Preventing SSI - what works?

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The Persatuan Kawalan Infekis & Antimicrobial Kota Kinabalu Sabah (PKIAKKS)
6th Borneo Infection Control Congress
Kompleks Pentadbiran Kerajaan Persekutuan Sabah, Kota Kinabalu Sabah
20th-21st September 2018.

U.S. Department of Health and Human Services (HHS)

- USA - The national target established by the US Department of Health and Human Services (HHS)
  - SSI Data - 2015 – 2020
  - SSI rate reduced by 30%

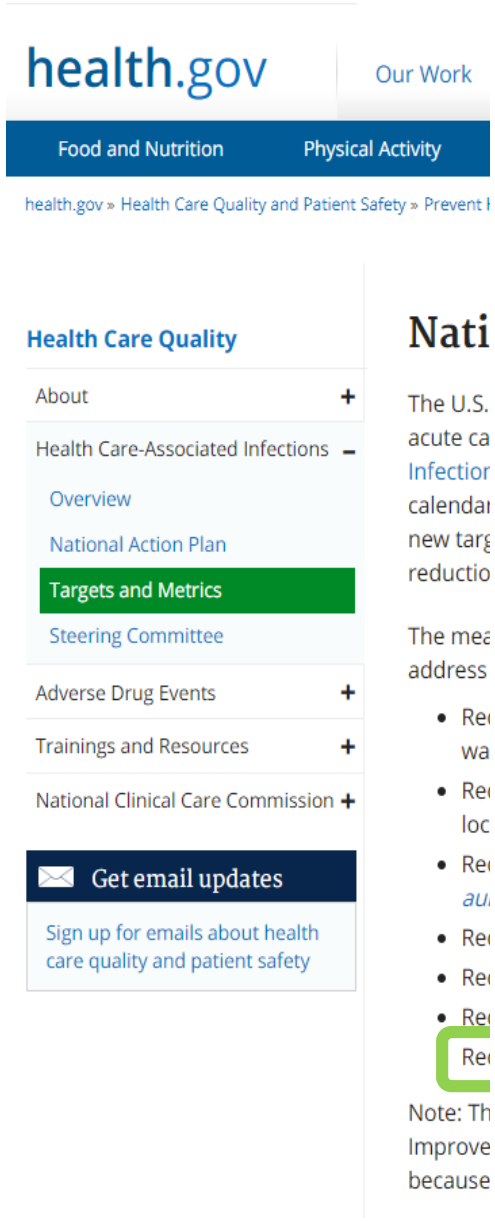

Table 1: 2020 National Acute Care Hospital HAI Metrics

Measure (and data source)	Progress made by 2016	2020 Target (from 2015 baseline)
CLABSI (NHSN)[1]	10% reduction	50% reduction
CAUTI (NHSN)[1]	6% relative reduction	25% reduction
Invasive MRSA (NHSN/EIP[2])	8% reduction	50% reduction
Hospital-onset MRSA (NHSN)	6% reduction	50% reduction
Hospital-onset CDI (NHSN)	7% reduction	30% reduction
SSI (NHSN)	Data to be released in 2018	30% reduction
Clostridium difficile hospitalizations (HCUP)[3]	Data pending release	30% reduction

[1] **NHSN:** The National Healthcare Safety Network, of the Centers for Disease Control and Prevention (CDC), is the nation's most widely used health care-associated infection tracking system. Since 2009, infection data has been reported to the NHSN to track the national progress of the reduction of HAIs.

https://health.gov/hcq/prevent-hai-measures.asp

The projected burden of complex surgical site infections following hip and knee arthroplasties in adults in the United States, 2020 through 2030

- **USA between 2020 and 2030**
  - Predict that SSI following knee and hip arthroplasties will increase by 14%
  - Projected a total burden of 77,653 SSIs; however,
  - Meeting a 30% rate reduction could prevent 23,297 SSIs
- Reducing the SSI rate to the national HHS target could prevent 23,000 SSIs and reduce subsequent morbidity, mortality, and Medicare costs

Infection Control & Hospital Epidemiology

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First View

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The projected burden of complex surgical site infections following hip and knee arthroplasties in adults in the United States, 2020 through 2030

Hannah M. Wolford (a1), Kelly M. Hatfield (a1), Prabasaj Paul (a1), Sarah H. Yi (a1) ...

https://doi.org/10.1017/ice.2018.184 Published online: 30 August 2018

Abstract

Background

As the US population ages, the number of hip and knee arthroplasties is expected to increase. Because surgical site infections (SSIs) following these procedures contribute substantial morbidity, mortality, and costs, we projected SSIs expected to occur from 2020 through 2030.

Wolford HM, et al. Infect Control Hosp Epidemiol. 2018;doi:10.1017/ice.2018.184.

Costs quadruple when SSIs develop after hip, knee replacements

- **Alberta, Canada**
- Calculation of the total 1-year health care cost for patients who develop complex SSI
  - Pts - primary hip or knee arthroplasty
  - April 1, 2012 - March 31, 2015
  - All pts who developed a complex SSI postoperatively
    - Provincial infection prevention and control database

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Article Metrics

First View

The cost of managing complex surgical site infections following primary hip and knee arthroplasty: A population-based cohort study in Alberta, Canada

Elissa D. Rennert-May [a1] [a2], John Conly [a1] [a3] [a4] [a5] [a6], Stephanie Smith [a7], Shannon Puloski [a8] ...

https://doi.org/10.1017/ice.2018.199 Published online: 10 September 2018

Abstract

Objective

Nearly 800,000 primary hip and knee arthroplasty procedures are performed annually in North America. Approximately 1% of these are complicated by a complex surgical site infection (SSI), leading to very high healthcare costs. However, population-based studies to properly estimate the economic burden are lacking. We aimed to address this knowledge gap.

Rennert-May ED, et al. Infect Control Hosp Epidemiol. 2018; doi:10.1016/j.ajic.2018.03.018.

Costs quadruple when SSIs develop after hip, knee replacements

- **Results**
  - Costs - Four times higher compared with patients who do not sustain an infection
  - 12-month cumulative health care costs for patients who developed a complex SSI were:
    - $95,321 vs. $19,893 ($US = $68,150 vs. $14,223)
    - $8.3 million annually/complex SSI
    - $1.67 million annually/no complex SSI
  - The magnitude of the cost difference persisted even after controlling for underlying patient factors
  - Most commonly identified causative pathogen (38%) was *Staphylococcus aureus* (95% MSSA)
  - Applying the same complex infection rate to the USA, (700,000 hip and knee arthroplasties annually)
    - Annual expenditure - $US496 million to manage SSIs vs $104 million had no infection developed

Infection Control & Hospital Epidemiology

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Rennert-May ED, et al. Infect Control Hosp Epidemiol. 2018; doi:10.1016/j.ajic.2018.03.018.

Surveillance program

- **Surveillance**

"There may be infection control without surveillance, but those who practice without measurement…..will be like the crew of an orbiting ship travelling through space without instruments, unable to identify their current bearings, the probability of hazards, their direction or their rate of travel"

Wenzel R P.

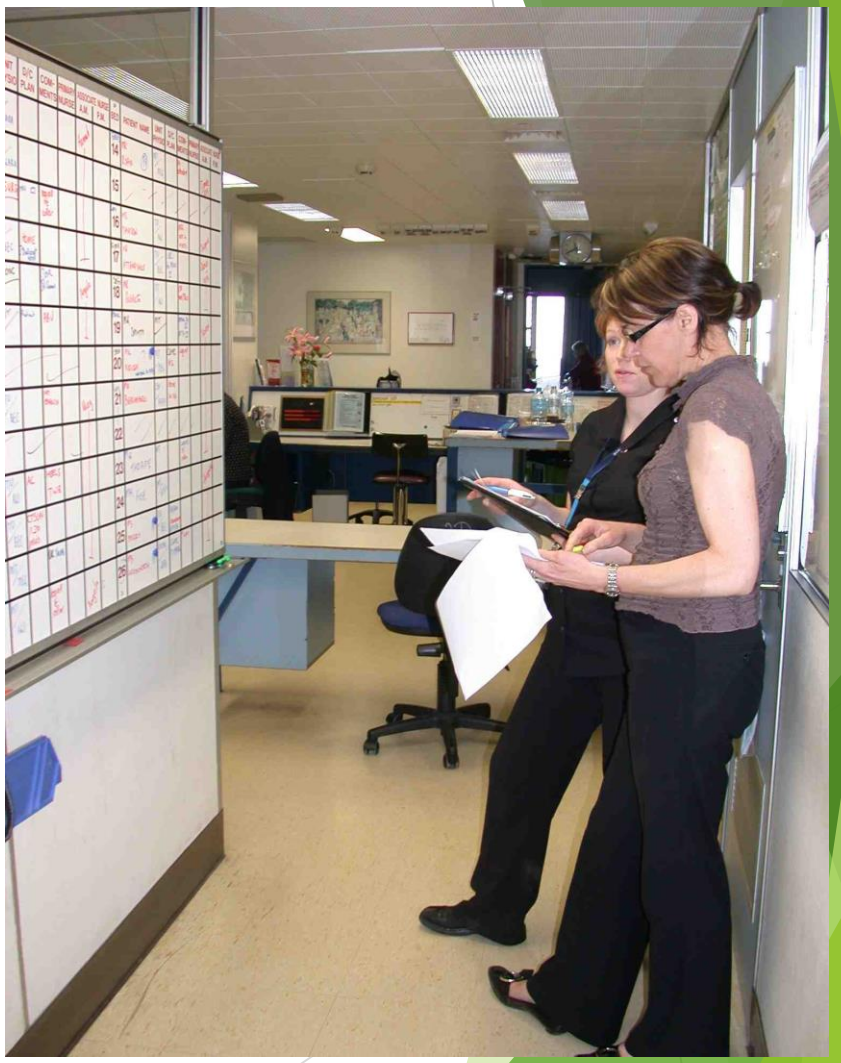
Infection Control Without Measurement

Surveillance program

- **Laboratory based ward liaison surveillance**
  - Review microbiology data on a routine and regularly basis
    - Identify clusters and outbreaks
    - Identify unusual pathogens
    - Identify greater than usual incidence of certain species
  - Infection control staff should conducts regular ward rounds
  - Keep a running sheet of results by ward

Surveillance program

- **Laboratory based ward liaison surveillance…….**
  - **Ward rounds**
    - i.e. Monday, Wednesday, Friday
    - Discuss microbiology results with ward/unit staff:
      - Likely mode/s of transmission
      - Advise on infection control precautions to minimize transmission
      - Patient placement
      - Patient risk factors
      - Device use
  - **Intensive "shoe leather" infection control**
    - Opportunity to observe what is actually happening



Surveillance program

- **Targeted surveillance - Surveillance of definable events**
  - High risk, high volume, high cost procedures/areas
  - Device related
  - Surgical site infections in specific population
- **Surveillance method**
  - **Simplicity**
    - Simple data collection management analysis, dissemination and maintenance systems
    - Easily applicable and understandable definitions
  - **Flexibility**
    - Able to respond to new problems, technologies and case definitions

