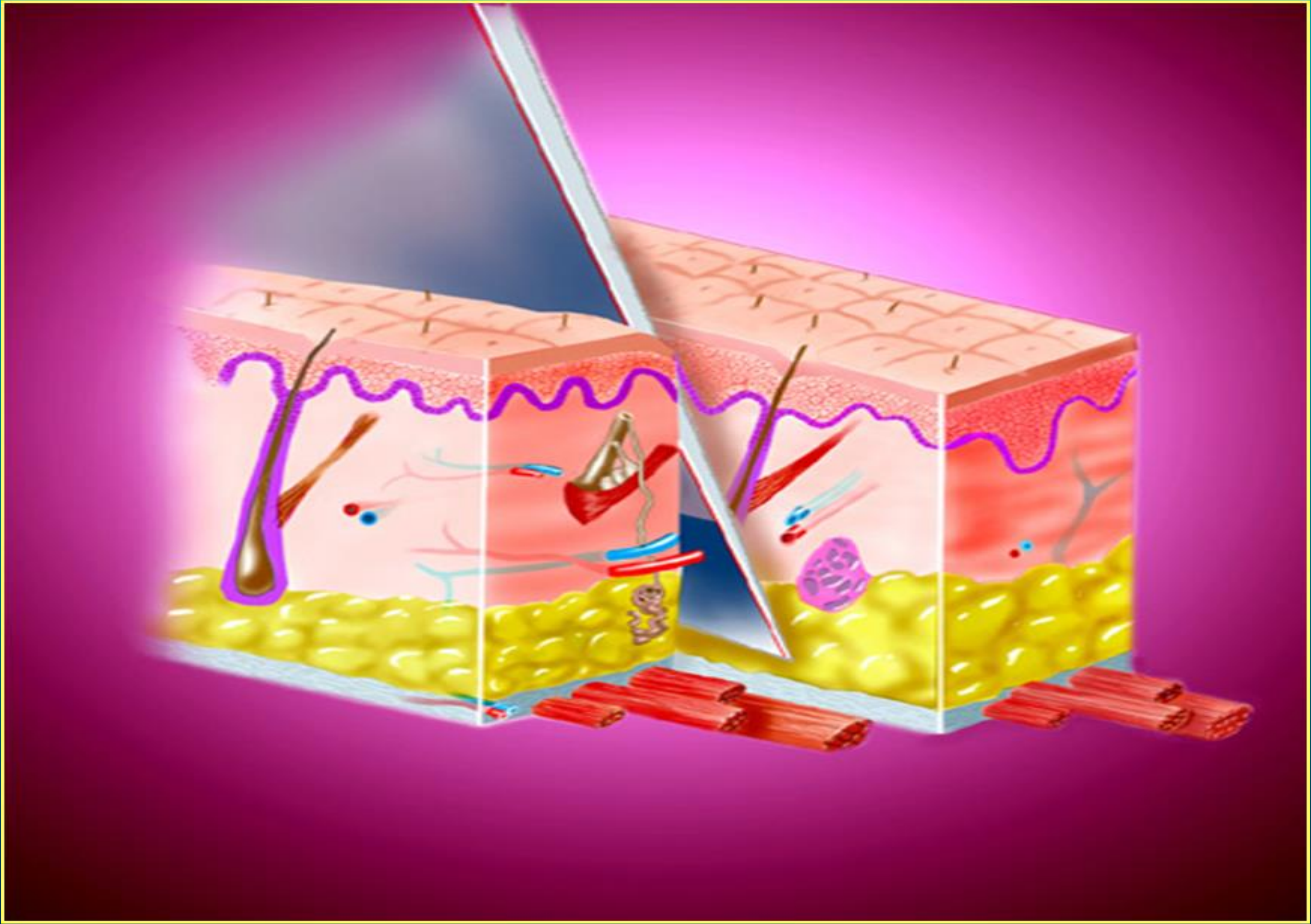
Items For Discussion Today

- Complexity of Surgical Site Infections
- Impact of the SCIP Process Intervention
- SSI Prevention Guidelines – What Do They Say and Are They Helpful?
- Reducing Risk through an Evidence-Based Perspective
- Choosing the Right Evidence-Based Interventions Across the Spectrum of Surgery

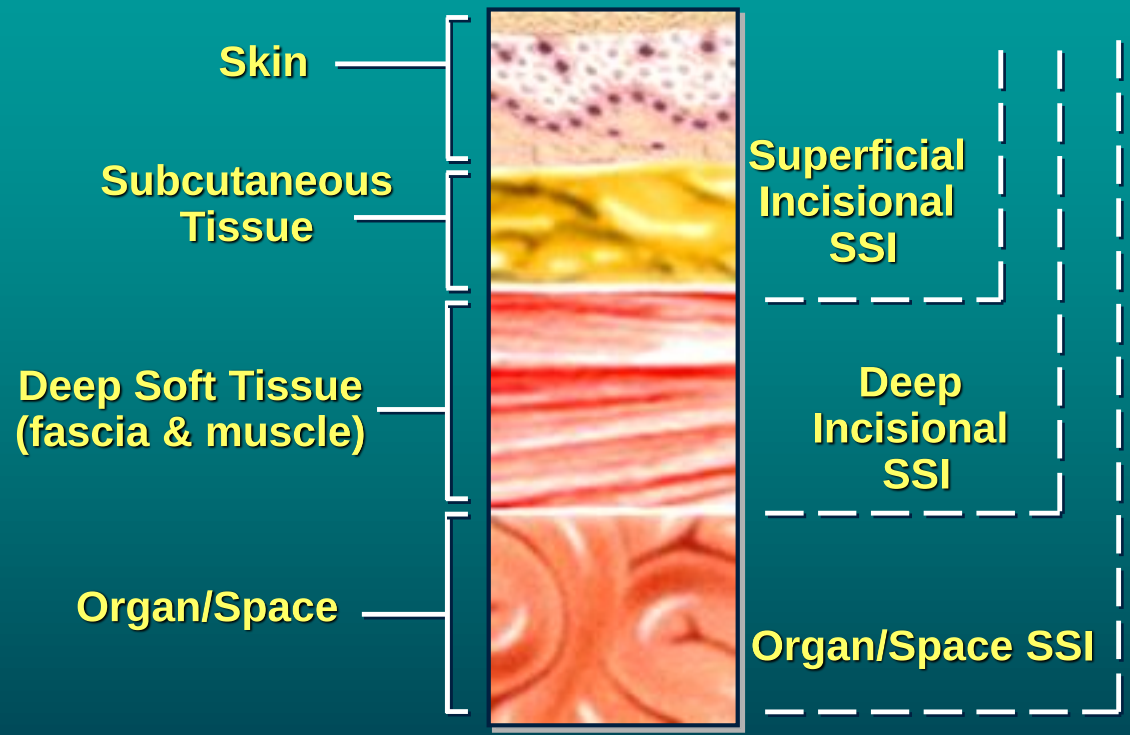
"It's all about the surgical wound"



"….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

Classification of Surgical Site Infections (SSI)

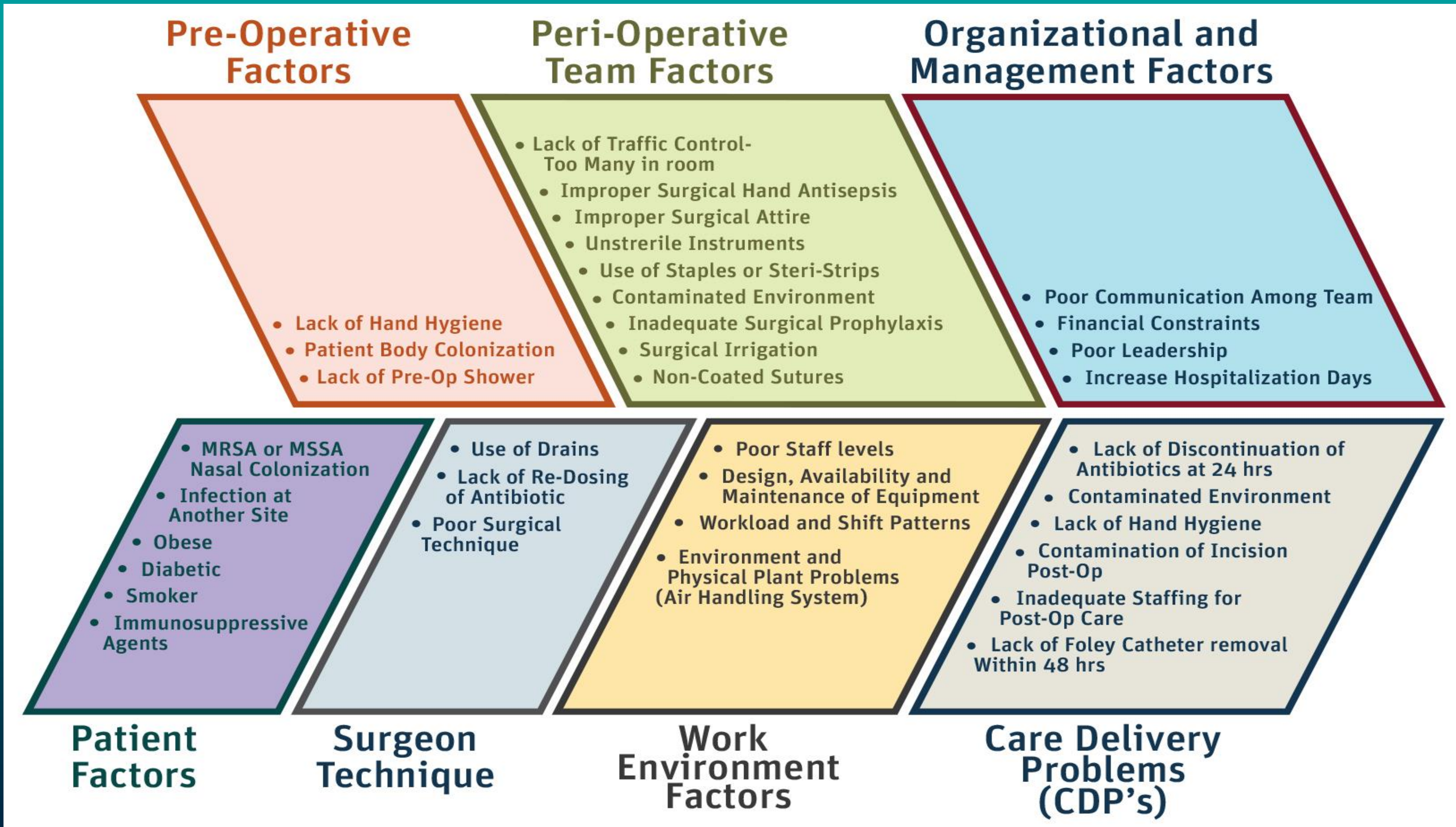


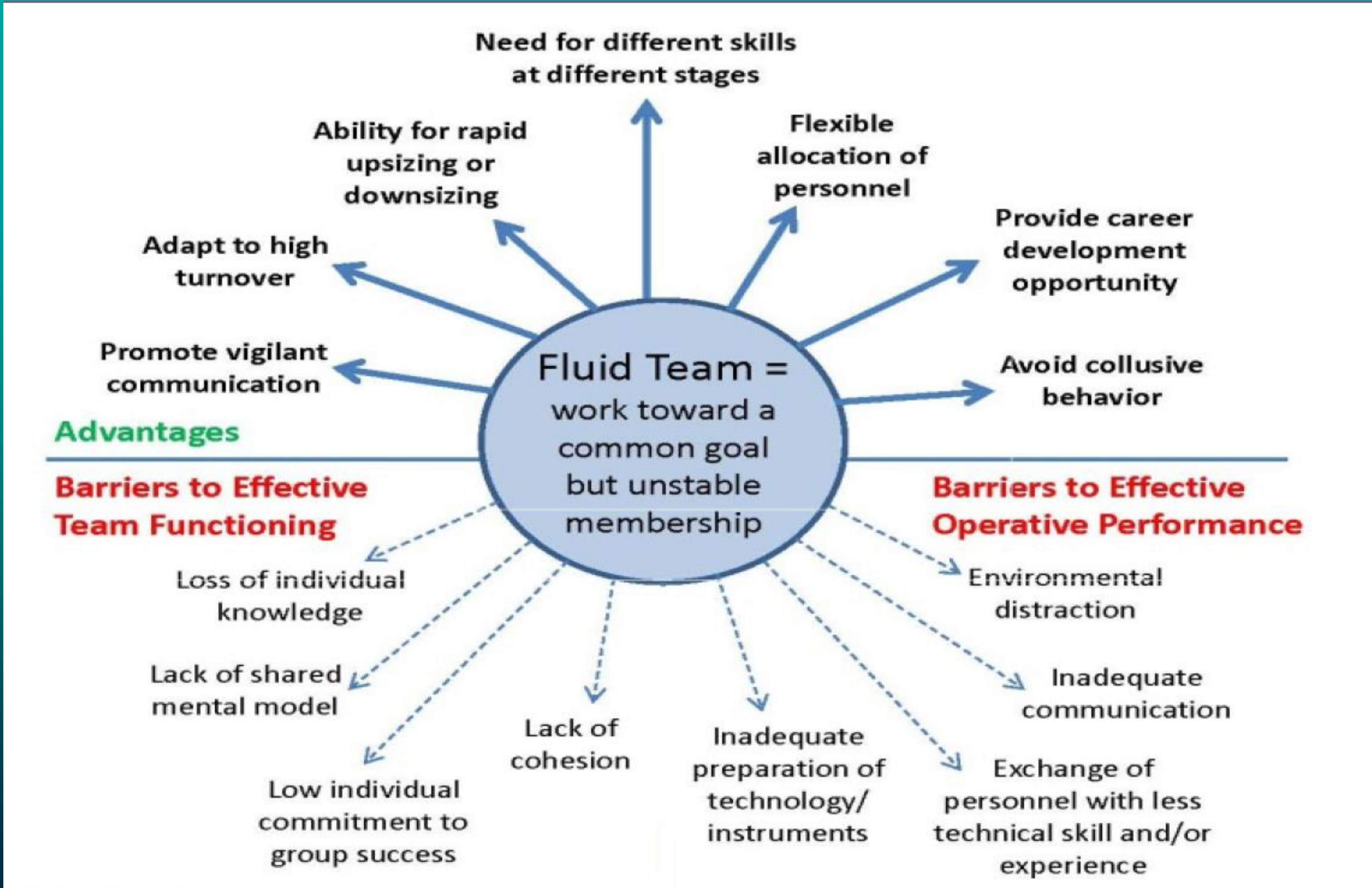
Recognition of the surgical locus of infection influences the development of specific interventional strategies

