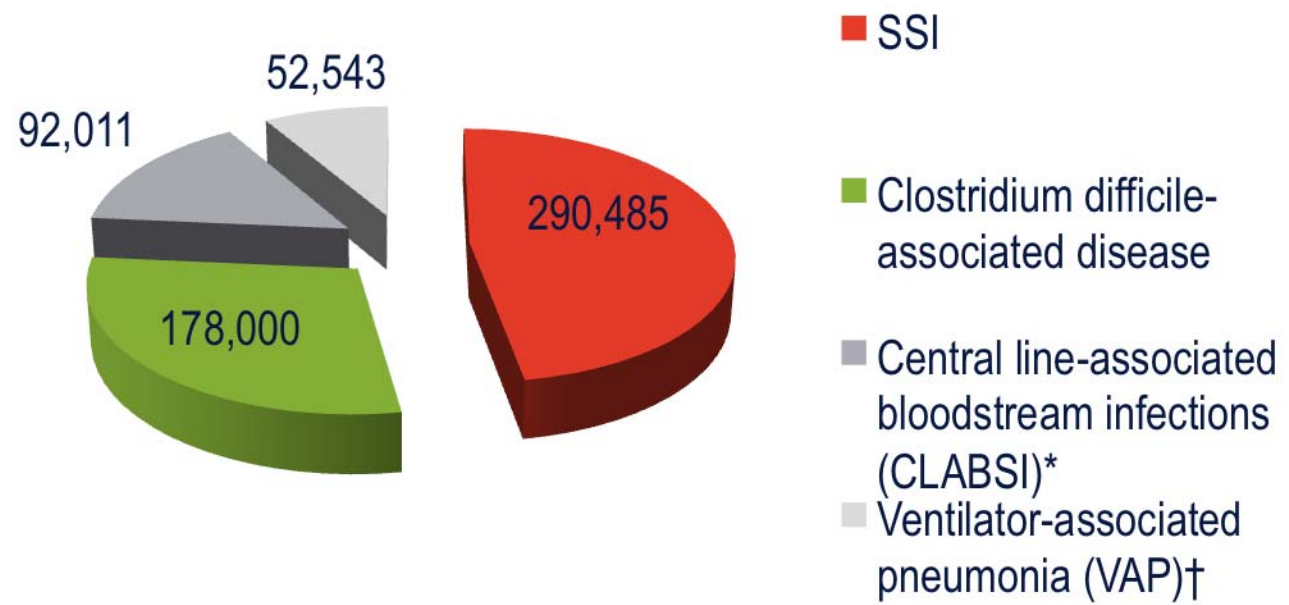


# CDC SSI Prevention Guidelines Update and Their Relevance to the Developing WHO Guideline

Joseph S. Solomkin, MD, FACS  
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University of Cincinnati College of  
Medicine

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# Relative Incidence of Hospital-Acquired Infections



\* Total BSI adjusted to estimate CLABSI ( $248,678 \times 0.37^{15}$ ) = 92,011; † Total pneumonia infections adjusted to estimate VAP ( $250,205 \times 0.21^{15}$ ) = 52,543.