Surveillance program

- **High-quality data**
  - Complete and valid
  - Staff training
  - Quality check on data entry
    - Interfacing and extracting data from existing computer systems – demographics/microbiology
- **High Acceptability**
  - Not overly burdensome
  - As data requirement increases data completeness **decreases**
    - Leads to problems with validity
- **High sensitivity and specificity**
  - **Sensitivity** – captures a high percentage of cases that meet the definition
- **Specificity**
  - Has a low rate of false-positive misclassification of non-cases as cases
- **High timeliness**
  - Timely feedback of data so appropriate interventions can be devised and implemented
- **High external validity**
  - Data should be generalizable to similar populations
- **Reliability**
  - Consistent collection management and analysis of data without lapses

Surveillance program

- **Case definitions**
  - Standardized and straight forward case definitions
  - Strict application of the definitions
- **Remember!**

"Surveillance definitions are for surveillance purposes not clinical purposes"

- **Risk adjustment - "compare apples with apples"**
  - Stratification by cofounders
    - Hospital unit
    - Device use
- Be aware of possible co-founding by the sensitivity of the local surveillance effort
  - Better surveillance systems will appear to have the higher rate of infection

RISK ADJUSTMENT

"COMPARE APPLES WITH APPLES"

Surveillance program

- **Compare your infection rate with your own rates (or zero) overtime**
- **Provide surveillance data for state/national clinical performance indicator and accreditation systems**
  - Understand the limitations of inter-hospital comparisons and benchmarking
- **HK hospital Authority surveillance KPIs**
  - Multidrug resistant organisms
  - Surgical site infections
  - Catheter associated bloodstream infections in Adult ICU

RISK ADJUSTMENT

"COMPARE APPLES WITH APPLES"

Prevention of SSI

GLOBAL GUIDELINES
FOR THE PREVENTION OF
SURGICAL SITE INFECTION

World Health Organization

Clinical Review & Education

JAMA Surgery | Special Communication

Centers for Disease Control and Prev
for the Prevention of Surgical Site In

Sandra I. Berríos-Torres, MD; Craig A. Umscheid, MD, MSCE; Dale W. Bratzler, DO, MPH; Bri
Erin C. Stone, MA; Rachel R. Kelz, MD, MSCE; Caroline E. Reinke, MD, MSHP; Sherry Morga
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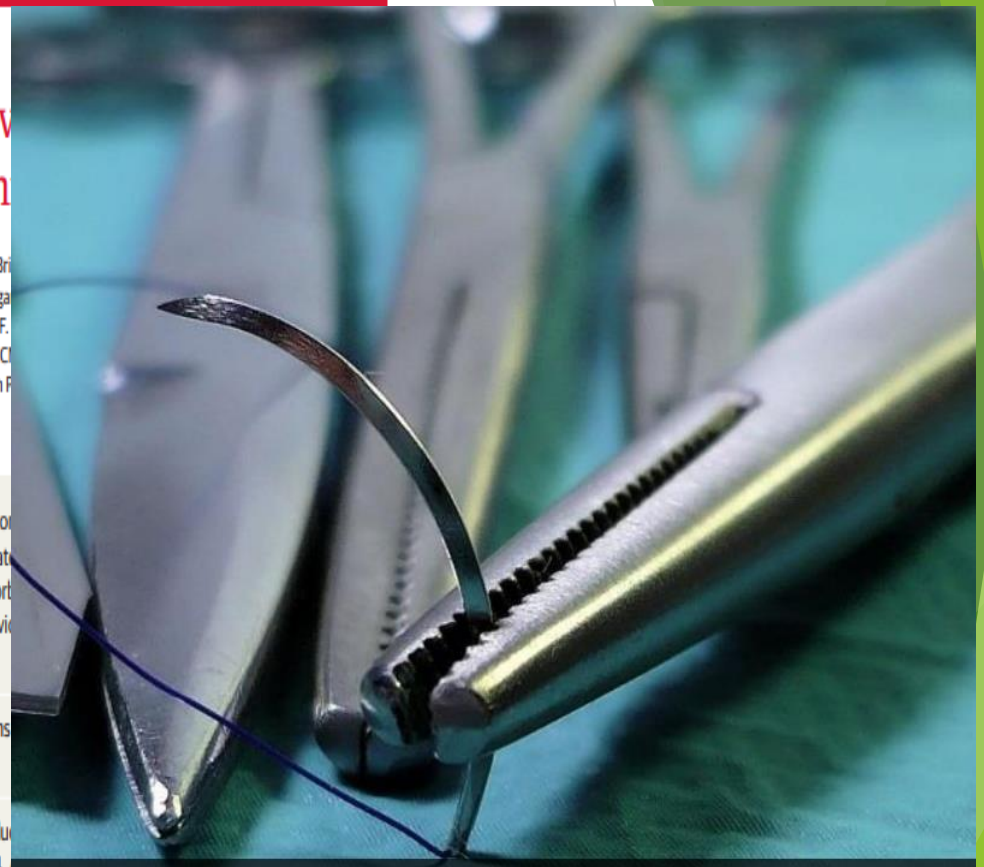
George Allen, PhD, CIC, CNOR; Jan A. J. W. Kluytmans, MD; Rodney Donlan, PhD; William P
for the Healthcare Infection Control Practices Advisory Committee

IMPORTANCE The human and financial costs of treating surgical site infectio
increasing. The number of surgical procedures performed in the United Stat
rise, and surgical patients are initially seen with increasingly complex comor
estimated that approximately half of SSIs are deemed preventable using evi
strategies.

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

EVIDENCE REVIEW A targeted systematic review of the literature was condu
EMBASE, CINAHL, and the Cochrane Library from 1998 through April 2014.
Grading of Recommendations, Assessment, Development, and Evaluation (
was used to assess the quality of evidence and the strength of the resulting
and to provide explicit links between them. Of 5759 titles and abstracts scre
underwent full-text review by 2 independent reviewers. After exclusions, 17
extracted into evidence tables, appraised, and synthesized.



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

January 2017

P- 01715 (Rev. 8/2017)

http://www.who.int/gpsc/ssi-prevention-guidelines/en/
https://www.dhs.wisconsin.gov/publications/p01715.pdf

Wisconsin Division of Public Health Supplemental Guidance for the Prevention of Surgical Site Infections

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.[30-32]
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

Antiseptic and Non-Parenteral Antimicrobial Prophylaxis Citations

30. Al-Niaimi A, Rice LW, Shitanshu U, et al. Safety and tolerability of chlorhexidine gluconate (2%) as a vaginal preparation in patients undergoing gynecologic surgery. Am J Infect Control 2016 May 24. pii: S0196-6553(16)30007-4. doi: 10.1016/j.ajic.2016.02.036 (Epub ahead of print).

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32. American College of Obstetricians and Gynecologists, Women's Health Care Physicians Committee Opinion No. 571: Solutions for surgical preparation of the vagina. Obstet Gynecology 2013;122:718-720.

33. Edmiston CE, Krepel C, Spencer M, 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;150:1027-1033.

34. Edmiston CE, Krepel CJ, Spencer M, et al. Preadmission application of 2% chlorhexidine gluconate (CHG): Enhancing patient compliance while maximizing skin surface concentrations. Infect Control Hosp Epidemiol 2016;37:254-259.

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

Wisconsin Division of Public Health Supplemental Guidance for the Prevention of Surgical Site Infections

Comparative Analysis of WHO, Proposed CDC, ACS and Wisconsin Supplemental 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 – 0.05% 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 ≤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

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

Preventing surgical site infections

AMERICAN HOSPITALS ASSOCIATION

http://www.hret-hiin.org/
https://www.dhs.wisconsin.gov/publications/p01715.pdf

Wisconsin Division of Public Health Supplemental Guidance for the Prevention of Surgical Site Infections

American Hospitals Association
Preventing Surgical Site Infections – 2018 Update

AIM

Primary Driver:

ANTIMICROBIAL PROPHYLAXIS.

Ideally, an antimicrobial agent for surgical prophylaxis should: prevent SSI; prevent SSI-related morbidity and mortality; reduce the cost of health care (given the subsequent costs associated

Suggested Process Measures for Your Test of Change

- Percentage of patients who received the appropriate antimicrobial dose timely prior to incision.
- Percentage of patients who received the appropriate weight-based antimicrobial pre-operative dose.
- Percentage of patients who received an additional antimicrobial agent when appropriate because of an extended duration of a surgical procedure.

Hardwire the Process

Ongoing monitoring of compliance to prophylaxis guidelines is vital to sustain recommended practices. Develop standardized order sets for each surgical procedure that include the name of the designated antibiotic, the appropriate dose, the timing of its administration and the recommendations for its discontinuation. Establish a protocol whereby the anesthesiologist is prompted to re-dose the patient (e.g., using a timer or clock). Audit compliance monthly and provide feedback to providers regarding the audit results. Report results regularly in quality or infection prevention committees. If compliance to antibiotic guidelines decreases, engage practitioners and nurses to examine contributing factors and potential changes. See Appendix II for an audit tool: Surgical Procedures Observation Checklist for Assessment of Infection Prevention Efforts.

http://www.hret-hiin.org/Resources/ssi/18/surgical-site-infections-change-package.pdf

Surgical care bundle

- 1. Weight based antimicrobial prophylaxis(IA)
- 2. Normotherapy (1A)
- 3. Antimicrobial (triclosan-coated) sutures(1A)
- 4. Non-absorbable oral antibiotics and mechanical bowel prep(1A)
- 5. Glycemic control(1A)
- 6. Chlorhexidine gluconate (2-4%) preadmission shower/wipes (High)
- 7. Supplemental oxygen (1A)
- 8. 70% alcohol/2% chlorhexidine preoperative skin prep (1A)
- 9. Glove change prior to fascial and subcuticular closure (High)
- 10. Separate wound closure tray (High)
- 11. smoking cessation (High)
- 12. Wound edge protector (High)
- 13. Staphylococcal colonsiation (1A)

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Antimicrobial sutures - Meta-Analysis of Prevention of Surgical Site Infections following Incision Closure with Triclosan-Coated Sutures: Robustness to New Evidence

- 15 RCTs with 4,800 patients
- Estimated a relative risk of 0.67 (95% CI: 0.54-0.84, p = 0.00053)
  - Demonstrating a highly statistically significant, lower risk of SSI following operative procedures in incisions which were closed with triclosan-coated sutures compared to non-antimicrobial closure technology

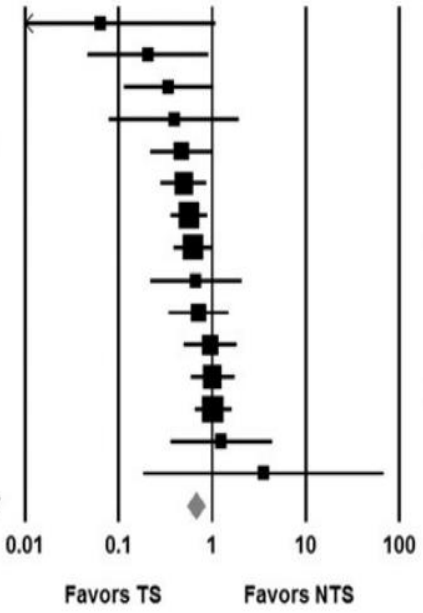
Surgical Infections, Vol. 15, No. 3 | Reviews

Meta-Analysis of Prevention of Surgical Site Infections following Incision Closure with Triclosan-Coated Sutures: Robustness to New