Mangram AJ, et al. Am J Infect Control 1999;27:97-132

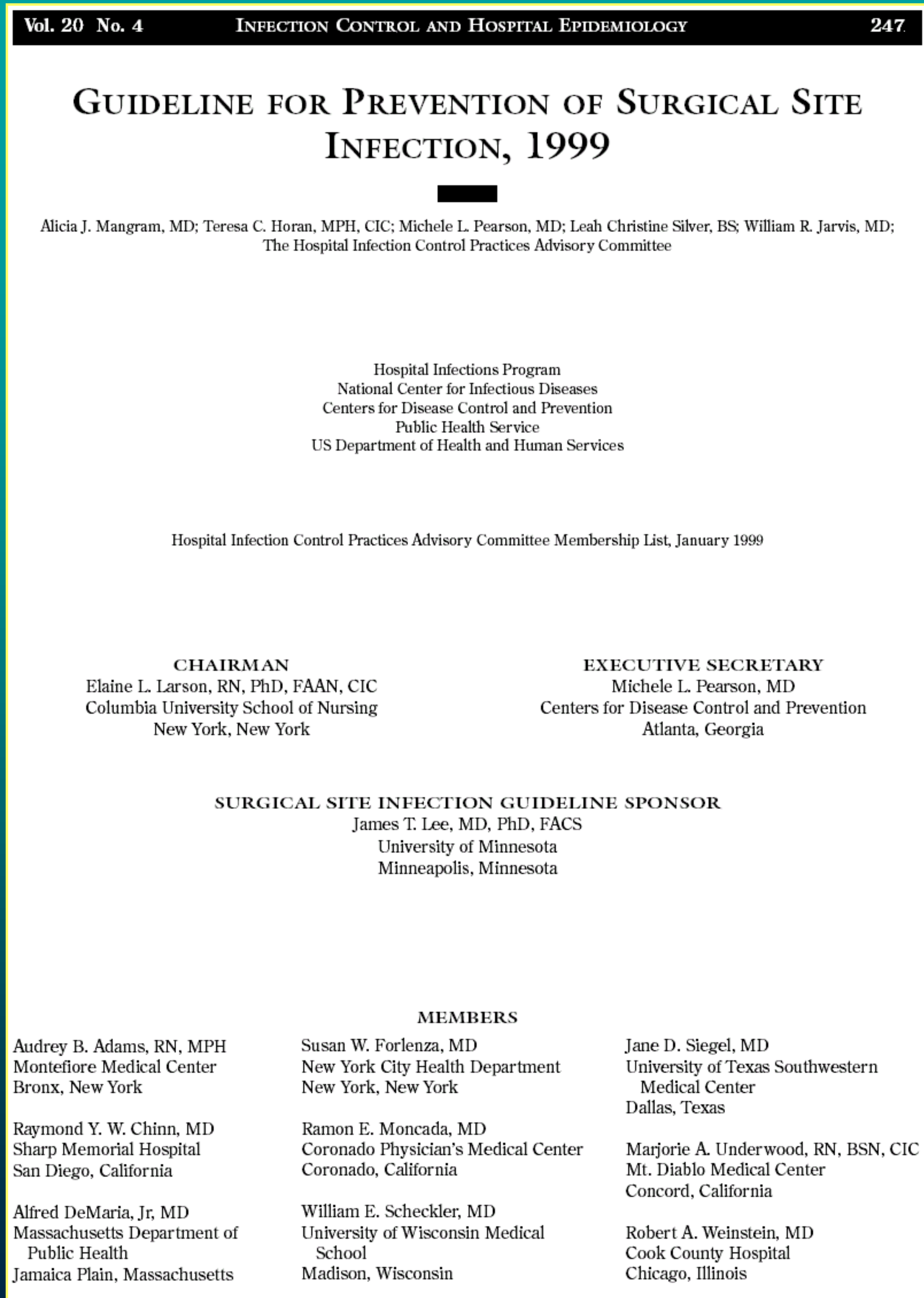
The Complexity of Risk

Risk is a Myriad of Events - SSI Fishbone Diagram




Need for different skills at different stages
Ability for rapid upsizing or downsizing
Flexible allocation of personnel
Adapt to high turnover
Provide career development opportunity
Promote vigilant communication
Avoid collusive behavior
Fluid Team = work toward a common goal but unstable membership
Advantages
Barriers to Effective Team Functioning
Barriers to Effective Operative Performance
Loss of individual knowledge
Environmental distraction
Lack of shared mental model
Inadequate communication
Lack of cohesion
Inadequate preparation of technology/ instruments
Low individual commitment to group success
Exchange of personnel with less technical skill and/or experience

Evidence-Based Hierarchy


Vol. 20 No. 4 INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY 247

GUIDELINE FOR PREVENTION OF SURGICAL SITE INFECTION, 1999

Alicia J. Mangram, MD; Teresa C. Horan, MPH, CIC; Michele L. Pearson, MD; Leah Christine Silver, BS; William R. Jarvis, MD; The Hospital Infection Control Practices Advisory Committee

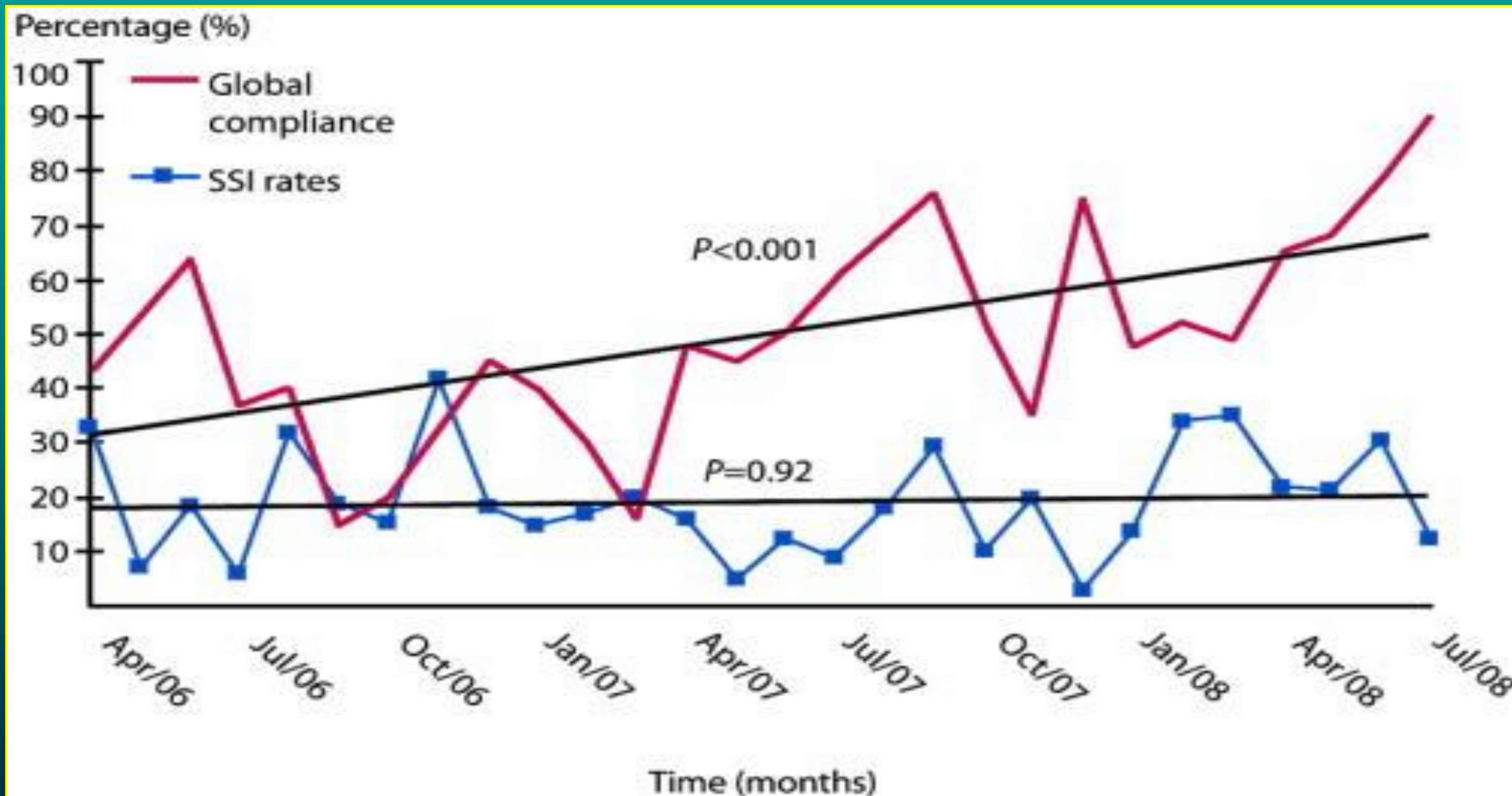
Hospital Infections Program
National Center for Infectious Diseases
Centers for Disease Control and Prevention
Public Health Service
US Department of Health and Human Services

Mitigating Risk - Surgical Care Improvement Project (SCIP) – An Evidence-Based "Bundle" Approach

- Timely and appropriate antimicrobial prophylaxis
- Glycemic control in cardiac and vascular surgery
- Appropriate hair removal
- Normothermia in general surgical patients

Is this the Holy Grail?

An Increase in Compliance With the Surgical Care Improvement Project Measures Does Not Prevent Surgical Site Infection in Colorectal Surgery



Pastor et al. Diseases of the Colon & Rectum 2010; 53:24-30

The effect of Surgical Care Improvement Project measures on national trends on surgical site infections in open vascular procedures

Anahita Dua, MD, MS, MBA,[a] Sapan S. Desai, MD, PhD, MBA,[b] Gary R. Seabrook, MD,[a] Kellie R. Brown, MD,[a] Brian D. Lewis, MD,[a] Peter J. Rossi, MD,[a] Charles E. Edmiston, PhD,[a] and Cheong J. Lee, MD,[a] *Milwaukee, Wisc; and Springfield, Ill*

Objective: The Surgical Care Improvement Project (SCIP) is a national initiative to reduce surgical complications, including postoperative surgical site infection (SSI), through protocol-driven antibiotic usage. This study aimed to determine the effect SCIP guidelines have had on in-hospital SSIs after open vascular procedures.

Methods: The Nationwide Inpatient Sample (NIS) was retrospectively analyzed using International Classification of Diseases, Ninth Revision, diagnosis codes to capture SSIs in hospital patients who underwent elective carotid endarterectomy, elective open repair of an abdominal aortic aneurysm (AAA), and peripheral bypass. The pre-SCIP era was defined as 2000 to 2005 and post-SCIP was defined as 2007 to 2010. The year 2006 was excluded because this was the transition year in which the SCIP guidelines were implemented. Analysis of variance and χ^2 testing were used for statistical analysis.

Results: The rate of SSI in the pre-SCIP era was 2.2% compared with 2.3% for carotid endarterectomy ($P = .06$). For peripheral bypass, both in the pre- and post-SCIP era, infection rates were 0.1% ($P = .22$). For open, elective AAA, the rate of infection in the post-SCIP era increased significantly to 1.4% from 1.0% in the pre-SCIP era ($P < .001$). Demographics and in-hospital mortality did not differ significantly between the groups.

Conclusions: Implementation of SCIP guidelines has made no significant effect on the incidence of in-hospital SSIs in open vascular operations; rather, an increase in SSI rates in open AAA repairs was observed. Patient-centered, bundled approaches to care, rather than current SCIP practices, may further decrease SSI rates in vascular patients undergoing open procedures. (J Vasc Surg 2014;60:1635-9.)

Do Guidelines Actually Guide Us or Do They Facilitate Controversy?

GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION

World Health Organization

http://www.who.int/gpsc/ssi-prevention-guidelines/en/

SPECIAL ARTICLES

American College of Surgeons and Surgical Infection Society: Surgical Site Infection Guidelines, 2016 Update

Kristen A Ban, MD, Joseph P Minei, MD, FACS, Christine Laronga, MD, FACS, Brian G Harbrecht, MD, FACS, Eric H Jensen, MD, FACS, Donald E Fry, MD, FACS, Kamal MF Itani, MD, FACS, E Patchen Dellinger, MD, FACS, Clifford Y Ko, MD, MS, MSHS, FACS, Therese M Duane, MD, MBA, FACS

Guidelines for the prevention, detection, and management of surgical site infections (SSI) have been published previously.[1-3] This document is intended to update earlier guidelines based on the current literature and to provide a concise summary of relevant topics.

Surgical site infections are both common and morbid. Surgical site infections are now the most common and costly of all hospital-acquired infections, accounting for 20% of all hospital-acquired infections. Surgical site infections are associated with increased length of stay and a 2- to 11-fold increase in the risk of mortality. Although most patients recover from an SSI without long-term adverse sequelae, 77% of mortality in patients with an SSI can be attributed to the infection itself.[1,4]

Disclosure Information: Nothing to disclose.

Disclosures outside the scope of this work: Dr. Minei receives clinical trial grant support from Irrespet Corp. AtoxBio. Dr. Laronga receives compensation for lectures from Genomic Health Inc. and royalties from Up-To-Date. Dr. Jensen is a consultant and paid speaker for Ethicon. Dr. Fry receives honoraria from CareFusion for their Speaker's Program, honoraria from Irrimax Corp. for consulting and Research Funding Prescient, and honoraria from Surgical Inc. for consultation. Dr. Itani is the site PI for a multi-institutional study for Sanofi-Pasteur and the ACS Research Committee Chair. Dr. Dellinger is on the Advisory Board for 3M, Melinta, and Theravance and a grant recipient from Motif for a clinical trial of iclaprim vs. vancomycin for treatment of skin and soft tissue infections. The remaining authors declare no conflicts.