## Slide 2

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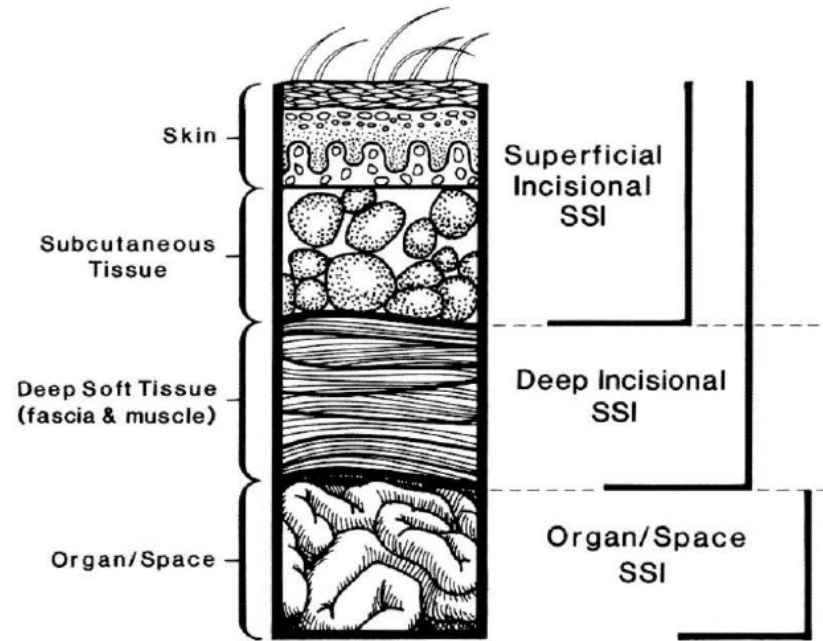
p2

I edited the figure data so that "Clostridium difficile" was italics per AMA but the italics are not showing on the figure. Please make this change if possible.

Please make the dagger at the end of legend key "Ventilator-associated pneumonia (VAP)" superscript if possible.

plarson, 30/9/2010

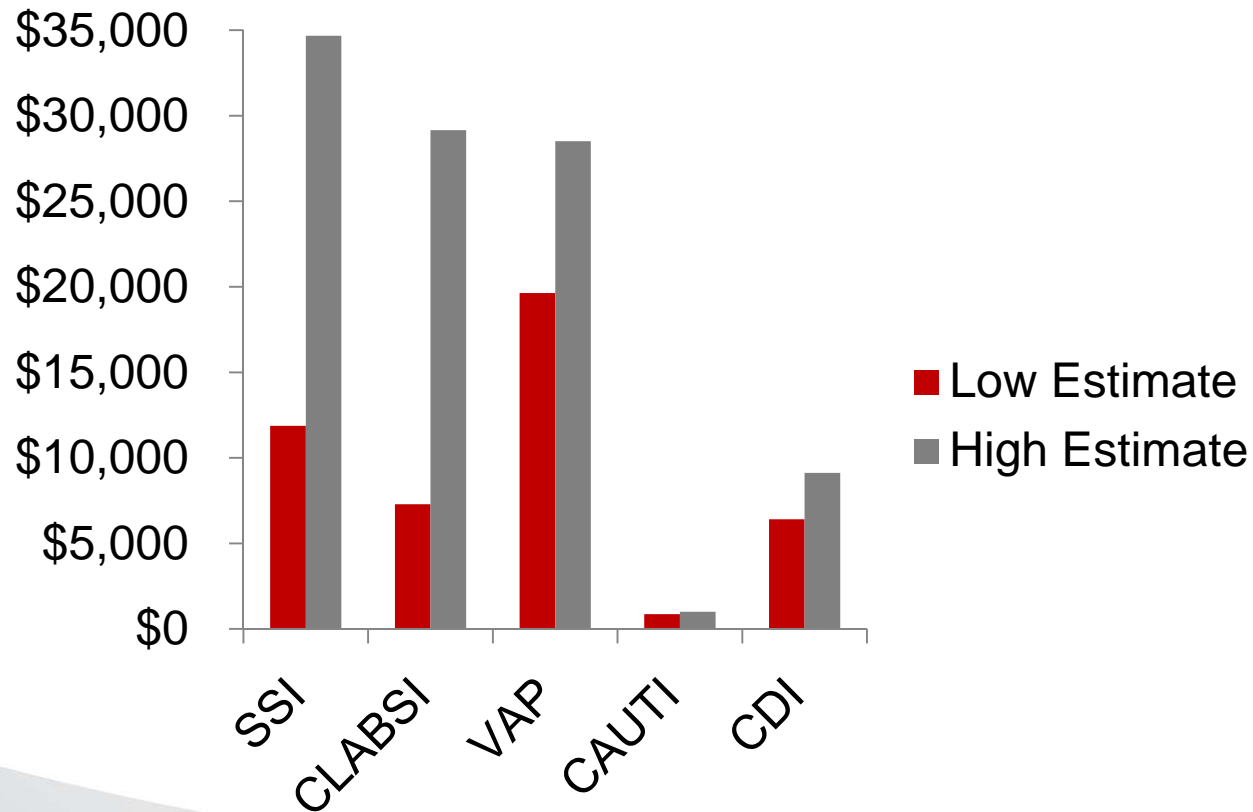
# CDC/NNIS/NHSN Anatomy of Surgical Site Infection