Random-Effects Pooled RR of SSIs - 15 RCTs

Study name	Risk ratio	Lower limit	Upper limit	p-Value	Infections / Total TS	Infections / Total NTS	Relative weight
Zhuang	0.064	0.004	1.067	0.056	0 / 150	15 / 300	0.63
Rozelle	0.207	0.047	0.915	0.038	2 / 46	8 / 38	2.13
Rasic	0.341	0.114	1.017	0.054	4 / 91	12 / 93	3.71
Zhang	0.392	0.080	1.928	0.249	2 / 51	5 / 50	1.88
Nakamura	0.469	0.217	1.012	0.054	9 / 206	19 / 204	6.67
Galal	0.493	0.283	0.858	0.012	17 / 230	33 / 220	10.63
Justinger	0.565	0.362	0.880	0.012	31 / 485	42 / 371	13.85
Thimour-Bergström	0.625	0.388	1.006	0.053	23 / 184	38 / 190	12.81
Isik	0.667	0.218	2.036	0.477	4 / 170	12 / 340	3.58
Williams	0.714	0.339	1.506	0.377	10 / 75	14 / 75	7.00
Seim	0.959	0.502	1.831	0.899	16 / 160	17 / 163	8.63
Baracs	1.004	0.588	1.716	0.988	23 / 188	24 / 197	11.12
Turtiainen	1.018	0.654	1.586	0.935	31 / 139	30 / 137	13.88
Mingmalairak	1.250	0.356	4.385	0.727	5 / 50	4 / 50	2.91
Ford	3.535	0.186	67.116	0.400	3 / 98	0 / 49	0.57
	0.671	0.536	0.841	0.001	180 / 2323	273 / 2477	

Risk ratio and 95% CI



RR: Risk Ratio, SSI: Surgical Site Infection, TS: Triclosan Suture, NTS: Non-Triclosan Suture, RCT: Randomized Controlled Trial

January 2017 British Journal of Surgery 104(2)

Meta-analysis of the potential economic impact following introduction of absorbable antimicrobial sutures

- An independent systematic review and meta-analysis of published evidence
- January 2005 to September 2016
- Comparing TCS with NCS
- Thirty-four studies were included in the final assessment
  - 20 of 34 studies were randomized, and 17 of 34 reported blinding of physicians and assessors
  - The odds ratio for SSI in the TCS compared with NCS control groups was statistically significant (odds ratio 0·61, 95 per cent c.i. 0·52 to 0·73; *P* < 0·001)
  - Triclosan sutures were linked with an average cost savings per surgical procedure of £91.25 across all wound classes
- "Antimicrobial sutures ought to be included into **SSI care bundles** and provide a further significant saving to National Health Service (England) surgical practice"

British Journal of Surgery 17 January 2017 https://doi.org/10.1002/bjs.10443

SSI Care bundles
Measuring compliance with care bundles

- "Unfortunately, **embracing the concept of a care bundle** without a mechanism in place to **measure compliance** negates the benefit of even the most robust interventions"

THE AUSTRALIAN HOSPITAL HEALTHCARE BULLETIN

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RISKCLEAR Risk & Quality Software for Hospitals. RiskClear captures the information you need to implement your risk management and quality improvement programs.

Reducing the risk of surgical site infections

By Dr Charles E Edmiston, Jr*
Tuesday, 11 September, 2018

Surgical site infections (SSIs) are now the most frequently reported health care–associated infection (HAI) in the United States. In Australia, infection of the surgical site occurs in approximately 3% of surgical procedures.[1,2]

Reported rates of surgical site infections vary according to the surgical procedure; 1–2% for clean surgical procedures (Class 1) and >20% for selective colorectal procedures (Class 3).[3]

Dr Charles E Edmiston, Jr., PhD, CIC, FIDSA, FSHEA, FAPIC is Emeritus Professor of Surgery, Department of Surgery, Medical College of Wisconsin, Milwaukee, Wisconsin USA. https://www.hospitalhealth.com.au/

Surgical site infection: poor compliance with guidelines and care bundles

Royal College of Surgeons
ADVANCING SURGICAL CARE

COLORECTAL SURGERY

Ann R Coll Surg Engl 2016; **98:** 270–274
doi 10.1308/rcsann.2016.0072

UK - A prospective cohort design - two teaching hospitals in England

- Baseline group consisted of 127 consecutive patients having colorectal surgery during a 6-month period while the intervention group comprised 166 patients in the subsequent 6 months.
- SSI and care bundle compliance data were collected using dedicated surveillance staff

RESULTS

- 24% of the patients in the baseline group developed a SSI compared with 28% in the care bundle group ($p>0.05$).
- However, compliance rates with individual interventions, both before and after the implementation of the bundle, were similar.
- In only **19% of cases was there compliance with the total care bundle**

Accepted 28 September 2015

Leaper DJ, Tanner J, Kiernan M, Assadian O, Edmiston CE Jr. Surgical site infection: poor compliance with guidelines and care bundles. Int Wound J 2015; 12:357-362. Ann R Coll Surg Engl 2016; 98: 270-274

international wound journal

International Wound Journal ISSN 1742-4801

ORIGINAL ARTICLE

Surgical site infection: poor compliance with guidelines and care bundles

David J Leaper[1], Judith Tanner[2], Martin Kiernan[3], Ojan Assadian[4] & Charles E Edmiston Jr[5]

Every patient should receive the best, evidence-based interventions, on every occasion at the right time, and hospital trusts should demonstrate that this has been done.

Knowledge, awareness, and attitude towards infection prevention and management among surgeons: identifying the surgeon champion

- The model was based on the concept of the “surgeon champion”
- The “champion” was a surgeon who on a day-to-day basis worked within the surgical unit, promoting and maintaining a culture in which both infection prevention and management were given high priority
- We think that the concept of the “surgeon champion” is a crucial way to improve infection prevention and antibiotic prescribing practices across the surgical practice pathway

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World Journal of Emergency Surgery

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Abstract
Background
The surgeon as a champion in preventing and treating infections
Conclusions
Declarations
References

Commentary | Open Access

Knowledge, awareness, and attitude towards infection prevention and management among surgeons: identifying the surgeon champion

Massimo Sartelli, Yoram Kluger, Luca Ansaloni, Federico Coccolini, Gian Luca Baiocchi, Timothy C. Hardcastle, Ernest E. Moore, Addison K. May, Kamal M. F. Itani, Donald E. Fry, Marja A. Boermeester, Xavier Guirao, Lena Napolitano, Robert G. Sawyer, Kemal Rasa, Fikri M. Abu-Zidan, Abdulrashid K. Adesunkanmi, Boyko Atanasov, Goran Augustin, Miklosh Bala, Miguel A. Cainzos, Alain Chichom-Mefire, Francesco Cortese, Dimitris Damaskos, Samir Delibegovic, Zaza Demetrashvili, Belinda De Simone, Therese M. Duane, Wagih Ghnnam, George Gkiokas, Carlos A. Gomes, Andreas Hecker, Aleksandar Karamarkovic, Jakub Kenig, Vladimir Khokha, Victor Kong, Arda Isik, Ari Leppäniemi, Andrey Litvin, Eftychios Lostoridis, Gustavo M. Machain, Sanjay Marwah, Michael McFarlane, Cristian Mesina, Ionut Negoi, Iyiade Olaoye, Tadeja Pintar, Guntars Pupelis, Miran Rems, Ines Rubio-Perez, Boris Sakakushev, Helmut Segovia-Lohse, Boonying Siribumrungwong, Peep Talving, Jan Ulrych, András G. Vereczkei, Francesco M. Labricciosa and Fausto Catena

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https://wjes.biomedcentral.com/articles/10.1186/s13017-018-0198-x

The Surgical Patient & Best Practice

- **Collaborative programs**
- **Use of enhanced recover pathways (ERP)**
  - Preoperative, intraoperative, and postoperative practices that decrease complications and accelerate recovery
    - Reduce surgical complications
    - Decreased length of stay
    - Decreased costs
    - Improved patient experience

ELSEVIER

Journal of the American College of Surgeons

Volume 221, Issue 3, September 2015, Pages 669-677

Original scientific article

Organizational Culture Changes Result in Improvement in Patient-Centered Outcomes: Implementation of an Integrated Recovery Pathway for Surgical Patients

Elizabeth C. Wick MD [a], Daniel J. Galante DO [a], Deborah B. Hobson BSN [d], Andrew R. Benson CRNA [b], K.H. Ken Lee DrPH, MHS [c], Sean M. Berenholtz MD, MHS [b, c], Jonathan E. Efron MD, FACS [a], Peter J. Pronovost MD, PhD [b, c], Christopher L. Wu MD [b]

Wick EC et al. Organizational culture changes result in improvement in patient-centered outcomes: Implementation of an integrated recovery pathway for surgical patients. Journal of the American College of Surgeons September 2015 221(3):669-77

The Surgical Patient & Best Practice

- **CUSP-Comprehensive unit-based safety program**
  - Focuses on improving important determinants of safety culture
    - Teamwork
    - Management involvement and
    - Reporting and learning from errors
    - Engaging staff at all levels in a continuous quality improvement process
- **Not working in silos**

Wick EC et al. Organizational culture changes result in improvement in patient-centered outcomes: Implementation of an integrated recovery pathway for surgical patients. Journal of the American College of Surgeons September 2015 221(3):669-77

Agency for Healthcare Research and Quality (AHRQ) Safety Program Improving Surgical Care and Recovery

- **Safety Program for Improving Surgical Care and Recovery (ISCR)**
  - Funded and guided by AHRQ
- **Collaboration**
  - The American College of Surgeons (ACS)/The Johns Hopkins Armstrong Institute for Patient Safety and Quality
    - $4 million contract with the option of $12 million over three years, for a total of about $16 million
- **Program**
  - Support hospitals in implementing perioperative evidence-based pathways
  - Enrol at least 750 hospitals throughout the five-year contract
- **Five service lines:**
  - Colorectal
  - Orthopaedic
  - Gynaecology
  - Emergency General Surgery
  - Bariatric

Agency for Healthcare Research and Quality (AHRQ) Safety Program, Improving Surgical Care and Recovery(ISCR)

- **Based on Comprehensive Unit-based Safety Program (CUSP)**
  - Hospitals that participate in the Enhanced Recovery After Surgery (ERAS) program will have access to the following:
    - Leading experts in ERAS, perioperative quality, and implementation science from the fields of surgery, anaesthesiology, and nursing
    - Evidence-based, locally adaptable ERAS protocols
    - Tools, including coaching calls, to assist with ERAS protocols implementation
    - Ad hoc implementation support from a quality improvement nurse consultant
    - America College of Surgeons(ACS)-based ERAS data collection platform and access to an ACS/ ERAS clinical support team
    - Face-to-face training and site visits

CUSP Toolkit

Take advantage of revised and updated tools, now in an editable, savable PDF format

- CUSP Phaseline
- CUSP Roles and Responsibilities
- Board Checklist
- Case Summary
- Conducting a Morning Briefing
- Culture Assessment: A Guide for CUSP Coordinators
- Culture Check-up Process
- Daily Goals Checklist
- Executive/Senior Leader Checklist
- Learning from Defects
- Observing Patient Care Rounds
- Physician Contact Information
- Pre-Kickoff Meeting Checklist
- Premortem Tool
- Safety Issues Worksheet for Senior Executive Partnership
- Science of Safety Training Attendance Sheet
- Shadowing Another Professional
- Staff Safety Assessment
- Staff Safety Assessment Results
- Status of Safety Issues
- Who's on Your CUSP Team?