Presented at the Surgical Infection Society, Palm Beach, FL, May 2016.

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The incidence of SSI is 2% to 5% in patients undergoing inpatient surgery.[1] Estimated annual incidence varies widely, ranging from 160,000 to 300,000 in the US.[1,4] These estimates are likely understated, given the surveillance challenges after discharge.

The financial burden of SSI is considerable; it ranks as the most costly of the hospital-acquired infections.[1] The annual cost of SSI in the US is estimated at \$3.5 to \$10 billion.[1] Increased costs from SSIs are driven by increased length of stay, emergency department visits, and readmissions. On average, SSI extends hospital length of stay by 9.7 days, and increases the cost of hospitalization by more than \$20,000 per admission. More than 90,000 readmissions annually are attributed to SSIs, costing an additional \$700 million per year. Because up to 60% of SSIs were estimated to be preventable with the use of evidence-based measures,[1] SSI has become a pay-for-performance metric and a target of quality-improvement efforts.

The most widely used definition of SSI has been provided by CDC.[5] This definition is used for research, quality improvement, public reporting, and pay-for-performance comparisons. According to this definition, SSIs are classified by depth and tissue spaces involved. A superficial incisional SSI involves only the skin or subcutaneous tissue, a deep incisional SSI involves the fascia or muscular layers, and an organ space SSI involves any part of the body opened or manipulated during a procedure, excluding the previously mentioned layers.

Numerous risk factors have been identified for the development of an SSI after surgery. These risk factors can be broadly separated into intrinsic (patient) factors that are modifiable or nonmodifiable, as well as extrinsic (eg procedure, facility, preoperative, and operative) factors (Table 1). Potentially modifiable patient risk factors include glycemic control and diabetic status, dyspnea, alcohol and smoking status, preoperative albumin <3.5 mg/dL, total bilirubin >1.0 mg/dL, obesity, and immunosuppression. Nonmodifiable patient factors include increasing age, recent radiotherapy, and history

http://dx.doi.org/10.1016/j.jamcollsurg.2016.10.029

JACS 2016; 224:59–74

JAMA Surgery | Special Communication

Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017

Sandra I. Berríos-Torres, MD; Craig A. Umscheid, MD, MSCE; Dale W. Bratzler, DO, MPH; Brian Leas, MA, MS; Erin C. Stone, MA; Rachel R. Kelz, MD, MSCE; Caroline E. Reinke, MD, MSHP; Sherry Morgan, RN, MLS, PhD; Joseph S. Solomkin, MD; John E. Mazuski, MD, PhD; E. Patchen Dellinger, MD; Kamal M. F. Itani, MD; Elie F. Berbari, MD; John Segreti, MD; Javad Parvizi, MD; Joan Blanchard, MSS, BSN, RN, CNOR, CIC; George Allen, PhD, CIC, CNOR; Jan A. J. W. Kluytmans, MD; Rodney Donlan, PhD; William P. Schecter, MD; for the Healthcare Infection Control Practices Advisory Committee

IMPORTANCE The human and financial costs of treating surgical site infections (SSIs) are increasing. The number of surgical procedures performed in the United States continues to rise, and surgical patients are initially seen with increasingly complex comorbidities. It is estimated that approximately half of SSIs are deemed preventable using evidence-based strategies.

OBJECTIVE To provide new and updated evidence-based recommendations for the prevention of SSI.

Invited Commentary

Supplemental content

JAMA Surg online May 2, 2017

Wisconsin Division of Public Health Supplemental Guidance for the Prevention of Surgical Site Infections: An Evidence-Based Perspective

January 2017

P-01715

wi-ssi-prevention-guidelines.pdf

Comparative Analysis of WHO, Proposed CDC, ACS and Wisconsin SSI Prevention Guidelines

INTERVENTION	WHO Guidelines	CDC Guidelines	ACS Guidelines	WISCONSIN SSI Prevention
Normothermia	Maintain normothermia	Maintain normothermia	Maintain normothermia	Maintain normothermia - FAW reduces incidence of SSI
Wound Irrigation	No recommendation	Intraoperative irrigation recommended - povidone iodine	No recommendation	Intraoperative irrigation recommended - CHG
Antimicrobial Prophylaxis	Short durational	Short durational	Short durational	Short durational – Follow ASHP weight-based dosing
Glycemic Control	Recommended	Recommended – No recommendation for Ha1c	Highly beneficial	Highly beneficial Ha1c $\leq$6.7
Perioperative Oxygenation	Recommended	Administer increased FIO_2 during surgery after extubation, immediate postop period	Recommended	Recommended – Strongest evidence in colorectal surgery
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 4% or 2% CHG night before/morning (surgery)
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

Building a Better Evidence-Based Bundle

Antimicrobial Prophylaxis – Weight-Based Dosing

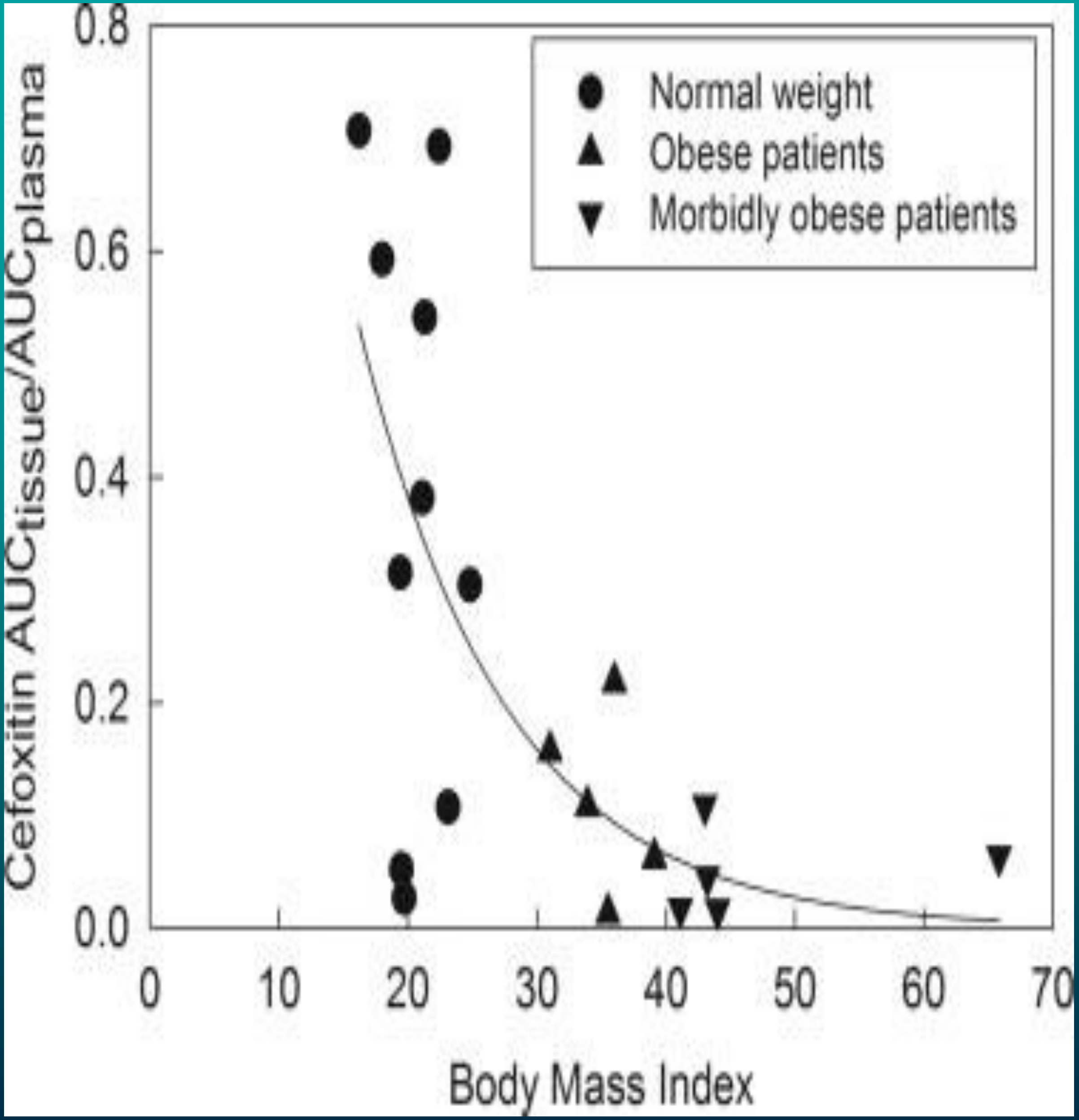
Does BMI Increase Risk?

Perioperative Antimicrobial Prophylaxis in Higher BMI (>40) Patients: Do We Achieve Therapeutic Levels?

Percent Therapeutic Activity of Serum / Tissue Concentrations Compared to Surgical Isolate (2002-2004) Susceptibility to Cefazolin Following 2-gm Perioperative Dose

Organisms	n	Serum	Tissues
Staphylococcus aureus	70	68.6%	27.1%
Staphylococcus epidermidis	110	34.5%	10.9%
E. coli	85	75.3%	56.4%
Klebsiella pneumoniae	55	80%	65.4%

Edmiston et al, Surgery 2004;136:738-747



- "Measured and dose-normalized subcutaneous cefoxitin concentrations and AUCs in the obese patients were significantly lower than in the normal-weight subjects.
- There was an inverse relationship between cefoxitin tissue penetration (AUC tissue/ AUC plasma ratio) and body mass index.
- **Tissue penetration was substantially lower in the obese patients compared to normal weight controls (*p = 0.05*)."**
- "This occurred despite 2-fold-higher cefoxitin dosage (1 to 2 gms).
- **Diminished tissue antibiotic concentrations in morbid obesity may influence the incidence of SSIs."**

Toma et al., Anesthesia Analgesia 2011;113:730-737

ASHP REPORT

Clinical practice guidelines for antimicrobial prophylaxis in surgery

DALE W. BRATZLER, E. PATCHEN DELLINGER, KEITH M. OLSEN, TRISH M. PERL, PAUL G. AUWAERTER, MAUREEN K. BOLON, DOUGLAS N. FISH, LENA M. NAPOLITANO, ROBERT G. SAWYER, DOUGLAS SLAIN, JAMES P. STEINBERG, AND ROBERT A. WEINSTEIN

Am J Health-Syst Pharm. 2013; 70:195-283

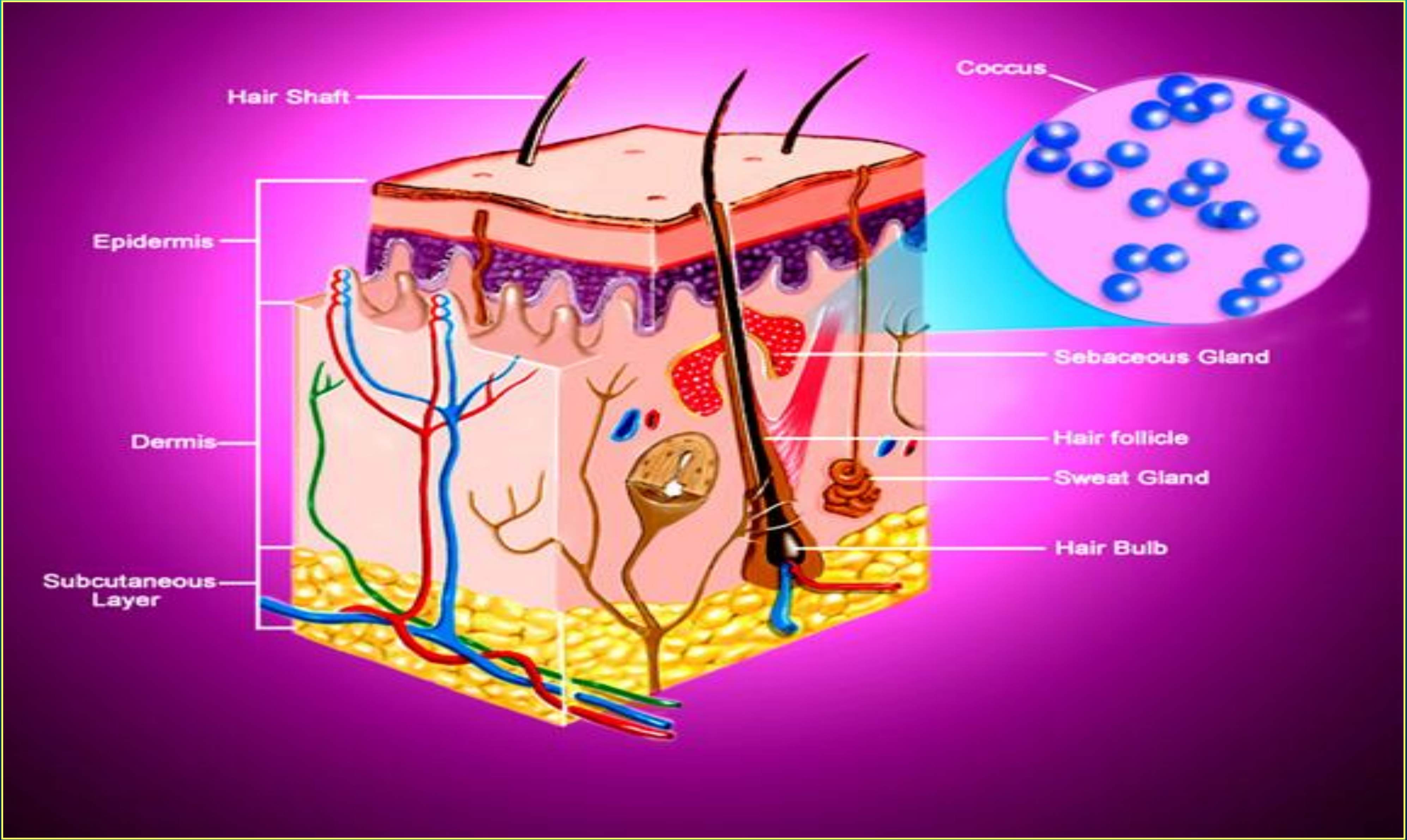
These guidelines were developed jointly by the American Society of Health-System Pharmacists (ASHP), the Infectious Diseases Society of America (IDSA), the Surgical Infection Society (SIS), and the Society for Healthcare Epidemiology of America (SHEA). This work represents an update to the previously published ASHP Therapeutic Guidelines on Antimicrobial Prophylaxis in Surgery,[1] as well as guidelines from IDSA and SIS.[2,3] The guidelines are intended to provide practitioners with a standardized approach to the rational, safe, and effective use of antimicrobial agents for the prevention of surgical-site infections (SSIs) based on currently available clinical evidence and emerging issues.