Anderson DJ, Chen LF, Sexton DJ, Kaye KS. Complex surgical site infections and the devilish details of risk adjustment: important implications for public reporting. *Infect Control Hosp Epidemiol.* Oct 2008;29(10):941-946.



# The Cost of Various Healthcare-Associated Infections



Scott RD, The Direct Medical Costs of Healthcare-Associated Infections in US Hospitals and the Benefits of Prevention. Available at [http://www.cdc.gov/ncidod/dhqp/pdf/Scott\\_CostPaper.pdf](http://www.cdc.gov/ncidod/dhqp/pdf/Scott_CostPaper.pdf). Accessed July 27, 2010.

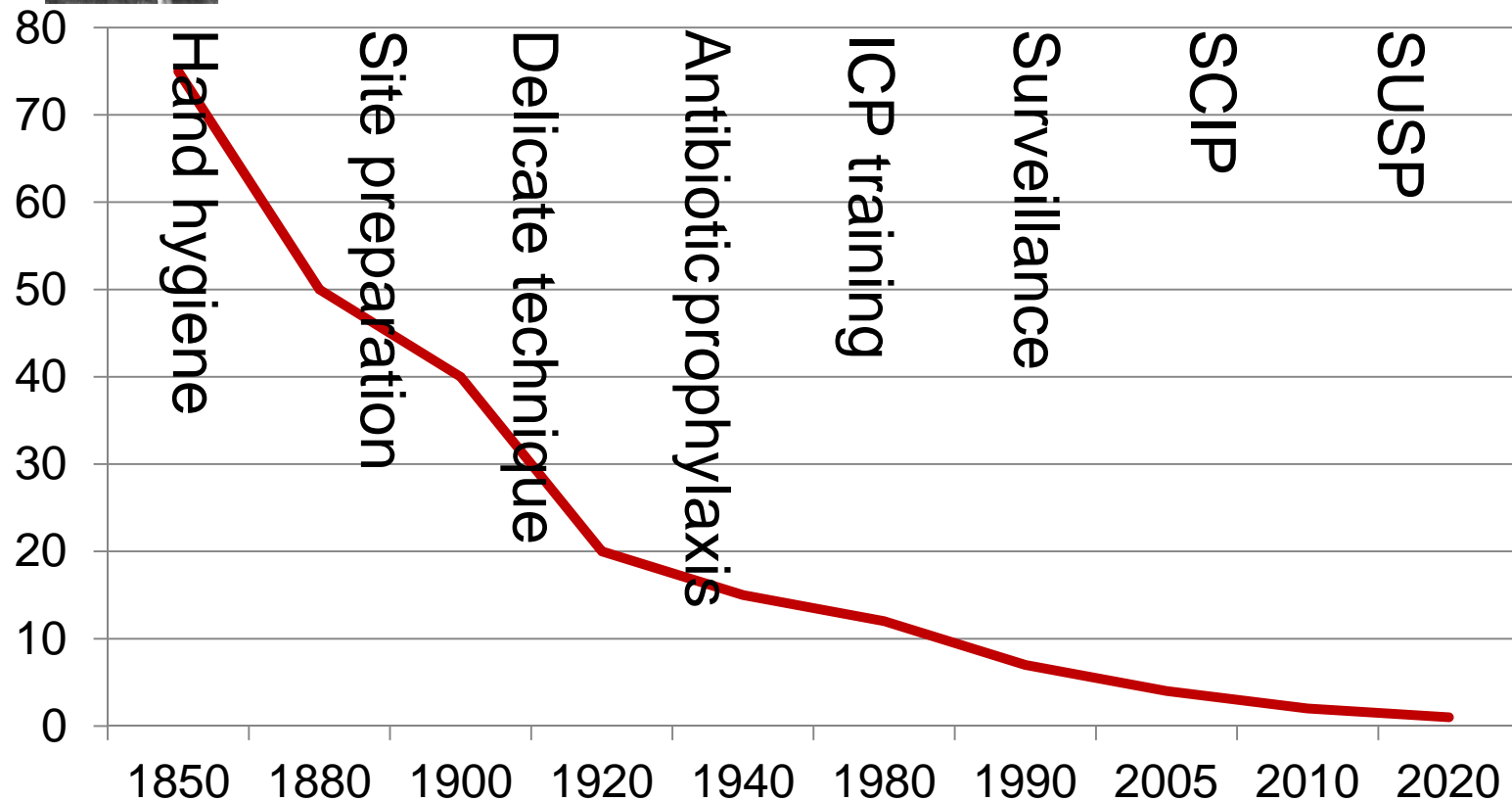
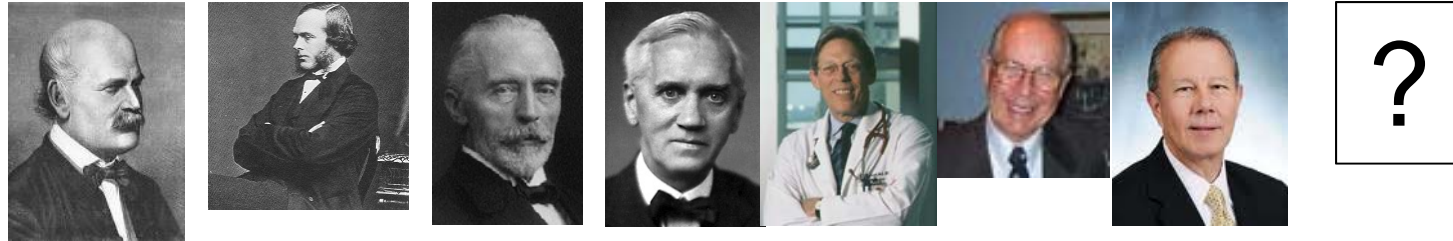
# Surgical Site Infection (SSI)