CUSP Guides

- Start Stop Continue
- Communication Plan
- CUSP Team Norms
- CUSP Adaptive Work
- Monthly Meeting Agenda Template
- Spreading the Science of Safety

https://www.hopkinsmedicine.org/armstrong_institute/training_services/workshops/cusp_implementation_training/index.html

Technical evidence reviews

Review

Geriatric Orthopaedic Surgery & Rehabilitation
Volume 9: 1-18

DOI: 10.1177/2151458518754451
journals.sagepub.com/home/gos
SAGE

Surgical Technical Evidence Review for Elective Total Joint Replacement Conducted for the AHRQ Safety Program for Improving Surgical Care and Recovery

Christopher P. Childers, MD[1], Anaar E. Siletz, MD, PhD[1], Emily S. Singer, MD[2], Claire Faltermeier, PhD[2], Q. Lina Hu, MD[1,3], Clifford Y. Ko, MD, MS, MSHS[1,3], Gregory J. Golladay, MD[4], Stephen L. Kates, MD[4], Elizabeth C. Wick, MD[5], and Melinda Maggard-Gibbons, MD, MSH[1]

Abstract

Background: Use of enhanced recovery pathways pathways remains low. The Agency for Healthcare R the Johns Hopkins Medicine Armstrong Institute fo Surgical Care and Recovery—a national effort to ca recovery of surgical patients. This review synthesi arthroplasty (TKA) and total hip arthroplasty (TH protocol relevant to surgeons; anesthesia compone existing pathways and from consultation with techn reviews, randomized trials, and observational studi THA. This primary evidence review was combin components were reviewed. Of the 10 preoperativ diabetes mellitus, tobacco use, obesity, nutrition, thromboembolism (VTE) prophylaxis, and bathing/ drains was the only intraoperative component ev tinuous passive motion, extended duration VTE pr review synthesizes the evidence supporting potent Program for Improving Surgical Care and Recove implement in the surgical care of TKA and THA pa

Keywords
enhanced recovery, total knee replacement, total k

Submitted November 9, 2017. Revised November 30, 2017. Ac

Evidence Review Conducted for the Agency for Healthcare Research and Quality Safety Program for Improving Surgical Care and Recovery: Focus on Anesthesiology for Colorectal Surgery

Kristen A. Ban, MD,*† Melinda M. Gibbons, MD, MSHS,‡ Clifford Y. Ko, MD, MS, MSHS,*‡ Elizabeth C. Wick, MD,§ Maxime Cannesson, MD, PhD,‖ Michael J. Scott, MB, ChB, FRCP, FRCA, FFICM,¶ Michael C. Grant, MD,# and Christopher L. Wu, MD§**

The Agency for Healthcare Research and Quality, in partnership with the American College of Surgeons and the Johns Hopkins Medicine Armstrong Institute for Patient Safety and Quality, has developed the Safety Program for Improving Surgical Care and Recovery (ISCR), which is a national effort to disseminate best practices in perioperative care to more than 750 hospitals across multiple procedures in the next 5 years. The program will integrate evidence-based processes central to enhanced recovery and prevention of surgical site infection, venous thromboembolic events, catheter-associated urinary tract infections with socioadaptive interventions to improve surgical outcomes, patient experience, and perioperative safety culture. The objectives of this review are to evaluate the evidence supporting anesthesiology components of colorectal (CR) pathways and to develop an evidence-based CR protocol for implementation. Anesthesiology protocol components were identified through review of existing CR enhanced recovery pathways from several professional associations/societies and expert feedback. These guidelines/recommendations were supplemented by evidence made further literature searches. Anesthesiology protocol components were identified spanning the immediate preoperative, intraoperative, and postoperative phases of care. Components included carbohydrate loading, reduced fasting, multimodal preanesthesia medication, antibiotic prophylaxis, blood transfusion, intraoperative fluid management/goal-directed fluid therapy, normothermia, a standardized intraoperative anesthesia pathway, and standard postoperative multimodal analgesic regimens. (Anesth Analg XXX;XXX:00–00)

Childers et al. Geriatric Orthopaedic Surgery & Rehabilitation Volume 9:1-18
www.anesthesia-analgesia.org[11 Apr 2018]
Ban et al.J Am Coll Surg_In Press

COLLECTIVE REVIEW

Surgical Technical Evidence Review for Colorectal Surgery Conducted for the AHRQ Safety Program for Improving Surgical Care and Recovery

Kristen A Ban, MD, Melinda M Gibbons, MD, MSHS, FACS, Clifford Y Ko, MD, MS, MSHS, FACS, Elizabeth C Wick, MD, FACS

Enhanced recovery has sparked excitement in the surgical community primarily because it works, but also because it is an innovative approach to delivering standardized, evidence-based care. Adoption of enhanced recovery pathways (ERPs) has been associated with reducing surgical complications, improving patient experience, and decreasing length of stay (LOS) and associated hospital costs without increasing readmission rates.[1-3] To successfully implement ERPs and achieve improvements, the entire perioperative team must function as a coordinated and collaborative group, breaking down silos among preoperative, operating room, recovery room, and inpatient units, and creating a transdisciplinary collaboration across perioperative disciplines (eg surgery, anesthesiology, hospitals across multiple procedure areas during the next 5 years. The program will integrate evidence-based processes central to enhanced recovery, as well as surgical site infection (SSI), venous thromboembolic events (VTEs), and catheter-associated urinary tract infections (CAUTIs), with socioadaptive interventions to meaningfully improve surgical outcomes, patient experience, and perioperative safety culture. Evidence-based clinical pathways will serve as the foundation for these efforts. To assist hospitals with transforming their perioperative care, the ISCR program will also include a registry for hospitals to track their progress in adhering to the clinical pathway and for benchmarking, patient engagement and education materials, change management and leadership

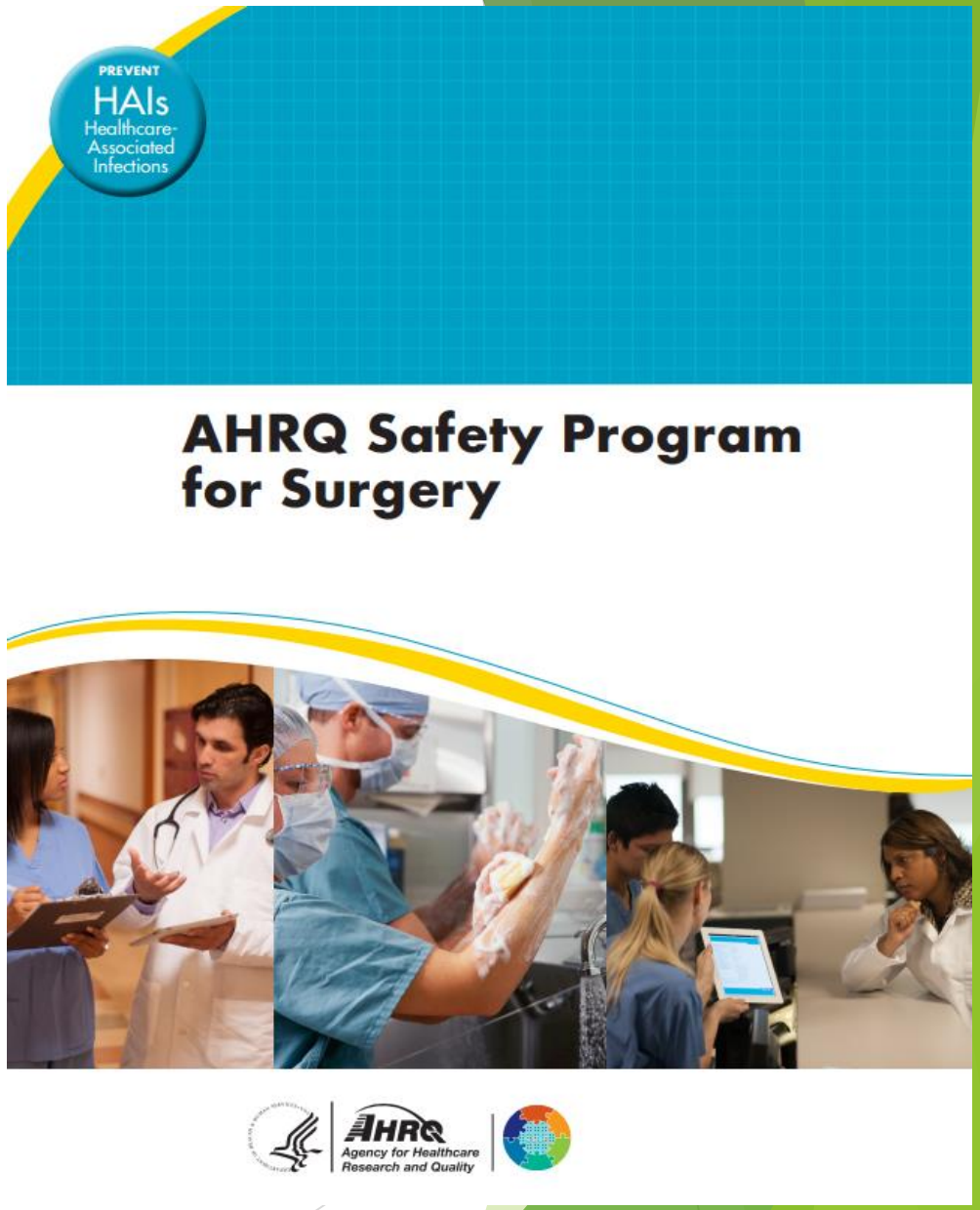
Enhanced Recover Pathways (ERP)

PREOPERATIVE			
Patient Education	Recommended approach: • Review existing patient education materials for colorectal surgery patients • Adapt the provided patient education booklet template as needed to your hospital and use it to counsel and educate patients on enhanced recovery • Identify staff (surgeons, nurses and/or office staff) who will ensure patients receive and understand education	Sample Patient Education Booklet (available mid-August)	**Preadmission Counseling**
IMMEDIATE PREOPERATIVE			
Bowel Preparation	Recommended approaches: 1. (Preferred) Bowel prep with neomycin 1,000 mg + metronidazole 1,000 mg three times the day before operation + polyethylene glycol 2. Bowel prep with neomycin 1,000 mg + erythromycin 1,000 mg three times the day before operation + polyethylene glycol 3. Other: _____	Patient Handout Sample Bowel Prep Protocol - Metronidazole Patient Handout Sample Bowel Prep Protocol - Erythromycin	**Preoperative Mechanical Bowel Prep** **Preoperative Oral Antibiotics**
Preoperative Bathing	Choose your approach: 1. Antiseptic agent (either washcloths with chlorhexidine gluconate or soap with chlorhexidine gluconate, such as Hibiclens) 2. Antibacterial Soap 3. Other: _____	Patient Handout Sample Skin Prep Before Surgery Protocol -Cloths Patient Handout Sample Skin Prep Before Surgery Protocol -Soap	

https://www.hawaiisafercare.com/

AHRQ Safety Program for Surgery

- **September 2011 through August 2015**
- Johns Hopkins Medicine Armstrong Institute for Patient Safety and Quality contracted to:
  - Create a scalable change package for SSI reduction
  - Disseminate and
  - Evaluate
- Comprehensive Unit-based Safety Program [CUSP] for Safe Surgery, or SUSP
  - 197 hospitals and 376 perioperative teams enrolled in the project
  - **Three core activities:**
  - Tap the wisdom of frontline staff by asking them how the next patient will develop an SSI
  - Audit local practice to identify opportunities for improvement
  - Apply emerging evidence for SSI reduction
- Focus on improving performance on colon procedures
- A subset of hospitals focused on a variety of other procedures



https://www.ahrq.gov/professionals/quality-patient-safety/hais/tools/surgery/about.html#report