Prophylaxis refers to the prevention of an infection and can be characterized as primary prophylaxis, secondary prophylaxis, or eradication. Primary prophylaxis refers to the prevention of an initial infection. Secondary prophylaxis refers to the prevention of recurrence or reactivation of a preexisting infection. Eradication refers to the elimination of a colonized organism to prevent the development of an infection. These guidelines focus on primary perioperative prophylaxis.

Guidelines development and use

Members of ASHP, IDSA, SIS, and SHEA were appointed to serve on an expert panel established to ensure the validity, reliability, and utility of the revised guidelines. The work of the panel was facilitated by faculty of the University of Pittsburgh School of Pharmacy and University of Pittsburgh Medical Center Drug Use and Disease State Management Program who served as contract researchers and writers for the project. Panel members and contractors were required to disclose any possible conflicts of interest before their appointment and throughout the guideline development process. Drafted documents for each surgical procedural section were reviewed by the expert panel and, once revised, were available for public comment on the ASHP website. After additional revisions were made to address reviewer comments, the final document was

Preadmission Showering/Cleansing



Microbial Ecology of Skin Surface

- Scalp 6.0 $\log_{10}$ cfu/cm^2
- Axilla 5.5 $\log_{10}$ cfu/cm^2
- Abdomen 4.3 $\log_{10}$ cfu/cm^2
- Forearm 4.0 $\log_{10}$ cfu/cm^2
- Hands 4.0-6.6 $\log_{10}$ cfu/cm^2
- Perineum 7.0-11.0 $\log_{10}$ cfu/cm^2

Looking at the Preadmission Shower from a Pharmacokinetic Perspective

Dose
Duration
Timing

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.

ORIGINAL ARTICLE

Preadmission Application of 2% Chlorhexidine Gluconate (CHG): Enhancing Patient Compliance While Maximizing Skin Surface Concentrations

Charles E. Edmiston, Jr, PhD;[1,2] Candace J. Krepel, MS;[1,2] Maureen P. Spencer, M.Ed;[3] Alvaro A. Ferraz, PhD, MD;[4] Gary R. Seabrook, MD;[1] Cheong J. Lee, MD;[1] Brian D. Lewis, MD;[1] Kellie R. Brown, MD;[1] Peter J. Rossi, MD;[1] Michael J. Malinowski, MD;[1] Sarah E. Edmiston, M.Ed;[2] Edmundo M. Ferraz, PhD, MD;[4] David J. Leaper, MD[5]

OBJECTIVE. Surgical site infections (SSIs) are responsible for significant morbidity and mortality. Preadmission skin antisepsis, while controversial, has gained acceptance as a strategy for reducing the risk of SSI. In this study, we analyze the benefit of an electronic alert system for enhancing compliance to preadmission application of 2% chlorhexidine gluconate (CHG).

DESIGN, SETTING, AND PARTICIPANTS. Following informed consent, 100 healthy volunteers in an academic, tertiary care medical center were randomized to 5 chlorhexidine gluconate (CHG) skin application groups: 1, 2, 3, 4, or 5 consecutive applications. Participants were further randomized into 2 subgroups: with or without electronic alert. Skin surface concentrations of CHG (μg/mL) were analyzed using a colorimetric assay at 5 separate anatomic sites.

INTERVENTION. Preadmission application of chlorhexidine gluconate, 2%

RESULTS. Mean composite skin surface CHG concentrations in volunteer participants receiving EA following 1, 2, 3, 4, and 5 applications were 1,040.5, 1,334.4, 1,278.2, 1,643.9, and 1,803.1 μg/mL, respectively, while composite skin surface concentrations in the no-EA group were 913.8, 1,240.0, 1,249.8, 1,194.4, and 1,364.2 μg/mL, respectively (ANOVA, $P<.001$). Composite ratios (CHG concentration/minimum inhibitory concentration required to inhibit the growth of 90% of organisms [MIC^{90}]) for 1, 2, 3, 4, or 5 applications using the 2% CHG cloth were 208.1, 266.8, 255.6, 328.8, and 360.6, respectively, representing CHG skin concentrations effective against staphylococcal surgical pathogens. The use of an electronic alert system resulted in significant increase in skin concentrations of CHG in the 4- and 5-application groups ($P<.04$ and $P<.007$, respectively).

CONCLUSION. The findings of this study suggest an evidence-based standardized process that includes use of an Internet-based electronic alert system to improve patient compliance while maximizing skin surface concentrations effective against MRSA and other staphylococcal surgical pathogens.

Edmiston et al. JAMA Surg 2015;150:1027-33

Edmiston et al. Infect Control Hosp Epidemiol 2016; 2016;37:254-259

To Maximize Skin Surface Concentrations of CHG – A Standardize Process Should Include:

4% Aqueous CHG

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

CHG conc ≥1000 µg/ml

2% CHG Cloth

- An SMS, text or voicemail reminder
- Oral and written patient instructions – Cleanse gently
- TOTAL OF 3 PACKAGES PER APPLICATION INTERVAL – 3 NIGHT BEFORE AND 3 THE MORNING OF SURGERY
- Use both sides of the cloth – maximize release of CHG
- CLEANSE GENTLY

CHG conc ≥ 1000 µg/ml

Remember the devil is always in the details

Edmiston et al. JAMA Surg 2015;150:1027-1033
Edmiston et al. Infect Control Hosp Epidemiol 2016; 2016;37:254-259

Clin Orthop Relat Res
DOI 10.1007/s11999-016-4767-6

Clinical Orthopaedics and Related Research®
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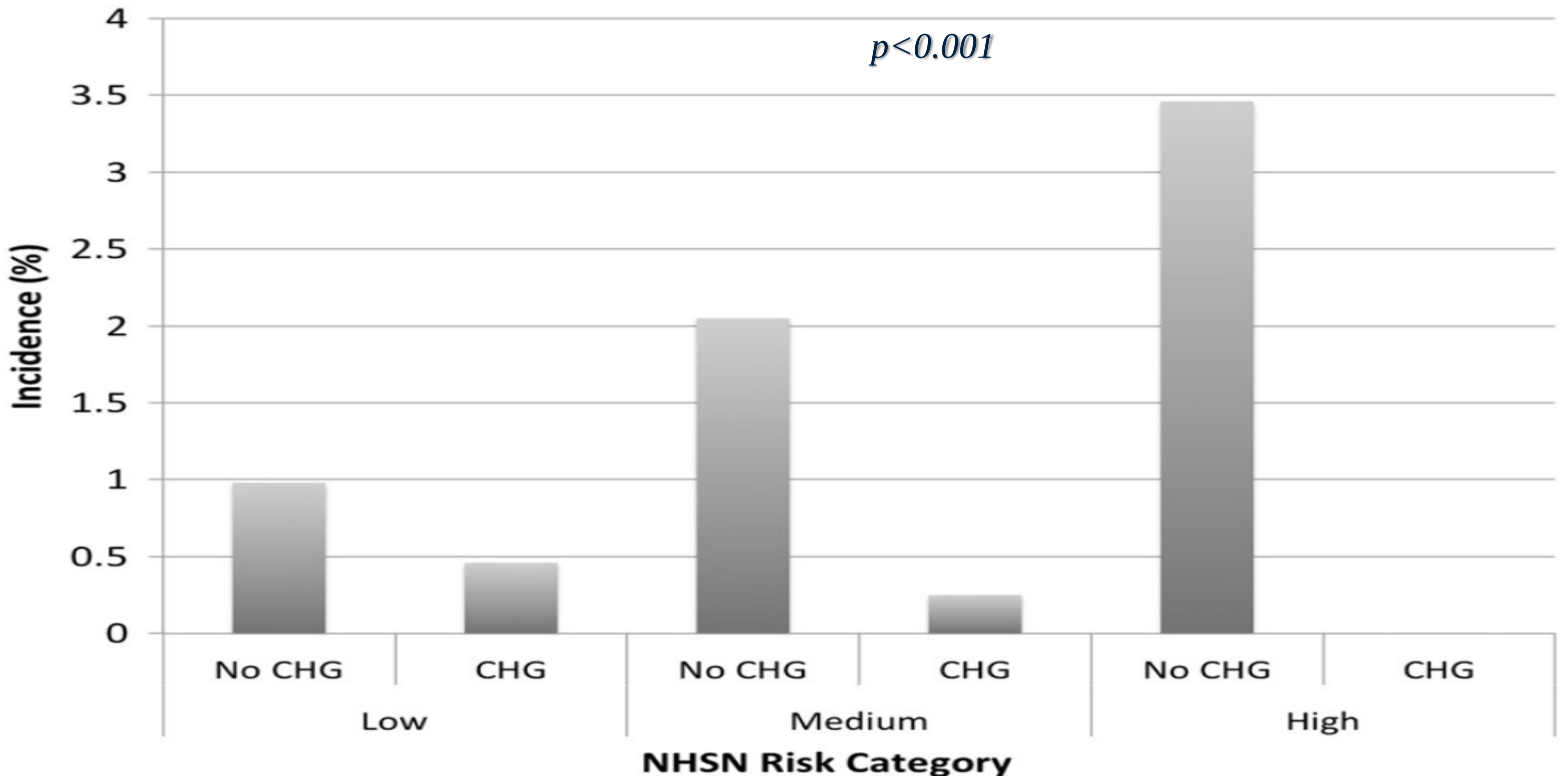
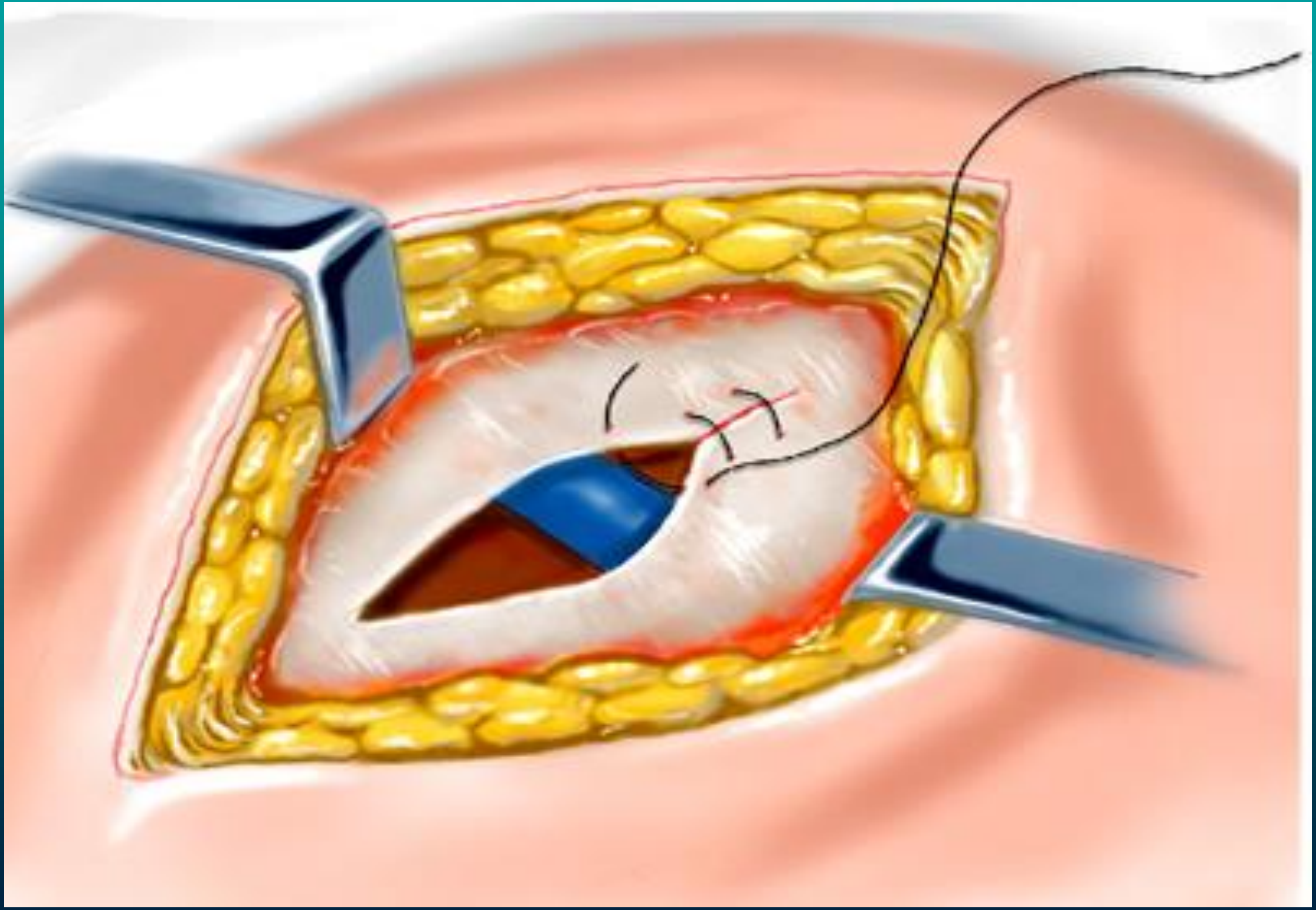
SYMPOSIUM: PROCEEDINGS OF THE 2015 MUSCULOSKELETAL INFECTION SOCIETY

Does Preadmission Cutaneous Chlorhexidine Preparation Reduce Surgical Site Infections After Total Knee Arthroplasty?