Civil War Era/ Surgery on the battlefield


Surgical site infections (SSIs) have been an adverse outcome from surgery over the ages

# Surgical Site Infection Rates Through Time





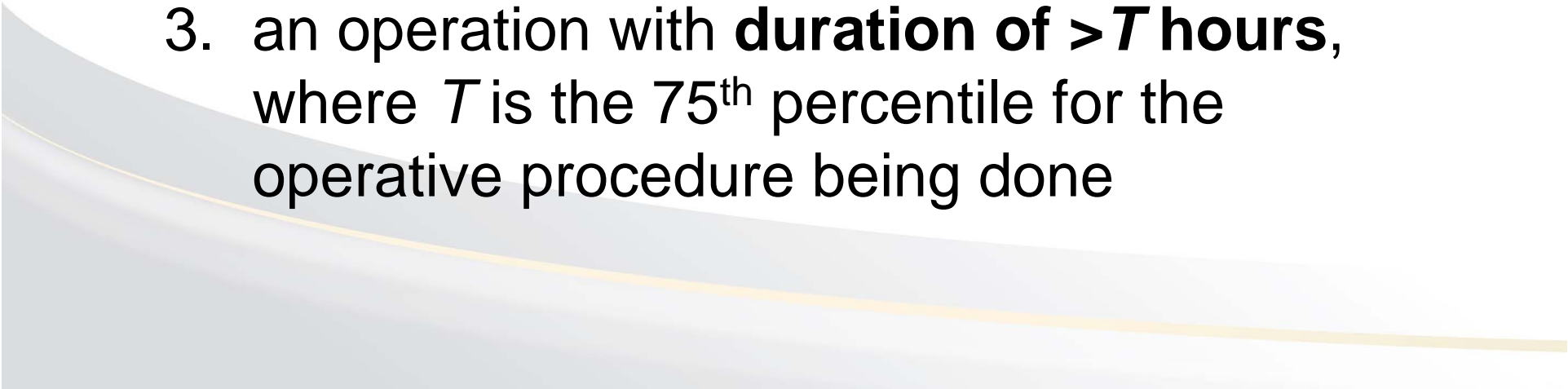
# Elements in SSI Prevention

- Equipment/Drapes/Gowns sterilization
  - Handwashing/Patient/Site preparation
  - Antibiotic prophylaxis
  - Shaving
  - Normothermia
  - Normoglycemia
  - Normoxia
- 

# Risk Models are Needed to Monitor Performance

- risk adjustment that accounts for differences in patient case mix is critical to allow for more meaningful comparisons between surgeons or between hospitals, especially when using SSI summary data as a quality improvement performance metric
- Is it likely CDC risk model will work in Africa?

# NNIS Risk Index

- One point given for each of the following:
    1. patient having an **American Society of Anesthesiologists (ASA)** preoperative assessment score of 3, 4, or 5
    2. an operation classified as either **contaminated or dirty-infected**
    3. an operation with **duration of  $>T$  hours**, where  $T$  is the 75<sup>th</sup> percentile for the operative procedure being done
- 

# NNI Risk Index: ASA Risk Index

<b>ASA PS Category</b>	<b>Preoperative Health Status Comments</b>	<b>Examples</b>
ASA PS 1	Normal healthy patient	
ASA PS 2	Patients with mild systemic disease	No functional limitations; has a well-controlled disease of one body system
ASA PS 3	Patients with severe systemic disease	Some functional limitation; has a controlled disease of more than one body system or one major system
ASA PS 4	Patients with severe systemic disease that is a constant threat to life	Has at least one severe disease that is poorly controlled or at end stage
ASA PS 5	Moribund patients who are not expected to survive without operation	

[http://en.wikipedia.org/wiki/ASA\\_physical\\_status\\_classification\\_system](http://en.wikipedia.org/wiki/ASA_physical_status_classification_system)

# NNI Risk Index: Definitions of Surgical Wound Classes

Wound Class	Definition
Clean	Uninfected surgical wounds with no inflammation and respiratory, GI, genital or urinary tract are not entered. Wounds are closed primarily and closed drainage used
Clean/contaminated	A surgical wound in which the contaminated respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination
Contaminated	Open fresh, accidental wounds, or procedures that have major breaks in sterile technique or where acute nonpurulent inflammation is encountered
Dirty	Old traumatic wounds that have retained devitalized tissue or drainage of management of abscesses, infection, or perforated viscera

# NNI Risk Index: Times for Specific Procedures

<b>Procedure</b>	<b>75% Percentile for Time (hours)</b>
CABG – chest and donor site	5
Liver and pancreas	4
Other GI	3
Herniorraphy	2
Mastectomy	3
Abdominal hysterectomy	2

# Surgical Site Infection Rates in the US: NNIS 1992-2004

Procedure	Rate Risk Index 0	Rate Risk Index 1	Rate Risk Index 2	Rate Risk Index 3
CABG	1.25	1.5	5.4	9.8
Small bowel	4.97	7.1	8.63	11.6
Abd hyster	1.36	2.3	5.17	---
Hip prosthesis	0.86	1.65	2.52	---
Laminectomy	0.88	1.35	2.46	---
Colorectal	3.98	5.66	8.54	11.25

January 1992 through June 2004.  
Am J Infect Control 2004;32:470-85.