Results

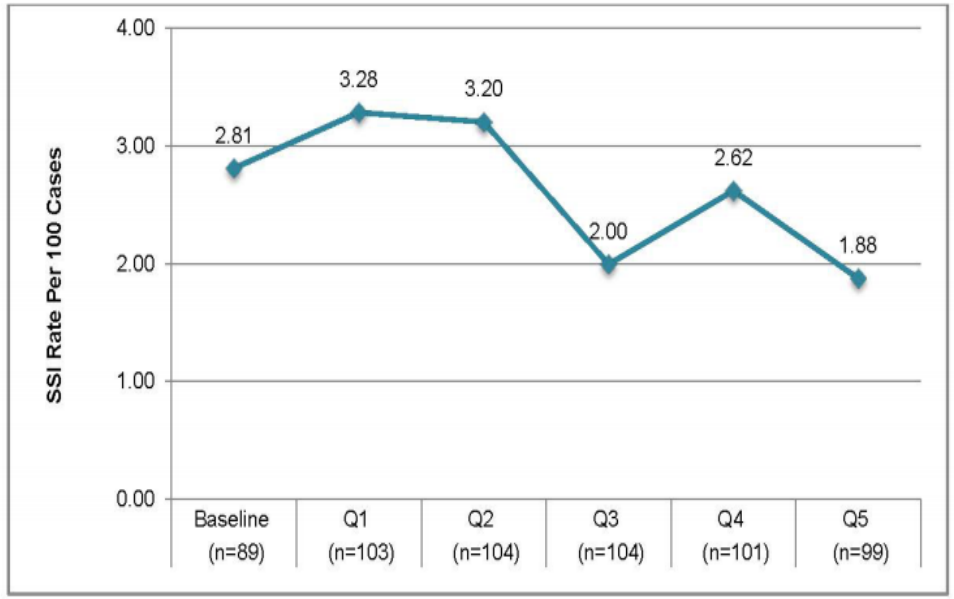
Results

The AHRQ Safety Program for Surgery was associated with a significant reduction in SSIs at participating hospitals. By comparing the fifth-quarter data with those of baseline, hospitals submitting NHSN SSI data observed a 33 percent relative reduction in SSIs for colon procedures and 34 percent reduction for non-colon procedures. Hospitals participating with ACS NSQIP data observed a 25 percent reduction in SSIs for colon procedures and 40 percent for non-colon procedures.

NHSN Colon Procedures and Non-Colon Procedures

SSI rates for the baseline and intervention period for NHSN colon and non-colon procedures can be found in Figure 9, Table 14, and Figure 10.

Figure 9. NHSN Colon Procedures: Perioperative Team-level Unadjusted SSI Rate Over Time[a]



n = number of perioperative teams
Baseline period was 12 months before program implementation.
Quarterly rate represents the average SSI rate across a 3-month project period.
[a]Paired analysis of unadjusted data from perioperative teams reporting baseline and followup data for any project quarter shows similar significant reduction in SSI rates (see Appendix).

https://www.ahrq.gov/professionals/quality-patient-safety/hais/tools/surgery/about.html#report

Results

- 33 percent relative reduction in SSIs for colon procedures and 34 percent reduction for non-colon procedures

National Project Teams:

- Meet hospitals where they are in the SSI prevention journey
- Teach improvement teams to identify local defects leading to SSIs across a variety of hospital and surgical patient populations
- **Reengage clinicians to lead efforts to improve care for surgical patients;** and
- Ensure that **all patients received evidence-based care**

Frontline staff

- **"Perioperative teams were less likely to be successful if the program "lived" with established infection control or quality improvement departments instead of frontline staff"**

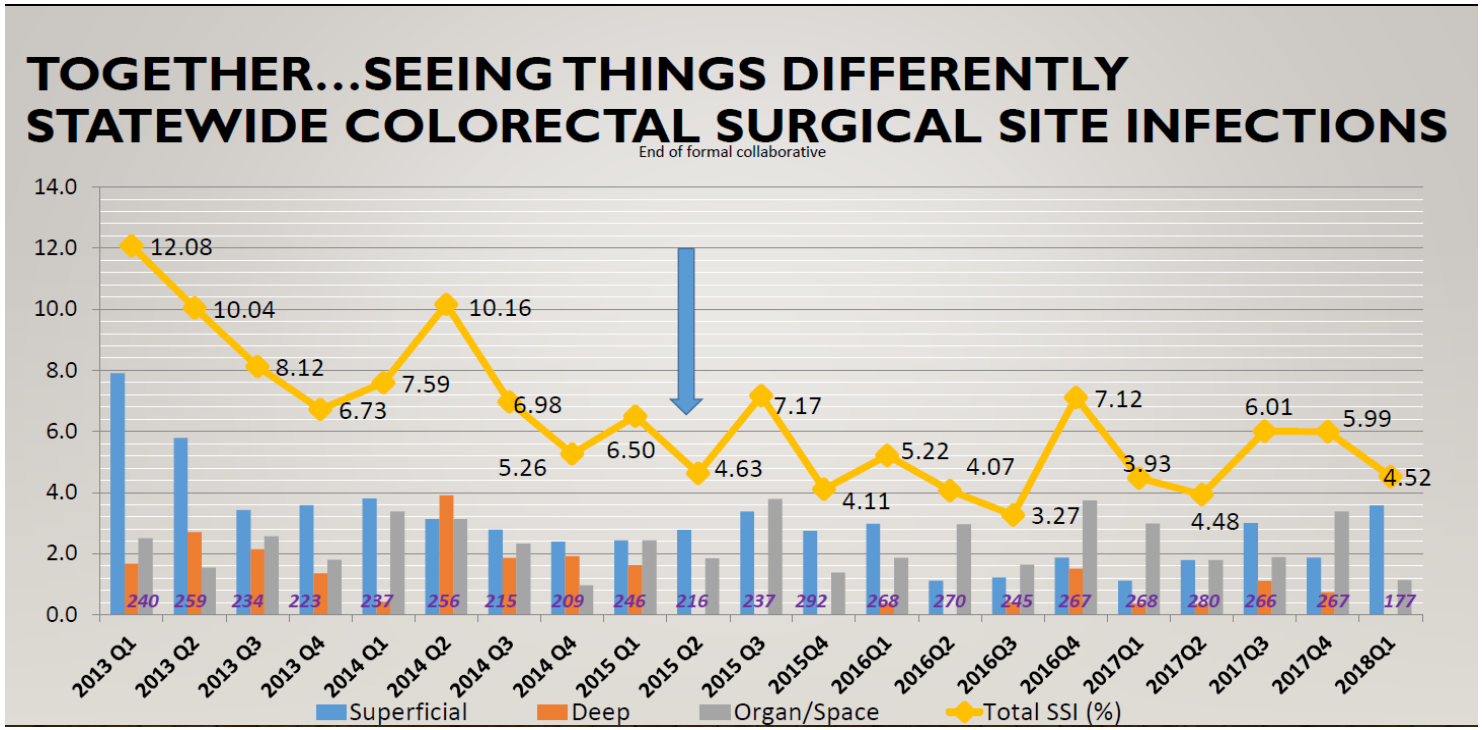
To read this article in full, please review your options for gaining access at the bottom of the page.

Statewide Collaborative to Reduce Surgical Site Infections: Results of the Hawaii Surgical Unit-Based Safety Program

Della M. Lin, MD, MS, FASA, Kathryn A. Carson, ScM, Lisa H. Lubomski, PhD, Elizabeth C. Wick, MD, FACS, Julius Cuong Pham, MD, PhD

Jan 2013 - June 2015

- 15 hospitals in Hawaii
- January 2013 (Q1) - June 2015 (Q2)
- **Colorectal SSI rate decreased from 12.08% to 4.63%; p < 0.01, 61.7%**
- Safety culture increased in 10 of 12 domains



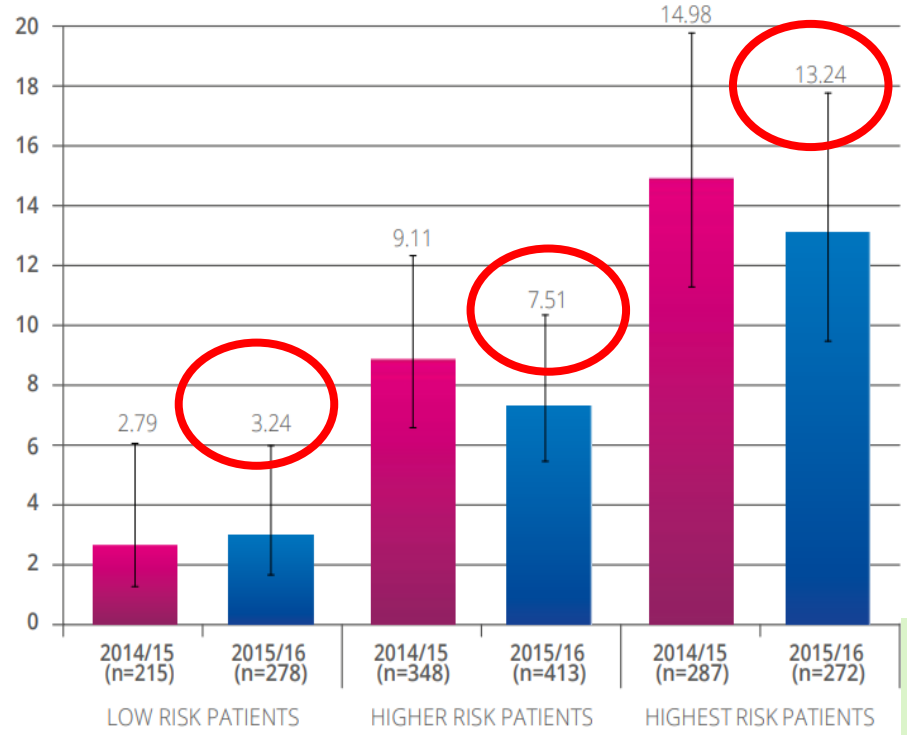
AHRQ_ Hospital Survey on Patient Safety Culture www.ahrq.gov/sops/quality-patient-safety/patientsafetyculture/hospital/index.html

VICNISS colorectal surgery surveillance

SSI - colorectal surgery

Participation in SSI surveillance for colorectal surgery is voluntary. In 2014-15 and 2015-16 there were 7 hospitals monitoring colorectal surgery respectively, all of them public hospitals.