Bhaveen H. Kapadia MD, Peter L. Zhou BA, Julio J. Jauregui MD,
Michael A. Mont MD

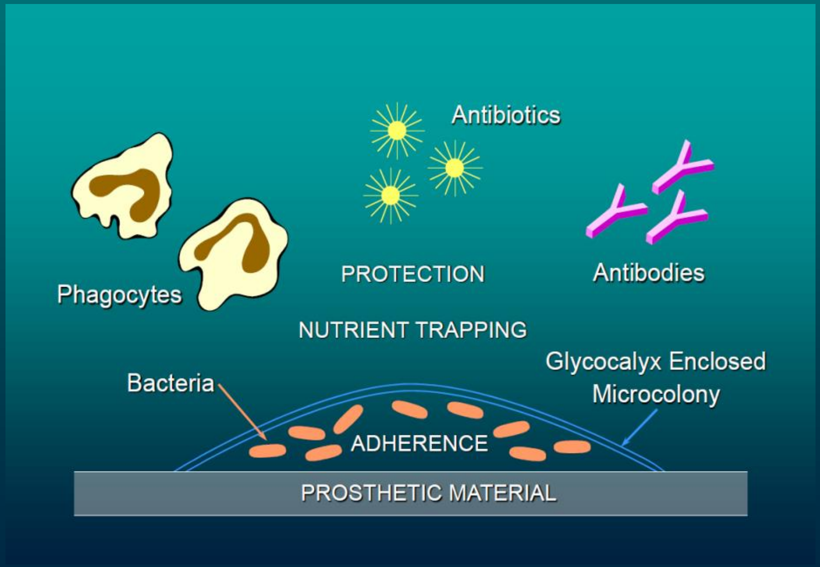


Are There Evidence-Based Studies to Validate the Use of an Antimicrobial (Triclosan) Wound Closure Technology?



Extrinsic Risk Factor: Bacterial Colonization of Implantable Devices

- Sutures are foreign bodies – As such can be colonized by Gram +/- bacteria
  - Implants provide nidus for bacterial adherence
  - Bacterial colonization can lead to biofilm formation
  - Biofilm formation enhances antimicrobial recalcitrance



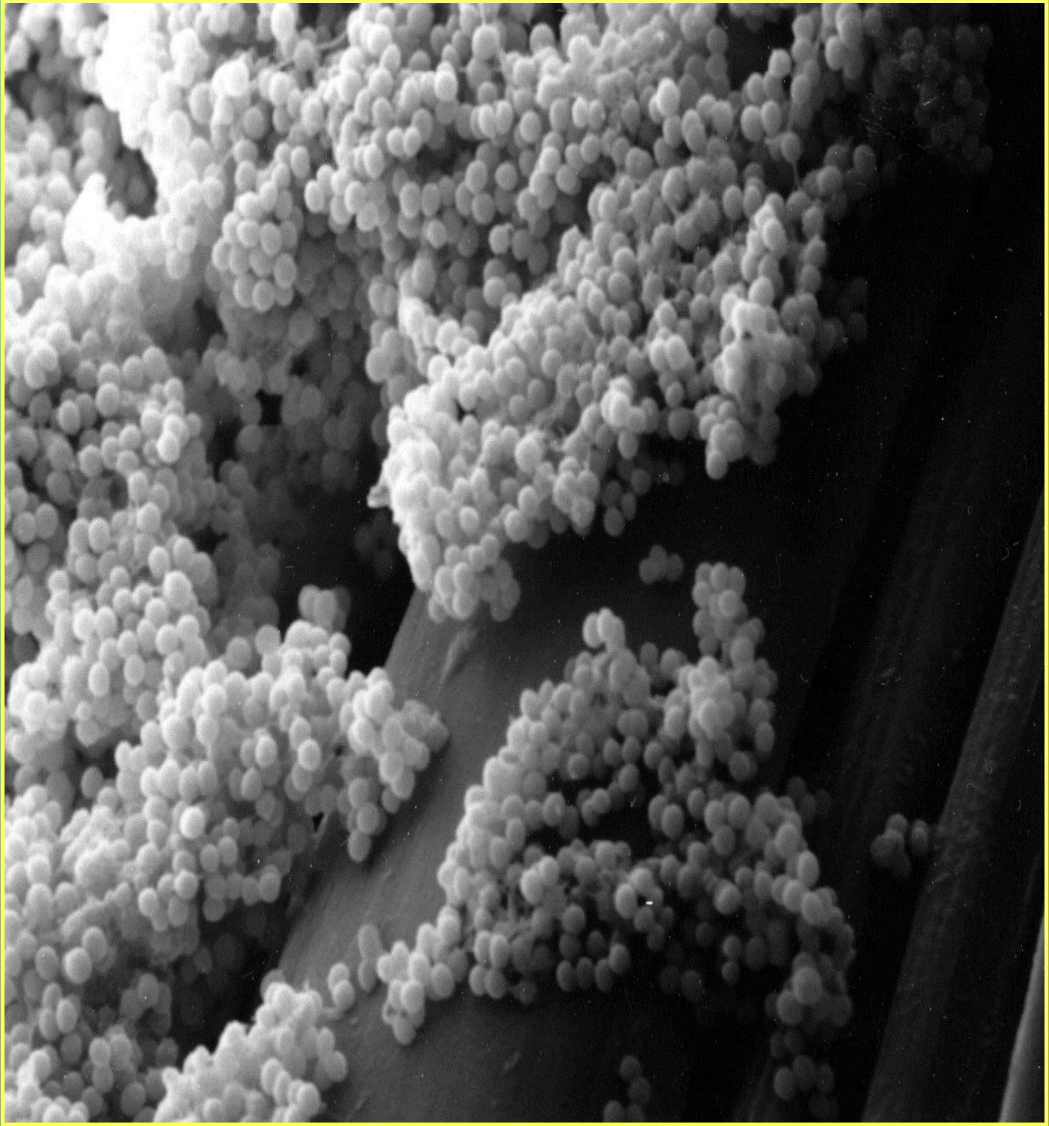
As little as 100 staphylococci can initiate a device-related infection

Ward KH et al. J Med Microbiol. 1992;36: 406-413.
Kathju S et al Surg infect. 2009;10:457-461
Mangram AJ et al. Infect Control Hosp Epidemiol.1999;27:97-134
Edmiston CE, Problems in General Surgery 1993;10: 444
Edmiston CE, J Clinical Microbiology 2013;51:417

Methicillin-Resistant *Staphylococcal aureus* (MRSA)

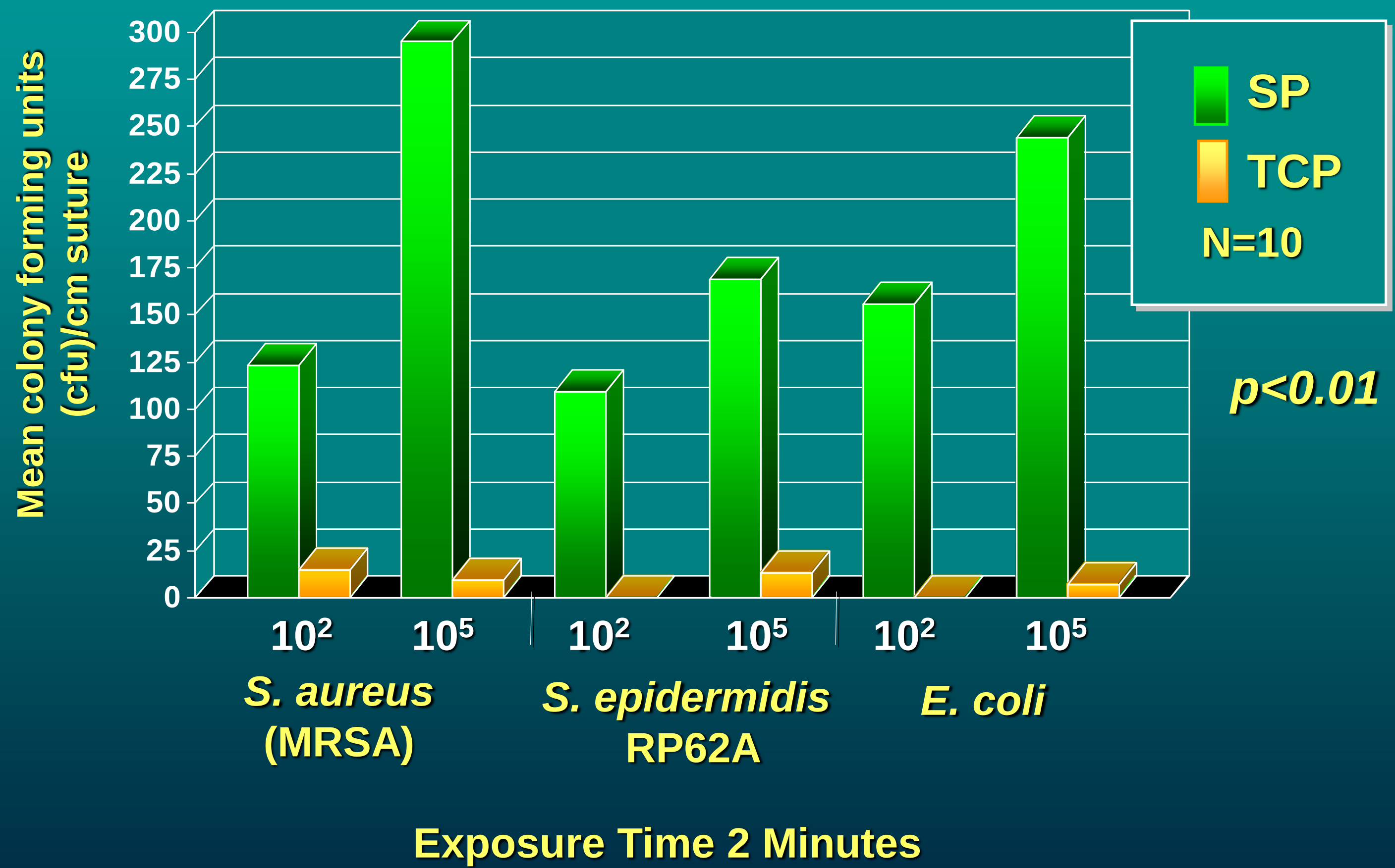
Are Sutures Really a Nidus for Infection?

Staphylococcus Vascular Graft Infection

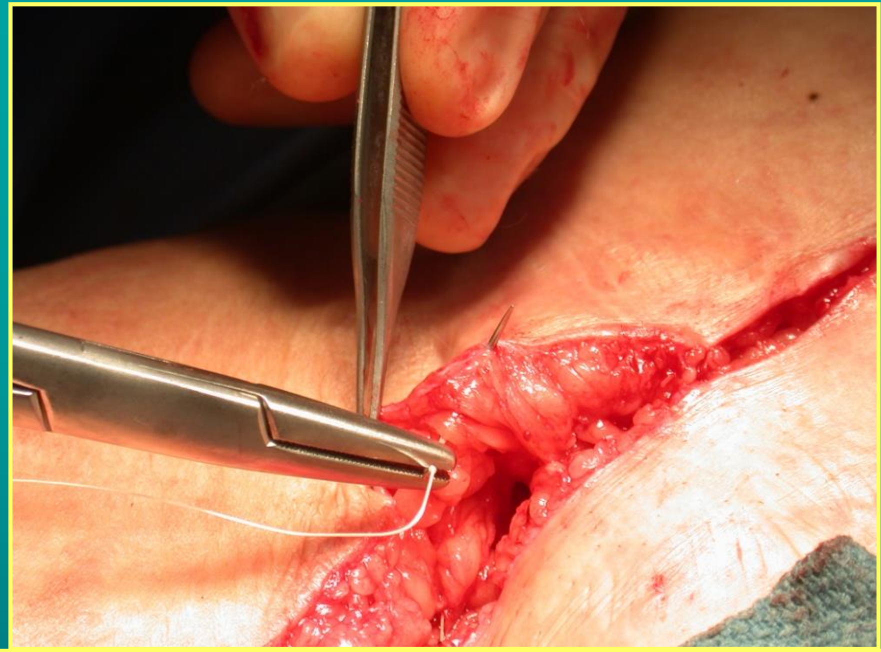


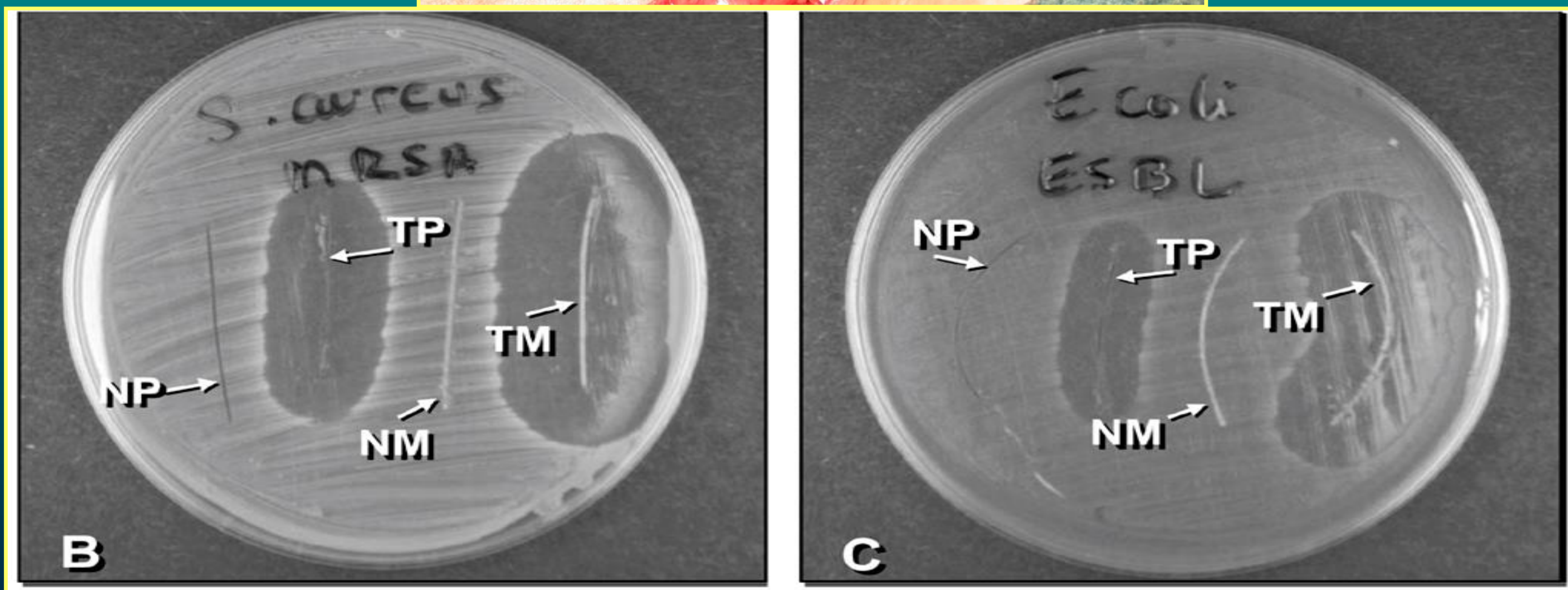
Surgical Microbiology Research Laboratory, Milwaukee - 2005