# Surgical Site Infection Rates: Deep Incision and Organ Space Infections NHSN 2011

Procedure	#Procedures	# Infections	Infection Rate (%)
CABG	87,934	926	1.05
Small bowel surgery	12,262	259	2.11
Colon Surgery	68,702	1663	2.42
Abdominal hysterectomy	82,082	524	0.64
Hip prosthesis	180,996	1,422	0.79

Mu Y, Edwards JR, Horan TC, Berrios-Torres, SL, Fridkin, SK: Improving Risk-Adjusted Measures of Surgical Site Infection for the National Healthcare Safety Network. Infection Control and Hospital Epidemiology, 2011., 32:, 970-986



INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY OCTOBER 2011, VOL. 32, NO. 10

ORIGINAL ARTICLE

# Improving Risk-Adjusted Measures of Surgical Site Infection for the National Healthcare Safety Network

Yi Mu, PhD;<sup>1</sup> Jonathan R. Edwards, MStat;<sup>1</sup> Teresa C. Horan, MPH;<sup>1</sup>  
Sandra I. Berrios-Torres, MD;<sup>1</sup> Scott K. Fridkin, MD<sup>1</sup>



# The New Goal

Procedure-specific, multivariate risk models that incorporate additional weighted patient factors could calculate more credible, standardized, and reliable risk-adjusted SSI metrics than stratified SSI rates that are limited to the traditional NHSN risk index.

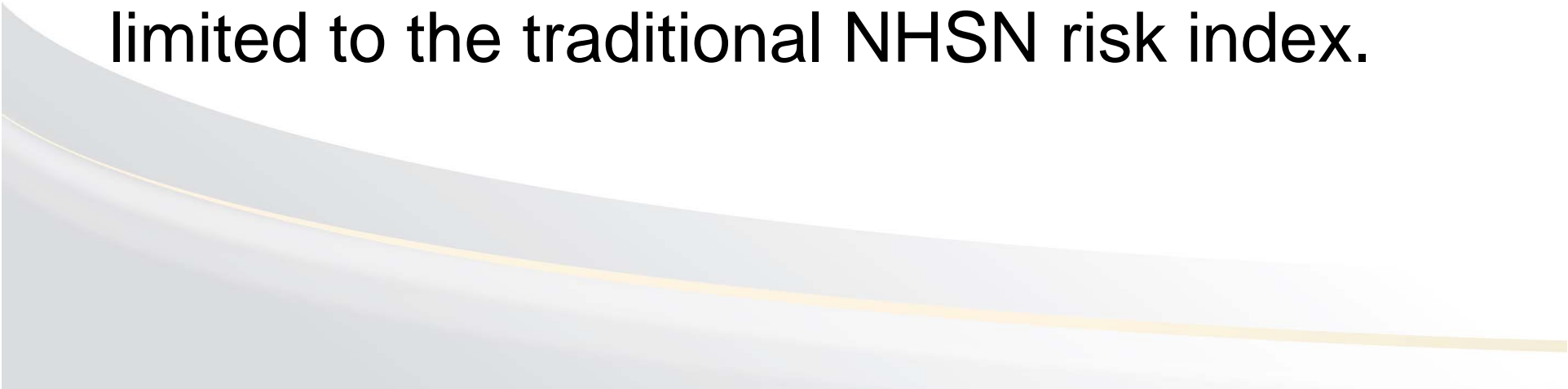


TABLE 1. List of Variables Collected and Available for Entry in the Models for All and Selected Procedures