Figure 19: Surgical site infections following colorectal surgery (total infections, rate per 100 procedures)



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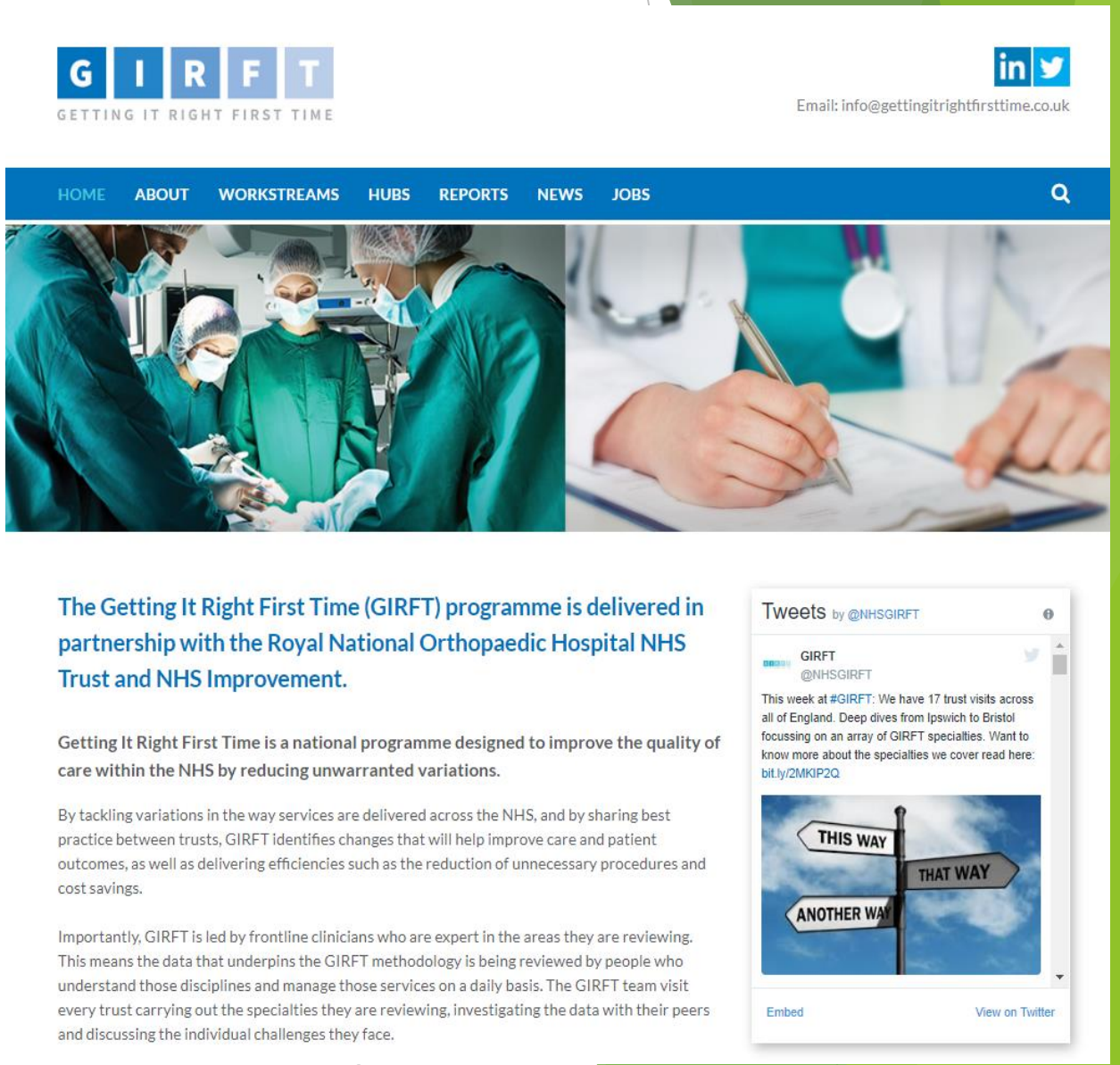
A bundle of care to reduce colorectal surgical infections: an

Low level of compliance with recommendations

Infection rate decreased from **15% [95%(CI): 10.4-20.2]** before the project to **7% (95% CI: 3.4-12.6)** 12 months after the project;

UK- Getting it right the first time!

- Getting It Right First Time (GIRFT)
- Collaboration
  - Partnership with the Royal National Orthopaedic Hospital NHS Trust and NHS Improvement
- National clinician-led programme
  - Designed to improve the quality of medical care within the NHS by reducing unwarranted variations
    - Surgical Site Infection (SSI) Audit
- The audit has been established to:
  - Identify the surgical site infection rates of specific procedures within key surgical specialties
  - Assess local practice in the prevention of surgical site infection for the specified procedures



http://gettingitrightfirsttime.co.uk/

UK- Getting it right the first time!

- Doctors local trust leads
  - In charge of data collection and submission for their specialty of interest
- Data collection assisted by local audit department and supported by local infection prevention team or the surgical site infection surveillance team (if established)
- Procedure specific data collection tools
  - Antimicrobial prophylaxis
  - Laminar flow theatre

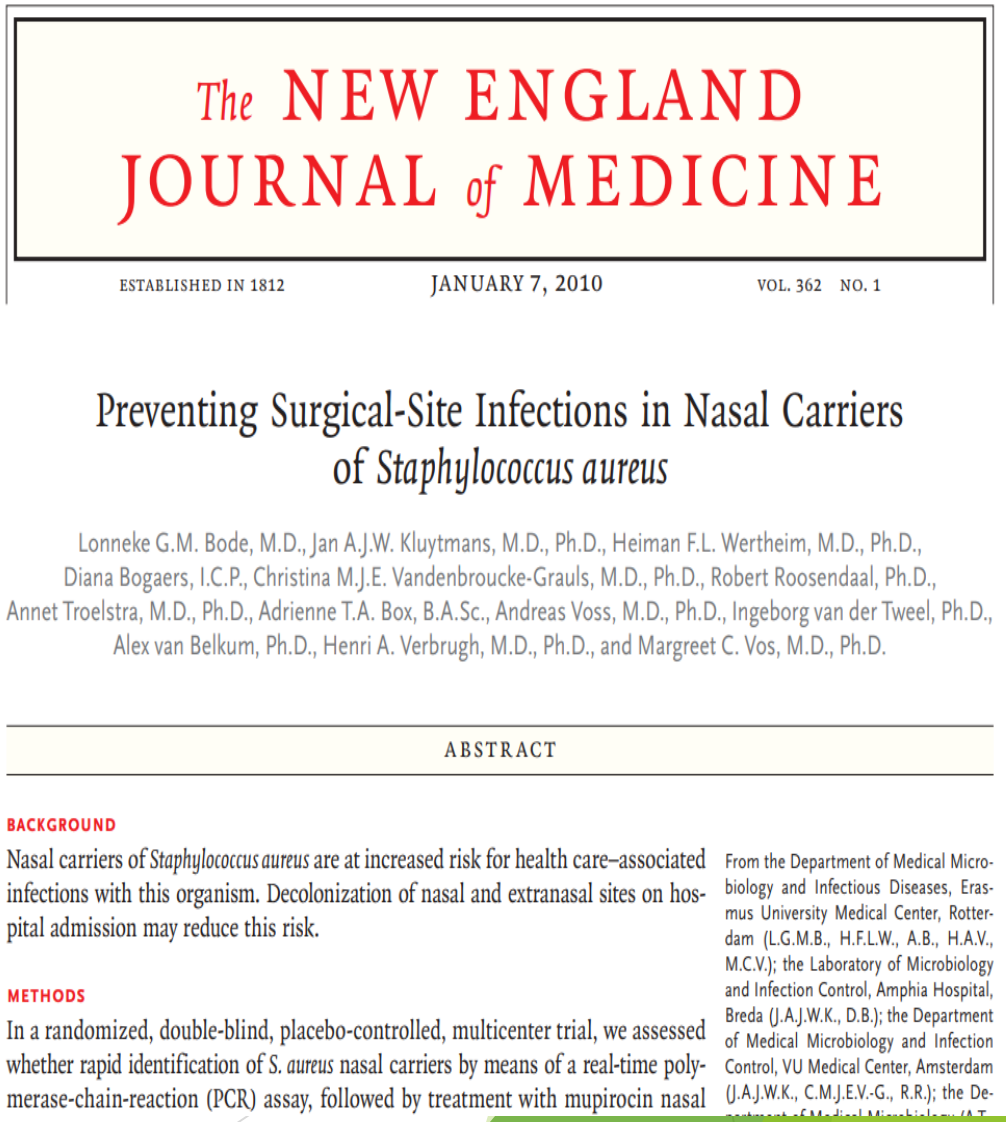
SURGICAL AUDIT	SURGICAL PROCEDURES
Breast Surgery	Cardiothoracic
Cranial Neurosurgery	General Surgery
Obstetrics and Gynaecology	Ear Nose and Throat
Oral and Maxillofacial Surgery	Orthopaedic Surgery
Ophthalmology	Paediatric Surgery
Spinal Surgery	Urology & Vascular Surgery

http://gettingitrightfirsttime.co.uk/

Preventing Staphylococcus aureus SSI

Orthopaedic or cardiothoracic surgery

- Randomized, double-blind, placebo-controlled, multicenter trial
- 5 days of nasal mupirocin ointment together with chlorhexidine showering
- The rate of S. aureus infection:
  - 3.4% (17 of 504 patients) in the mupirocin–chlorhexidine group
  - 7.7% (32 of 413 patients) in the placebo group (relative risk of infection, 0.42; 95% confidence interval [CI], 0.23 to 0.75)
  - The effect of mupirocin–chlorhexidine treatment was most pronounced for deep surgical-site infections (4 infections [0.9%] vs. 16 [4.4%]; relative risk, 0.21; 95% CI, 0.07 to 0.62)
- **An enormous potential for infection prevention**
  - **Options - Screen & treat or Treat all**



The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 7, 2010 VOL. 362 NO. 1

Preventing Surgical-Site Infections in Nasal Carriers of *Staphylococcus aureus*

Lonneke G.M. Bode, M.D., Jan A.J.W. Kluytmans, M.D., Ph.D., Heiman F.L. Wertheim, M.D., Ph.D., Diana Bogaers, I.C.P., Christina M.J.E. Vandenbroucke-Grauls, M.D., Ph.D., Robert Roosendaal, Ph.D., Annet Troelstra, M.D., Ph.D., Adrienne T.A. Box, B.A.Sc., Andreas Voss, M.D., Ph.D., Ingeborg van der Tweel, Ph.D., Alex van Belkum, Ph.D., Henri A. Verbrugh, M.D., Ph.D., and Margreet C. Vos, M.D., Ph.D.

ABSTRACT

BACKGROUND

Nasal carriers of *Staphylococcus aureus* are at increased risk for health care–associated infections with this organism. Decolonization of nasal and extranasal sites on hospital admission may reduce this risk.