Mean Microbial Recovery from Standard Polyglactin Sutures Compared to Triclosan (Antimicrobial)-Coated Polyglactin Closure Devices



Edmiston et al, J Am Coll Surg 2006;203:481-489





Antimicrobial Activity Against MDRO

Is there an evidence-based argument for embracing an antimicrobial (triclosan)-coated suture technology to reduce the risk for surgical-site infections?: A meta-analysis

Charles E. Edmiston, Jr, PhD,[a] **Frederic C. Daoud, MD,**[b] *and* **David Leaper, MD, FACS,**[c] *Milwaukee, WI, Paris, France, and London, UK*

Background. *It has been estimated that 750,000 to 1 million surgical-site infections (SSIs) occur in the United States each year, causing substantial morbidity and mortality. Triclosan-coated sutures were developed as an adjunctive strategy for SSI risk reduction, but a recently published systematic literature review and meta-analysis suggested that no clinical benefit is associated with this technology. However, that study was hampered by poor selection of available randomized controlled trials (RCTs) and low patient numbers. The current systematic review involves 13 randomized, international RCTs, totaling 3,568 surgical patients.*

Methods. *A systematic literature search was performed on PubMed, Embase/Medline, Cochrane database group (Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Health Economic Evaluations Database/Database of Health Technology Assessments), and www.clinicaltrials.gov to identify RCTs of triclosan-coated sutures compared with conventional sutures and assessing the clinical effectiveness of antimicrobial sutures to decrease the risk for SSIs. A fixed- and random-effects model was developed, and pooled estimates reported as risk ratio (RR) with a corresponding 95% confidence interval (CI). Publication bias was assessed by analyzing a funnel plot of individual studies and testing the Egger regression intercept.*

Results. *The meta-analysis (13 RCTs, 3,568 patients) found that use of triclosan antimicrobial-coated sutures was associated with a decrease in SSIs in selected patient populations (fixed effect: RR = 0.734; 95% CI: 0.590–0.913; P = .005; random-effect: RR = 0.693; 95% CI: 0.533–0.920; P = .011). No publication bias was detected (Egger intercept test: P = .145).*

Conclusion. *Decreasing the risk for SSIs requires a multifaceted "care bundle" approach, and this meta-analysis of current, pooled, peer-reviewed, randomized controlled trials suggests a clinical effectiveness of antimicrobial-coated sutures (triclosan) in the prevention of SSIs, representing Center for Evidence-Based Medicine level 1a evidence. (Surgery 2013;154:89-100.)*

Meta-analysis

Systematic review and meta-analysis of triclosan-coated sutures for the prevention of surgical-site infection

Z. X. Wang[1,2], C. P. Jiang[1,2], Y. Cao[1,2] and Y. T. Ding[1,2]

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Background: Surgical-site infections (SSIs) increase morbidity and mortality in surgical patients and represent an economic burden to healthcare systems. Experiments have shown that triclosan-coated sutures (TCS) are beneficial in the prevention of SSI, although the results from individual randomized controlled trials (RCTs) are inconclusive. A meta-analysis of available RCTs was performed to evaluate the efficacy of TCS in the prevention of SSI.

Methods: A systematic search of PubMed, Embase, MEDLINE, Web of Science®, the Cochrane Central Register of Controlled Trials and internet-based trial registries for RCTs comparing the effect of TCS and conventional uncoated sutures on SSIs was conducted until June 2012. The primary outcome investigated was the incidence of SSI. Pooled relative risks with 95 per cent confidence interval (c.i.) were estimated with RevMan 5.1.6.

Results: Seventeen RCTs involving 3720 participants were included. No heterogeneity of statistical significance across studies was observed. TCS showed a significant advantage in reducing the rate of SSI by 30 per cent (relative risk 0·70, 95 per cent c.i. 0·57 to 0·85; $P < 0{\cdot}001$). Subgroup analyses revealed consistent results in favour of TCS in adult patients, abdominal procedures, and clean or clean-contaminated surgical wounds.

Conclusion: TCS demonstrated a significant beneficial effect in the prevention of SSI after surgery.

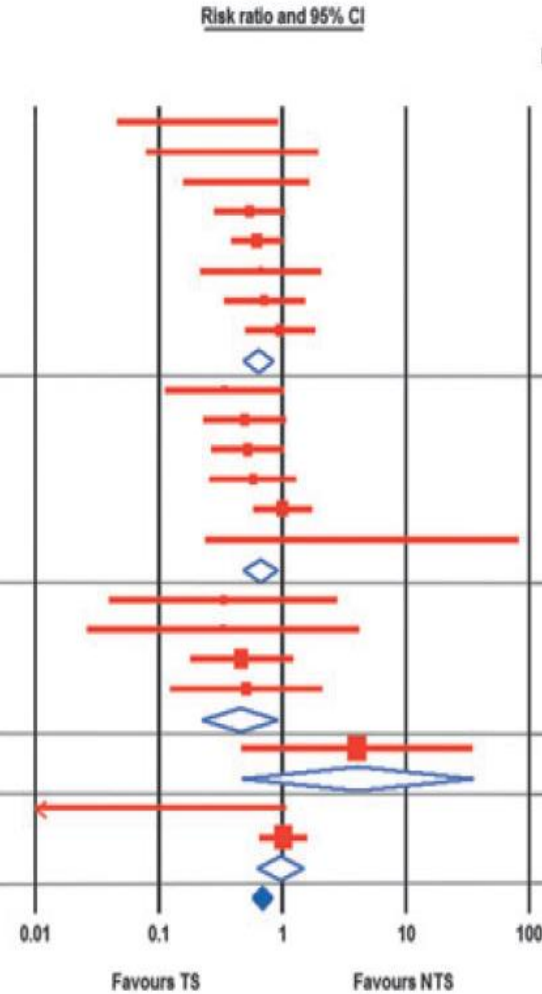
Edmiston et al., Surgery 2013;154;89-100

Wang et al., British J Surg 2013;100;465-473

Meta-Analysis of Risk Reduction by Wound Classification

Random-effects pooled RR of SSIs - 15 RCTs - RR by CDC class

Group by CDC class	Study name	Risk ratio	Lower limit	Upper limit	p-Value	TS	NTS	Relative weight
I	Rozelle I	0.207	0.047	0.915	0.038	2 / 46	8 / 38	3.38
I	Zhang I	0.392	0.080	1.928	0.249	2 / 51	5 / 50	2.95
I	Galal I	0.509	0.157	1.643	0.258	4 / 117	8 / 119	5.45
I	Justinger I	0.545	0.285	1.042	0.066	14 / 286	22 / 245	17.84
I	Thimour-Bergström I	0.625	0.388	1.006	0.053	23 / 184	38 / 190	33.00
I	Isik I	0.667	0.218	2.036	0.477	4 / 170	12 / 340	6.01
I	Williams I	0.714	0.339	1.506	0.377	10 / 75	14 / 75	13.47
I	Seim I	0.959	0.502	1.831	0.899	16 / 160	17 / 163	17.90
I		0.632	0.481	0.831	0.001	75 / 1089	124 / 1220	
II	Rasic II	0.341	0.114	1.017	0.054	4 / 91	12 / 93	8.48
II	Nakamura II	0.495	0.228	1.076	0.076	9 / 205	18 / 203	16.84
II	Justinger II	0.524	0.268	1.026	0.059	14 / 162	16 / 97	22.49
II	Galal II	0.579	0.259	1.295	0.184	8 / 71	14 / 72	15.68
II	Baracs II	1.004	0.588	1.716	0.988	23 / 188	24 / 197	35.33
II	Ford II	4.400	0.239	81.159	0.319	3 / 34	0 / 21	1.19
II		0.656	0.477	0.902	0.010	61 / 751	84 / 683	
III	Mingmalairak III	0.333	0.040	2.769	0.309	1 / 12	3 / 12	11.19
III	Nakamura III	0.333	0.027	4.186	0.395	0 / 1	1 / 1	7.84
III	Galal III	0.468	0.181	1.208	0.116	5 / 35	11 / 36	55.68
III	Justinger III	0.507	0.124	2.072	0.344	3 / 37	4 / 25	25.29
III		0.447	0.220	0.908	0.026	9 / 85	19 / 74	
IV	Mingmalairak IV	4.000	0.468	34.157	0.205	4 / 38	1 / 38	100.00
IV		4.000	0.468	34.157	0.205	4 / 38	1 / 38	
missing	Zhuang missing	0.064	0.004	1.067	0.056	0 / 150	15 / 300	2.43
missing	Turtiainen missing	1.018	0.654	1.586	0.935	31 / 139	30 / 137	97.57
missing		0.952	0.615	1.475	0.827	31 / 289	45 / 437	
Overall		0.680	0.567	0.814	0.000	180 / 2252	273 / 2452	



RR: Risk Ratio. SSI: Surgical Site Infections. TS: Triclosan Sutures, NTS: Non-Triclosan Sutures, RCT: Randomized Controlled Trial

Daoud, Edmiston, Leaper - Surgical Infections 2014: On Line

What Do the Various Meta-Analyses Tell Us About Triclosan Suture as a Risk Reduction Strategy?

- *Wang et al, BJS 2013;100-465: 17 RCT (3720 patients) – 30% decrease in risk of SSI (p<0.001)*
- *Edmiston et al, Surgery 2013;154:89-100: 13 RCT (3568 patients) – 27% to 33% decrease in risk of SSI (p<0.005)*
- *Sajid et al, Gastroenterol Report 2013:42-50: 7 RCT (1631 patients) – Odds of SSI 56% less in triclosan suture group compared to controls (p<0.04)*
- *Daoud et al, Surg Infect 2014;15:165-181: 15 RCT (4800 patients) – 20% to 50% decreased risk of SSI (p<0.001)*
- *Apisarnthanarak et al. Infect Cont Hosp Epidemiol 2015;36:1-11: 29 studies (11,900 patients) – 26% reduction in SSI (p<0.01)*
- *Guo et al, Surg Research 2016;* doi:10.1016/j.jss.2015.10.015 *– 13RCT (5256 patients) (risk ratio [RR] 0.76, 95% confidence interval [CI] 0.65e0.88, P < 0.001)*

How Does One Evaluate An Antimicrobial Risk - Reduction Technology – The Triclosan Suture Story?

Safety (700-750 million strands)

- No MAUDE (FDA) reports (13 years) documenting significant evidence linking triclosan to adverse impact in surgical wounds; No evidence of pediatric toxicity, *Renko et al. Lancet Infectious Disease 2016;17:50–57;* No evidence of human toxicity following oral or dermal exposure, *Roidricks et al. Crit. Rev. Toxicol. 2010;40:422. doi: 10.3109/10408441003667514*.

Microbicidal Activity (Spectrum)

- Gram-positive and Gram-negative antimicrobial activity - No published studies have demonstrated that use of triclosan coated sutures are associated with the emergence of resistant surgical pathogens.

Evidence-based Clinical Effectiveness (Meta-Analysis)

- Currently 10 meta-analysis in the peer-literature document clinical efficacy of triclosan (antimicrobial) suture technology.

Cost-Effectiveness

- Two recent studies, *Singh et al. (Infect Control Hosp Epidemiol 2014;35:1013); Leaper and Edmiston (British Journal Surgery 2017;104:e134-e144)]* document that use of triclosan-coated sutures provides significant fiscal benefit to hospital, third party-payer and patient.

What Constitutes the Ideal Surgical Care Bundle?

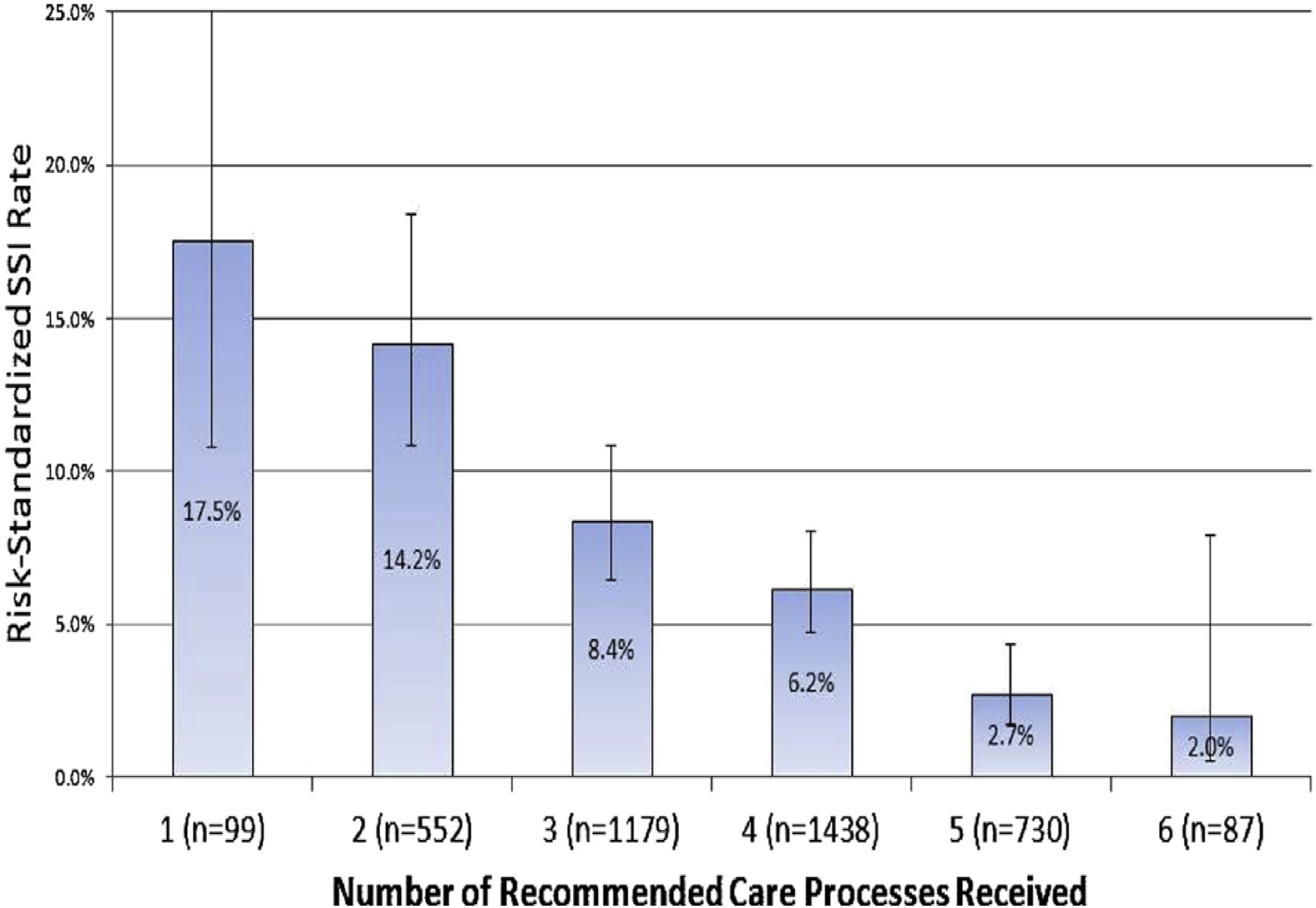
Developing an argument for bundled interventions to reduce surgical site infection in colorectal surgery