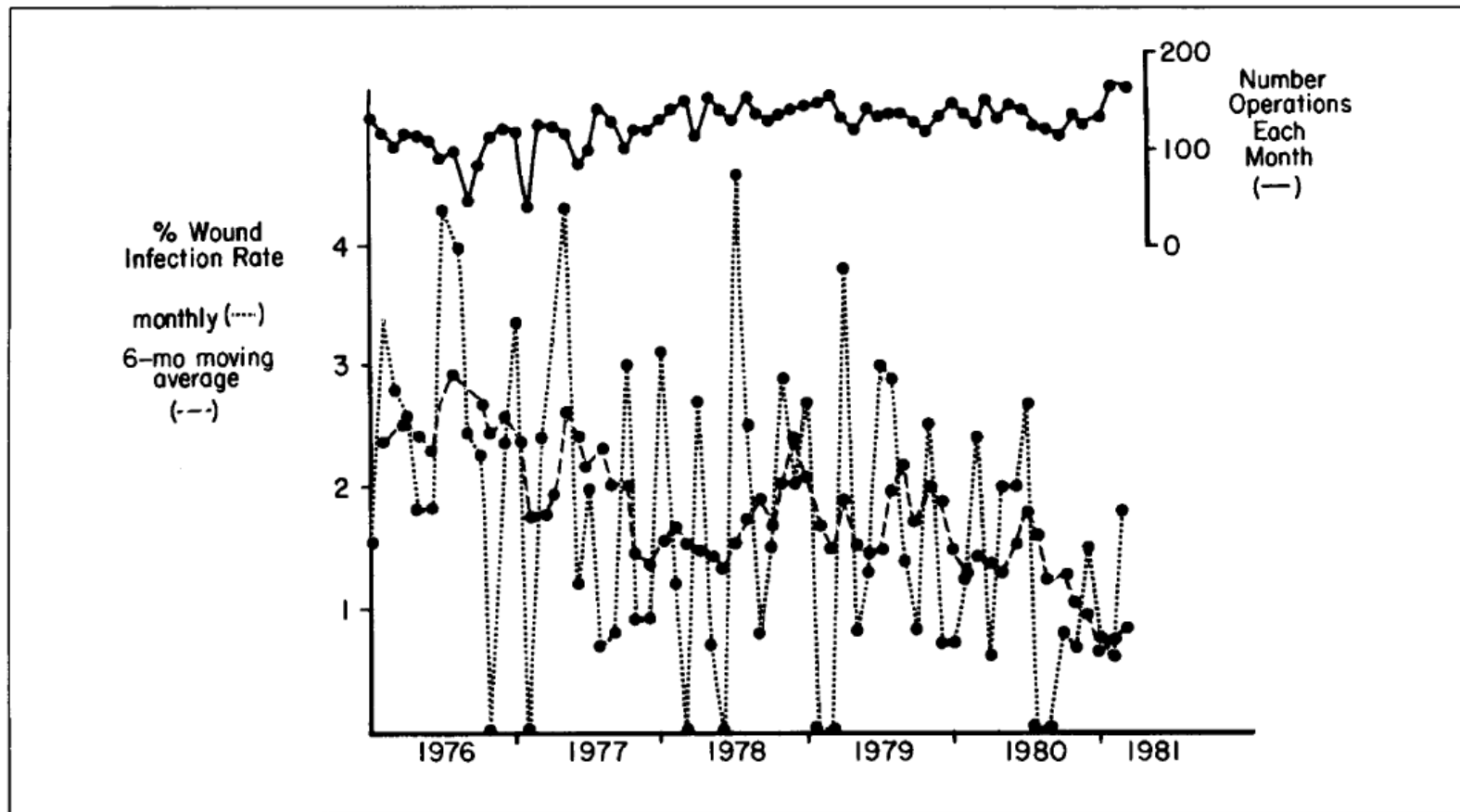
Procedure code	Variable
All	Gender, age, emergency, trauma, general anesthesia, ASA score, wound classification, duration, medical school affiliation, no. of hospital beds, endoscope, outpatient
HPRO	Type of surgery (total primary, partial primary, partial revision, total revision)
KPRO	Type of surgery (revision, primary)
CSEC	Labor, blood loss, body mass index
FUSN/RFUSN	Approach, spinal level, diabetes

NOTE. Procedure codes are National Healthcare Safety Network procedure codes.<sup>18</sup> ASA, American Society of Anesthesiologists.

# Organizing to Reduce SSIs



# Effect of a Surveillance Program with Feedback



Condon RE, Schulte WJ, Malangoni MA, et al:  
**Effectiveness of a surgical wound surveillance program.**  
Arch Surg. 1983; 118(3):303-7.