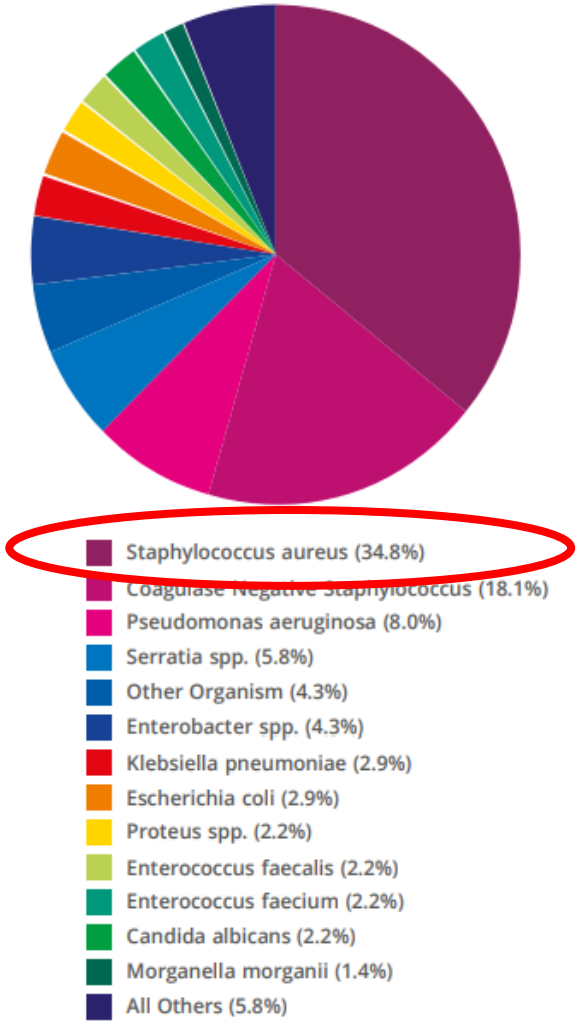
METHODS

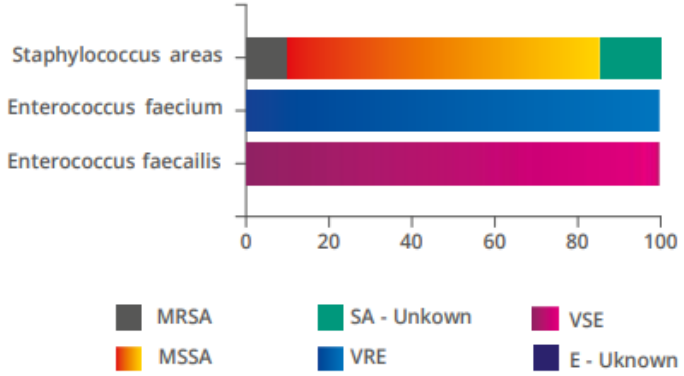
In a randomized, double-blind, placebo-controlled, multicenter trial, we assessed whether rapid identification of *S. aureus* nasal carriers by means of a real-time polymerase-chain-reaction (PCR) assay, followed by treatment with mupirocin nasal

From the Department of Medical Microbiology and Infectious Diseases, Erasmus University Medical Center, Rotterdam (L.G.M.B., H.F.L.W., A.B., H.A.V., M.C.V.); the Laboratory of Microbiology and Infection Control, Amphia Hospital, Breda (J.A.J.W.K., D.B.); the Department of Medical Microbiology and Infection Control, VU Medical Center, Amsterdam (J.A.J.W.K., C.M.J.E.V.-G., R.R.); the De-

Australia - VICNISS Causative Organisms - SSI

Figure 23: Pathogens isolated from infections following cardiac bypass surgery 2014-2016





No. of patients with infections and organisms reported	112
No. of Infections with Organisms	117
No. of Distinct Pathogens	22

Figure 23

VICNISS	2012	2014/15	2015/16
Hip Prosthesis	29%	42.9%	37.7%
Knee Prosthesis	36%	52.0%	38.5%

Infection in joint replacement – the use of laminar airflow and space suites

- **Infection in joint replacement**
  - The overall rate of infection in joint replacement is extremely low
  - Multitude of factors potentially responsible
  - Conducting randomised trials with sufficient statistical power is unrealistic

New Zealand Joint Registry between 1999 and 2008

- The use of laminar flow and space suits and the rate of early deep infection in revision arthroplasty
- 64 hospitals which supplied data to the registry

Hypothesis

- **That both laminar flow and the use of space suits would result in a lower rate of early deep infection requiring a revision procedure following total hip (THR) and knee (TKR) replacements**
- 51,485 primary THRs and 36,826 primary TKRs analysed
- Laminar-flow theatres were used in 35.5% and space suits in 23.5%

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Arthroplasty

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Does the use of laminar flow and space suits reduce early deep infection after total hip and knee replacement?

THE TEN-YEAR RESULTS OF THE NEW ZEALAND JOINT REGISTRY

G. J. Hooper, A. G. Rothwell, C. Frampton, M. C. Wyatt

Published Online: 1 Jan 2011 | https://doi.org/10.1302/0301-620X.93B1.24862

We have investigated whether the use of laminar-flow theatres and space suits reduced the rate of revision for early deep infection after total hip (THR) and knee (TKR) replacement by reviewing the results of the New Zealand Joint Registry at ten years.

Of the 51 485 primary THRs and 36 826 primary TKRs analysed, laminar-flow theatres were used in 35.5% and space suits in 23.5%. For THR there was a significant increase in early infection in those procedures performed with the use of a space suit compared with those without ($p < 0.0001$), in those carried out in a laminar-flow theatre compared with a conventional theatre ($p < 0.003$) and in those undertaken in a laminar-flow theatre with a space suit ($p < 0.001$) when compared with conventional theatres without such a suit. The results were similar for TKR with the use of a space suit ($p < 0.001$), in laminar-flow theatres ($p < 0.019$) and when space suits were used in those theatres ($p < 0.001$). These findings were independent of age, disease and operating time and were unchanged when the surgeons and hospital were analysed individually.

Hooper GJ et al. Does the use of laminar flow and space suits reduce early deep infection after total hip and knee replacement?: the ten-year results of the New Zealand Joint Registry. J Bone Joint Surg Br 2011; 93(1): 85-90.

Laminar air flow and space suite

- Results
- **THR**
  - Significant increase in early infection in those procedures performed:
    - with the use of a space suit compared with those without ($p < 0.0001$)
    - in those carried out in a laminar-flow theatre compared with a conventional theatre ($p < 0.003$) and
    - in those undertaken in a laminar-flow theatre with a space suit ($p < 0.001$) when compared with conventional theatres without such a suit
- **TKR**
  - The results were similar for TKR with:
    - the use of a space suit ($p < 0.001$),
    - in laminar-flow theatres ($p < 0.019$) and
    - when space suits were used in those theatres ($p < 0.001$)

Total hip replacements

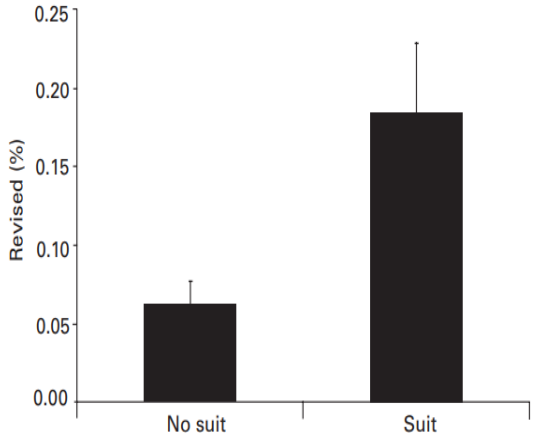


Fig. 1a

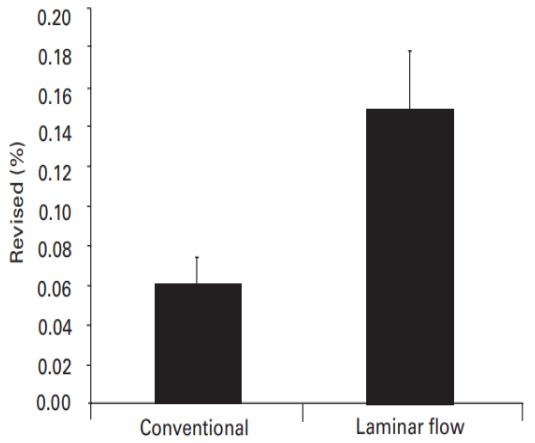


Fig. 1b

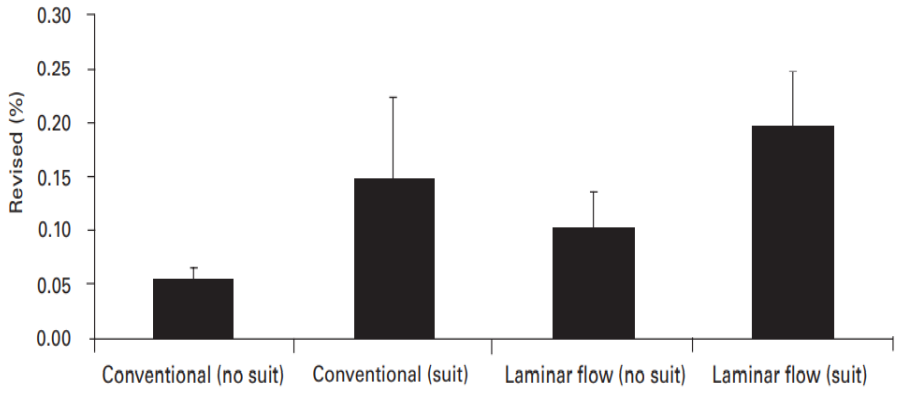


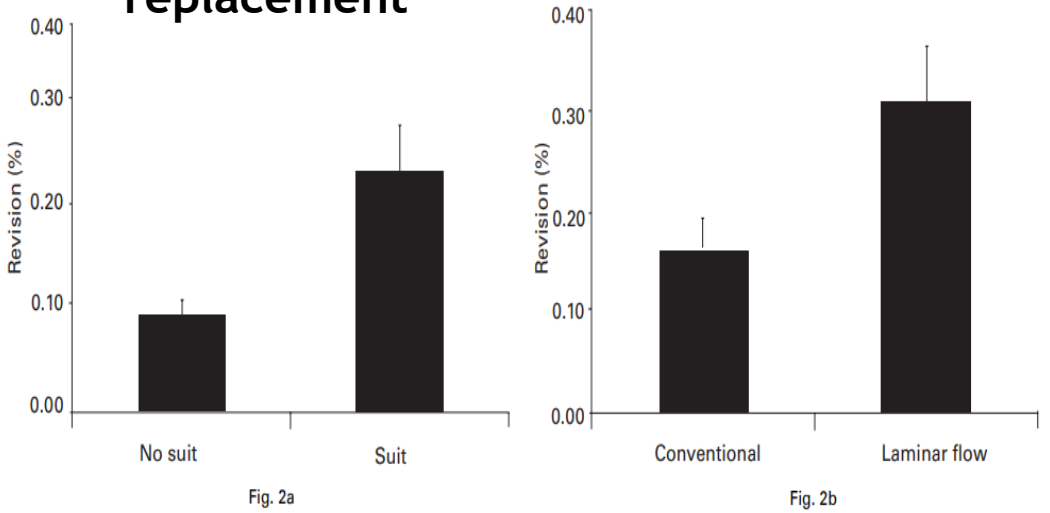
Fig. 1c

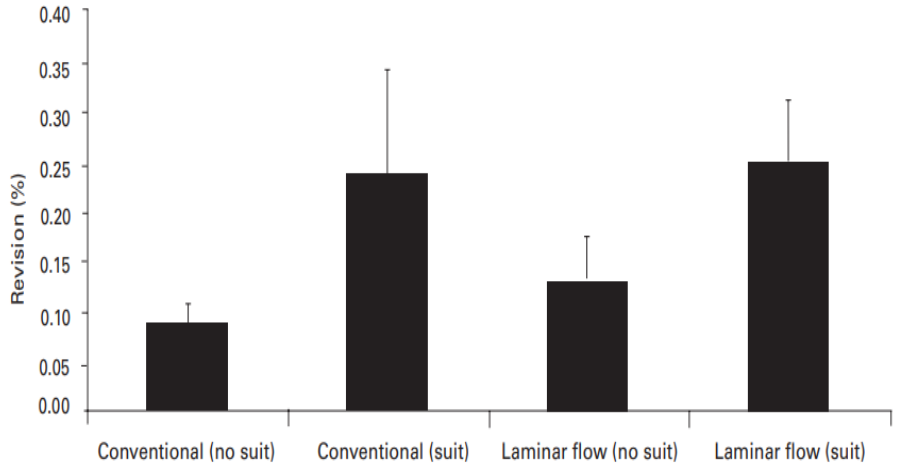
Hooper GJ et al. Does the use of laminar flow and space suits reduce early deep infection after total hip and knee replacement?: the ten-year results of the New Zealand Joint Registry. J Bone Joint Surg Br 2011; 93(1): 85-90.