Seth A. Waits, MD,[a] Danielle Fritze, MD,[a] Mousumi Banerjee, PhD,[a,b] Wenying Zhang, MA,[a] James Kubus, MS,[a] Michael J. Englesbe, MD,[a] Darrell A. Campbell, Jr, MD,[a] *and* **Samantha Hendren, MD, MPH,[a]** *Ann Arbor, MI*

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.)*

From the Departments of Surgery[a] and Biostatistics,[b] University of Michigan, Ann Arbor, MI

Waits et al, Surgery 2014;155:602



Waits et al, Surgery 2014;155:602

Original Investigation

JAMA Surg. doi:10.1001/jamasurg.2014.346
Published online August 27, 2014.

The Preventive Surgical Site Infection Bundle in Colorectal Surgery

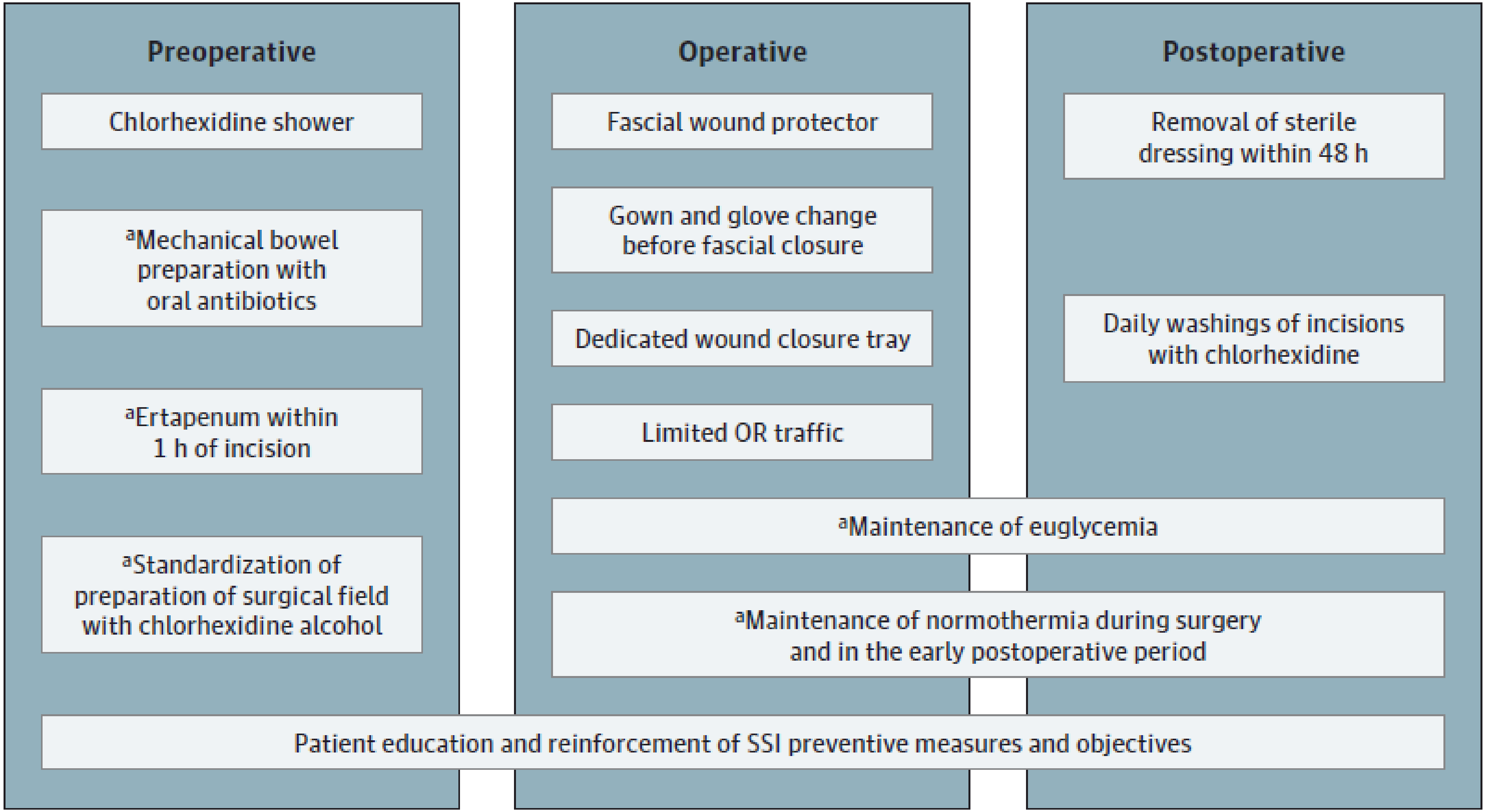
An Effective Approach to Surgical Site Infection Reduction and Health Care Cost Savings

Jeffrey E. Keenan, MD; Paul J. Speicher, MD; Julie K. M. Thacker, MD; Monica Walter, DNP; Maragatha Kuchibhatla, PhD; Christopher R. Mantyh, MD

RESULTS Of 559 patients in the study, 346 (61.9%) and 213 (38.1%) underwent their operation before and after implementation of the bundle, respectively. Groups were matched on their propensity to be treated with the bundle to account for significant differences in the preimplementation and postimplementation characteristics. Comparison of the matched groups revealed that implementation of the bundle was associated with reduced superficial SSIs (19.3% vs 5.7%, $P < .001$) and postoperative sepsis (8.5% vs 2.4%, $P = .009$). No significant difference was observed in deep SSIs, organ-space SSIs, wound disruption, length of stay, 30-day readmission, or variable direct costs between the matched groups. However, in a subgroup analysis of the postbundle period, superficial SSI occurrence was associated with a 35.5% increase in variable direct costs (\$13 253 vs \$9779, $P = .001$) and a 71.7% increase in length of stay (7.9 vs 4.6 days, $P < .001$).

CONCLUSIONS AND RELEVANCE The preventive SSI bundle was associated with a substantial reduction in SSIs after colorectal surgery. The increased costs associated with SSIs support that the bundle represents an effective approach to reduce health care costs.

Figure 1. The Preventive Surgical Site Infection (SSI) Bundle in Colorectal Surgery



JAMA Surg. doi:10.1001/jamasurg.2014.346
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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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Corresponding author: Jamie N. Bakkum-Gamez, MD, Department of Obstetrics

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

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*

Surgery 2015;158:66-77

Putting it all Together

The Journal of Arthroplasty 32 (2017) 2040–2046

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AAHKS Symposium

Prevention of Periprosthetic Joint Infection: Examining the Recent Guidelines

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ABSTRACT

Background: The global rise in infectious disease has led the Center for Disease Control and Prevention and the World Health Organization to release new guidelines for the prevention of surgical site infection.
Methods: In this article, we summarize current recommendations based on level of evidence, review unresolved and unaddressed issues, and supplement them with new literature.
Results: Although the guidelines discuss major issues in reducing surgical site infection, many questions remain unanswered.
Conclusion: These guidelines will hopefully help in setting a standard of care based on best evidence available and focus investigators on areas where evidence is lacking.

Developing An Orthopedic Care Bundle

★ Fully Vetted – Evidence-Based

- Weight-based dosing prophylaxis
- Shower (2X) before surgery
- Hair removal not necessary
- Alcohol/CHG perioperative skin prep
- Maintain normothermia
- Antimicrobial sutures
- Nasal decolonization

Not Fully Vetted – Dogmatic or Weak

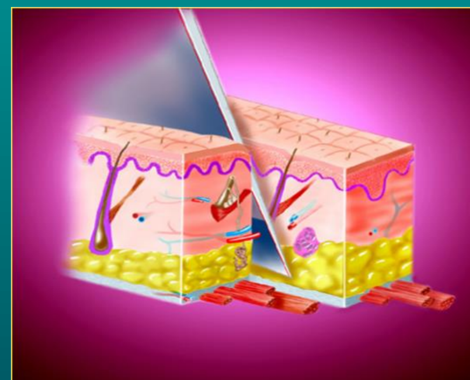
- Laminar air flow
- Adhesive drapes not necessary
- Wound irrigation with iodophor
- Antimicrobial dressings
- NPWT in high-risk patients

Unresolved Issues - Really

- Body exhaust suits
- Intensive glycemic control
- Antibiotic impregnated cement

Selecting Evidence-Based (EB) Surgical Care Bundle

- Limit OR Traffic
- Mechanical Bowel Prep Oral Antibiotics ★
- Antimicrobial Prophylaxis – Weight-based ★
- ★ Normothermia
- ★ Glycemic Control
- Triclosan Sutures Fascial/ Sub-cuticular closure ★
- 0.05% Antiseptic Irrigation of Surgical Wound ★
- Appropriate Hair Removal ★
- 2% / 4% CHG Preadmission Shower/cleansing ★
- Wound Edge Protector ★
- Supplemental Oxygen ★
- Smoking Cessation ★
- Separate Wound Closure Tray ★
- Glove Change Prior to Fascia / Subcuticular Closure ★
- 70% alc / 2% CHG Skin Antisepsis ★



★ Moderate to High (1A) Level of Evidence-Based Documentation

Building an Effective Surgical Care Bundle*

Baseline Evidence-Based Interventions – Designated 1A

- Normothermia**
- Perioperative antimicrobial prophylaxis – weight-based
- Antimicrobial (triclosan) coated sutures
- Preadmission CHG shower/cleansing – Standardized regimen
- Perioperative antisepsis – 2% CHG/ 70%
- Glycemic control
- Appropriate hair removal

Inclusive Evidence-Based Intervention for Consideration in 2018*

- Supplemental oxygen – Colorectal
- Oral antibiotics / Mechanical bowel prep - Colorectal
- Wound edge protector
- Staphylococcal decolonization – Orthopedic / CT – high
- Glove change prior to fascial/subcuticular closure
- Separate wound closure tray
- Smoking cessation
- Irrigation with 0.05% CHG
- OR traffic control

**Evidence-Based Medicine is a Moving Target*

*** Published level of evidence*

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

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.

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Invited Commentary page 690

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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 Operation duration longer than 140 minutes (7.5% vs 5.0%; $p = 0.05$)

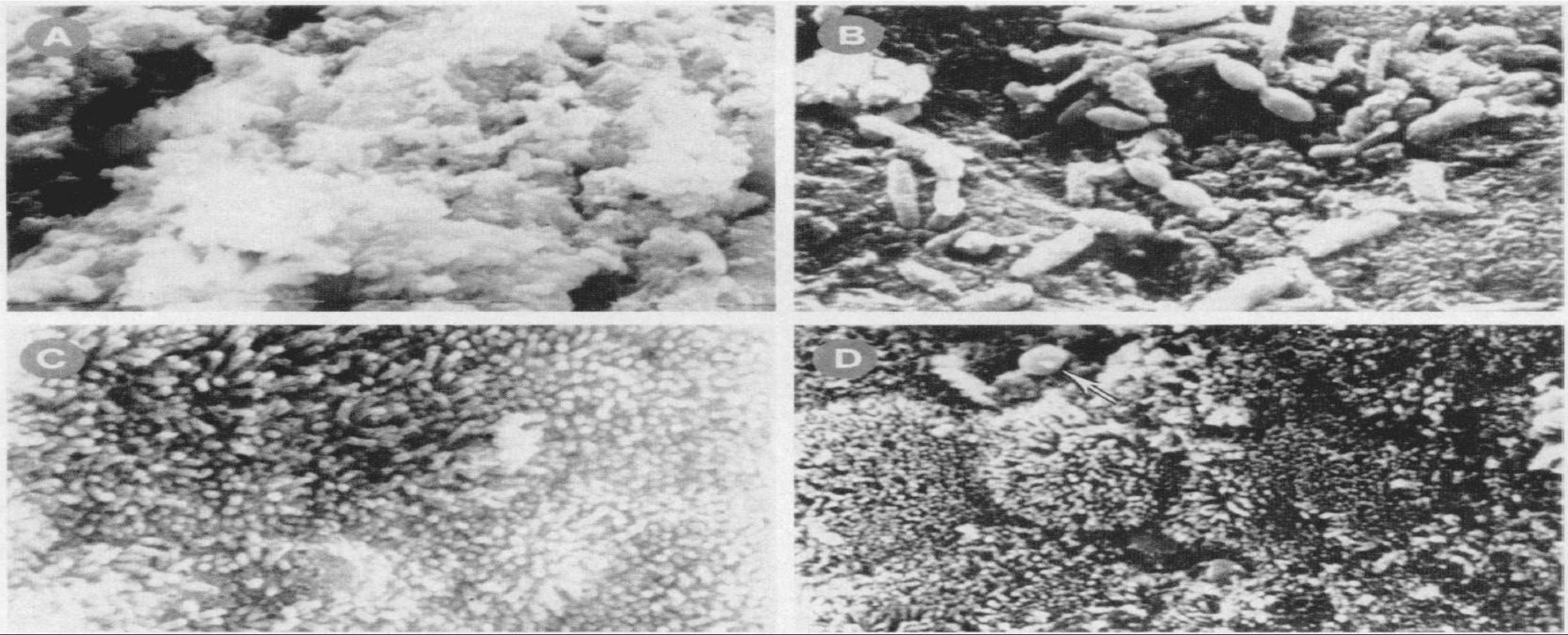
These risk factors were also associated with an increase in SSI rates as a compounded score ($P < 0.001$).

- 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) had a 13.6%

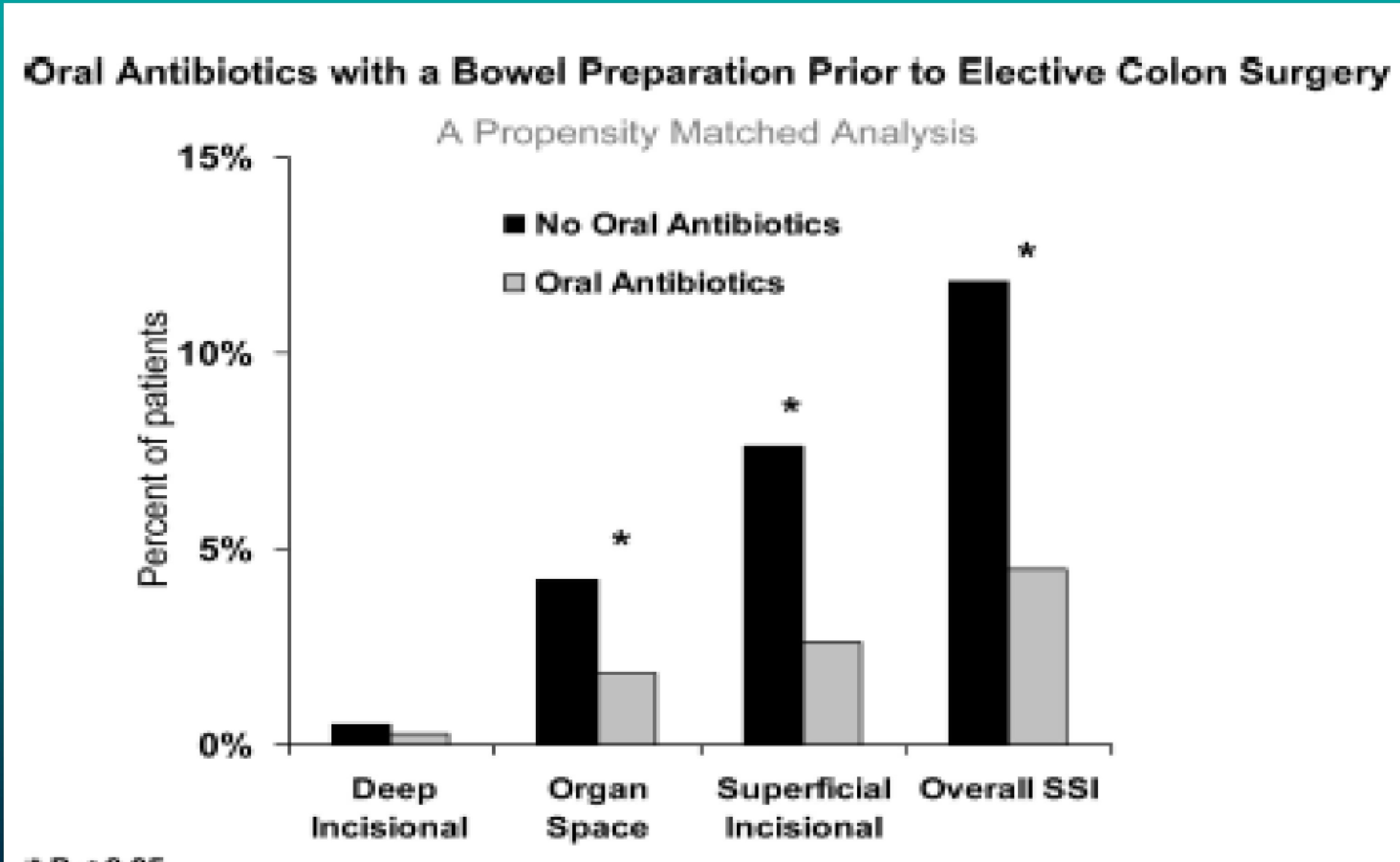
JAMA Surg 2017;152:686-690

The Efficacy of Oral Antimicrobials in Reducing Aerobic and Anaerobic Colonic Mucosal Flora

Jonathan I. Groner, MD; Charles E. Edmiston, Jr, PhD; Candace J. Krepel;
Gordon L. Telford, MD; Robert E. Condon, MD, MS



Arch Surg. 1989;124:281-284



Englesbe et al . A statewide assessment of surgical site infection following colectomy: the role of oral antibiotics. Ann Surg. 2010;252:514-9

international wound journal

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ORIGINAL ARTICLE

Surgical site infection: poor compliance with guidelines and care bundles

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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

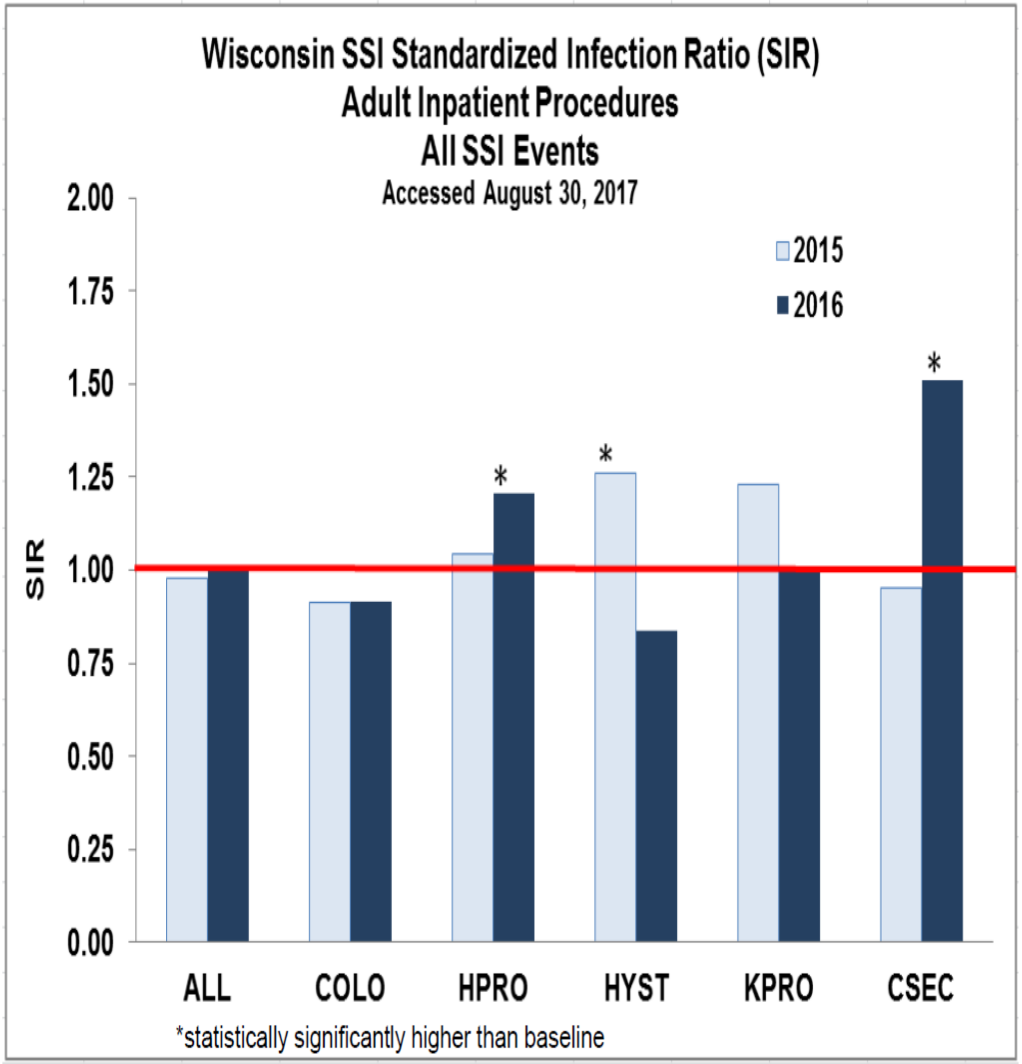
Abstract

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

Wisconsin Surgical Champion Program
Peer-to-Peer Collegial Intervention

Wisconsin Surgical Champion Program



SSI occurrence among WI acute care facilities visited during August-December 2015
n = 10

Year	Number Procedures	Number Infections	Number Predicted Infections	SIR	P-value	95 % CI
2015	3125	68	42	1.61	0.0003	1.26, 2.03
2016	2834	36	41	0.88	0.45	0.62, 1.21

The number of infections was reduced by 47% and the 2016 SIR was 45% lower than the 2015 SIR (p = 0.002)

SSI occurrence among WI acute care facilities NOT visited during August-December 2015:
n ~ 90

Year	Number Procedures	Number Infections	Number Predicted Infections	SIR	P-value	95 % CI
2015	40,359	574	601	0.96	0.96	0.88, 1.04
2016	41,753	659	645	1.02	0.59	0.94, 1.10

No reduction in number of infections, and no difference in the 2016 SIR compared to 2015 (p = 0.19)

JAMA Surgery | Original Investigation

Surgeon Variation in Complications With Minimally Invasive and Open Colectomy Results From the Michigan Surgical Quality Collaborative

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IMPORTANCE Minimally invasive colectomy (MIC) is an increasingly common surgical procedure. Although case series and controlled prospective trials have found the procedure to be safe, it is unclear whether safe adaptation of this approach from open colectomy (OC) is occurring among surgeons.

OBJECTIVE To assess rates of complications for MIC compared with OC among surgeons.

DESIGN, SETTING, AND PARTICIPANTS We analyzed 5196 patients who underwent MIC or OC from January 1, 2012, through December 31, 2015, by 97 surgeons in the Michigan Surgical Quality Collaborative, with each surgeon performing at least 10 OCs and 10 MICs. Hierarchical regression was used to assess surgeon variation in adjusted rates of complications and the association of these outcomes across approaches.

MAIN OUTCOMES AND MEASURES Primary study outcome measurements included overall 30-day complication rates, variation in complication rates among surgeons, and surgeon rank by complication rate for MIC vs OC.

RESULTS Of the 5196 patients (mean [SD] age, 62.9 [14.4] years; 2842 [54.7%] female; 4429 [85.2%] white), 3118 (60.0%) underwent MIC and 2078 (40.0%) underwent OC. Overall, 1149 patients (22.1%) experienced complications (702 [33.8%] in the OC group vs 447 [14.3%] in the MIC group; $P < .001$). For MIC, the rates of complications varied from 8.8% to 25.9% among surgeons. For OC, rates of complications were higher but varied less (1.7-fold) among surgeons, ranging from 25.9% to 43.8%. Among the 97 surgeons ranked, the mean change in ranking between OC and MIC was 25 positions. The top 10 surgeons ranged in rank from 6 of 97 for OC to 89 of 97 for MIC.

CONCLUSIONS AND RELEVANCE Surgeon-level variation in complications was nearly twice as great for MIC than for OC among surgeons enrolled in a statewide quality collaborative. Moreover, surgeon rankings for OC outcomes differed substantially from outcomes for those same surgeons performing MIC. This finding implies a need for improved training in adoption of MIC techniques among some surgeons.

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Supplemental content

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Key Points

Question How do rates of complications and surgeon ranking compare for minimally invasive colectomy vs open colectomy among surgeons?

Findings In this cohort study of 97 surgeons and 5196 patients, rates of complications varied nearly twice as much among surgeons for minimally invasive colectomy compared with open colectomy.

Meaning The study findings imply a need for improved training in adoption of minimally invasive colectomy techniques among some surgeons.

Table 2. Unadjusted Complications by Surgical Approach

Complication	Minimally Invasive Colectomy (n = 3118)	Open Colectomy (n = 2078)	*P* Value[a]
Mortality	34 (1.1)	141 (6.8)	<.001
Sepsis	122 (3.9)	221 (10.6)	<.001
Severe sepsis	43 (1.4)	121 (5.8)	<.001
SSI			
Superficial	83 (2.7)	138 (6.6)	<.001
Deep incisional	26 (0.8)	36 (1.7)	<.001
Organ space	86 (2.8)	97 (4.7)	<.001
Clostridium difficile colitis	29 (0.9)	42 (2.0)	.001
CLABSI	3 (0.1)	3 (0.1)	.62
DVT	37 (1.2)	60 (2.9)	<.001
PE	15 (0.5)	23 (1.1)	.01
Pneumonia			
Unplanned intubation	29 (1.6)	100 (4.8)	<.001
Cardiac arrhythmia	63 (2.0)	102 (4.9)	<.001
Cardiac arrest requiring CPR	22 (0.7)	24 (1.2)	.09
MI	18 (0.6)	28 (1.4)	<.001
Stroke or CVA	7 (0.2)	6 (0.3)	.65
Acute renal insufficiency and/or failure	44 (1.4)	83 (4.0)	<.001
UTI	54 (1.7)	72 (3.5)	<.001

Healy et al. JAMA Surg 2017;152:860-867

Wisconsin DPH Resources

https://www.dhs.wisconsin.gov/hai/ssi-prevention.htm

Antimicrobial Prophylaxis - Weight-based Dosing

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Antimicrobial Wound Closure

CHG Shower

CHG Wound Irrigation

Colon Surgery Bundle

Guideline Evaluation

HAI Prevalence Data

Infection Control Practices for Ambulatory Surgery Centers

MRSA Surveillance/Decolonization

Postoperative Wound Care

Selective Interventional Strategies beyond SCIP

“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

Thank You