Laminar air flow and space suite

- **Space suites**
  - **Surgeons**
    - At times their spatial awareness was limited by the hood
    - It was easier to contaminate themselves while wearing a space suit since there was an apparent false sense of security within it
  - Observers have noted that surgeons often adjust the suit or hood during the procedure
  - The exhaust systems of the space suits - the flow of the expelled air from exhaust systems
    - ? air is concentrated with debris and significant numbers of colony-forming units close to the surgical site
- **Conclusion**
  - **There is no benefit in the use of laminar flow or space suits in reducing the rate of revision for early deep joint infection in total joint replacement**

Total knee replacement





Hooper GJ et al. Does the use of laminar flow and space suits reduce early deep infection after total hip and knee replacement?: the ten-year results of the New Zealand Joint Registry. J Bone Joint Surg Br 2011; 93(1): 85-90.

Space suits

- **1970s - Body exhaust suits**
  - Use exhaust aspiration to maintain **negative pressure** inside the suit
  - 60 litres of air per minute per gown in order to maintain negative pressure
  - Exhaust tubing was cumbersome in practice
- **1990s - Surgical helmet systems/Personal protection systems**
  - More portable
  - Intake fan on the helmet draws air in using the hood material as a filter
  - Air is then blown across the surgeon's face and neck, creating a '**positive pressure**' environment inside the gown
  - Exhausts air into the operating room

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Clin Orthop Relat Res. 2011 Nov; 469(11): 3065–3069.
Published online 2011 Jun 14. doi: 10.1007/s11999-011-1883-1
PMCID: PMC3183196
PMID: 21671110

Sterility of the Personal Protection System in Total Joint Arthroplasty

Kenneth A. Kearns, MD, Dan Witmer, BS, Junaid Makda, MD, Javad Parvizi, MD, FRCS, and Donald Jungkind, PhD

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At time zero (immediately after the hood was placed over the helmet), 22 of 102 cultures isolated an organism, accounting for a contamination rate of 22%

The bacterial contamination rate of the PPS at the conclusion of the procedure was 47% (48 of 102)

The relative percentage of the various organisms found was coagulase-negative staphylococci 50%, Micrococcus sp. 20%, methicillin-susceptible S. aureus 11%, and methicillin-resistant S. aureus (MRSA) 1%

Kearns KR et al. Clin Orthop Relat Res (2011) 469:3065-3069

Space suits

- **Compared four different commercially available hood systems**
  - All are battery operated portable hood systems
  - 3 - utilised a single built in axial inflow fan and no mechanical means of air exhaust
  - 1 - dual built in fan system with an axial fan for air inflow and a separate axial fan for air outflow
- The flow of air exhaust for each system were compared using a fog machine and serial still photographs

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Journal of Hospital Infection

Available online 17 March 2018

In Press, Accepted Manuscript — Note to users

Comparison of air exhausts for surgical body suits (space suit) and the potential for periprosthetic joint infection

Dr Ferraby Ling, Dr Suleiman Halabi, Mr Chris Jones

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https://doi.org/10.1016/j.jhin.2018.03.012

Ling F et al. J Hosp Infect. 2018 Jul;99(3):279-283

Space suits

- **Findings**
  - In a positive pressure environment air is exhausted along the path of least resistance:
    - predominantly out through the posterior gown folds when used with a standard surgical gown, or
    - from the bottom of the gown when using a with a dedicated zippered suit or
    - From around the neck

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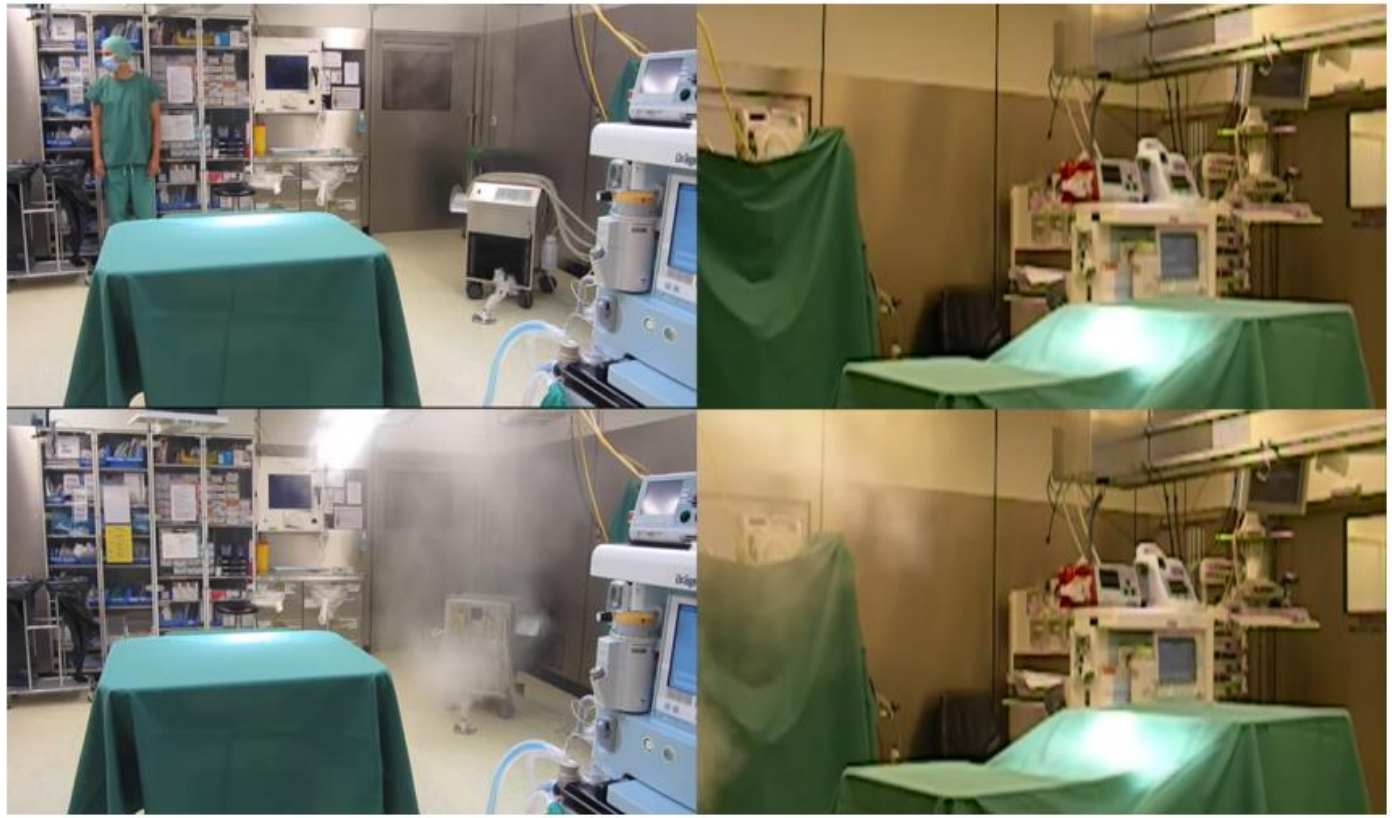
Space suits

Heater-cooler devices (HCDs) and global outbreak of Mycobacterium chimaera

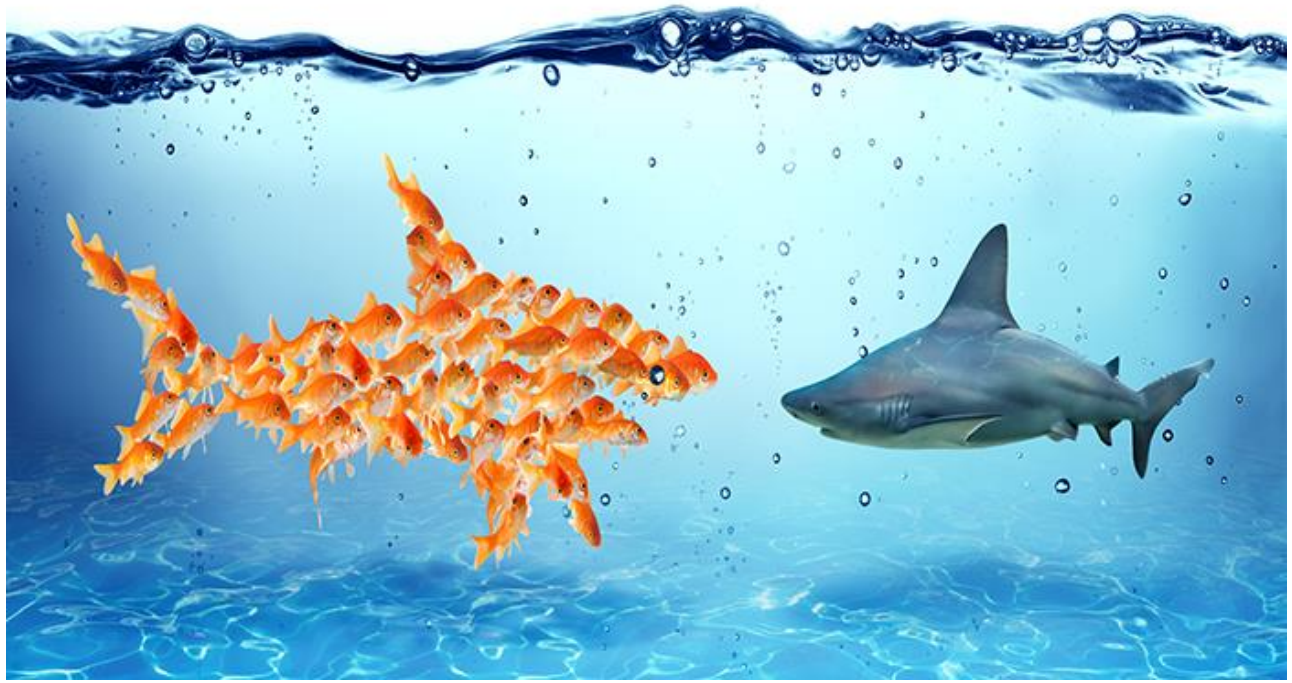
- **HCU contamination with *M chimaera* at the LivaNova factory**
- When an *M. chimaera*-contaminated HCD is operating:
  - the organism can be detected in air samples and
  - on settle plates in the operating room
- When air bubbles in the HCD water tank reach the surface, they burst and water droplets are ejected into the air and escape through openings in the water circuit
- The bioaerosol, with a **particle size <1 µm**, is released into the OR and disseminated via the cooling fans of the HCD, perhaps aided by turbulent air flow
- Dissemination of this airborne inoculum results in contamination of:
  - the operative field and/or
  - the implant if it is exposed on the sterile field prior to implantation

Global outbreak of severe *Mycobacterium chimaera* disease after cardiac surgery: a molecular epidemiological study



Transmission of Mycobacterium chimaera

TEAMWORK



Thank you

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