**In order to enhance the prevention of SSI through surveillance**, ECDC in collaboration with Member States should propose a set of evidence based key interventions for the prevention and control of SSI and monitor their implementation through structure and process indicators integrated in the ECDC SSI surveillance protocol, e.g. in accordance with recent guidelines and as recommended by the Council. This will also allow improving the interpretation of observed SSI incidence trends

European Centre for Disease Prevention and Control.  
Surveillance of surgical site infections in Europe 2010– 2011. Stockholm:  
ECDC; 2013



The Institute for Healthcare Improvement (IHI) has launched the **Surgical Care Improvement Project (SCIP)**. The goal of this initiative is to prevent surgical site infections by implementing the four components of care:

1. **Appropriate use of prophylactic antibiotics**
2. Appropriate hair removal
3. Controlled 0600 postoperative serum glucose in cardiac surgery patients
4. Immediate postoperative normothermia for colorectal patients

# Antibiotics

- Antibiotic administration is prescribed preoperatively at 30 to 60 or 120 minutes prior to the incision, depending the type of antibiotic ordered
- The antibiotic should be continued for at most 24 hours postprocedure
- Dosage should be adjusted for patient weight to prevent larger individuals being underdosed
- Patients must be redosed during long procedures to maintain appropriate serum antibiotic levels

Bratzler Houck AmJSurg 2005

Bratzler DW, Houck PM. Antimicrobial prophylaxis for surgery: an advisory statement from the National Surgical Infection Prevention Project. Clin Infect Dis 2004;38(12):1706–15.

QualityNet Web site. <https://www.qualitynet.org/dcs/ContentServer?c=MQParents&pagename=Medqic%2FContent%2FParentShellTemplate&cid=1228694349383&parentName=Category>. Accessed September 30, 2010.



## Slide 23

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**ki7**      Bullets 3 and 4 are duplicates of bullets on previous slide.

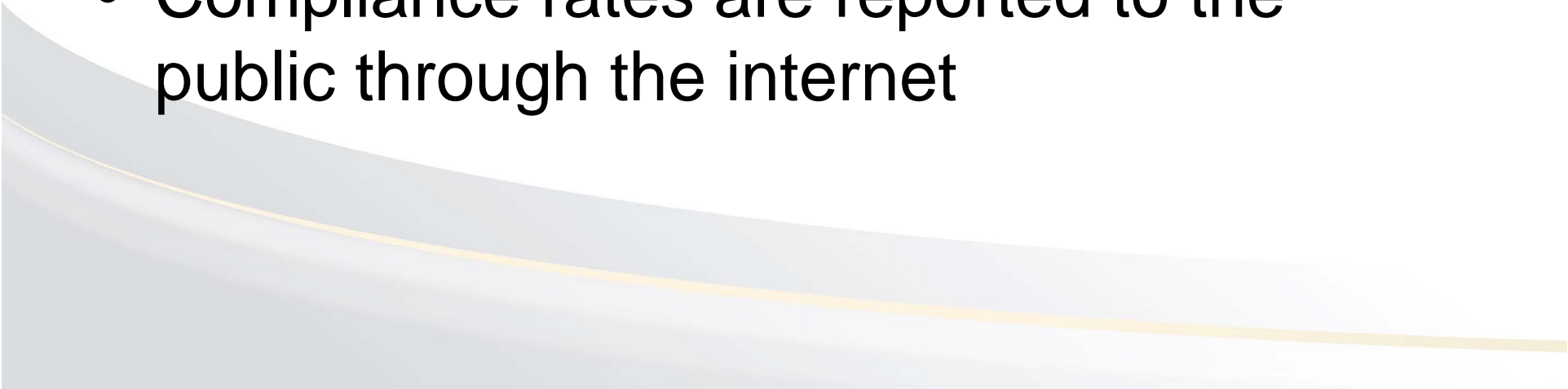
Bullets 1 and 2 need reference.

kittoca, 30/9/2010

**o3**      Deleted redundant bullets from previous slide

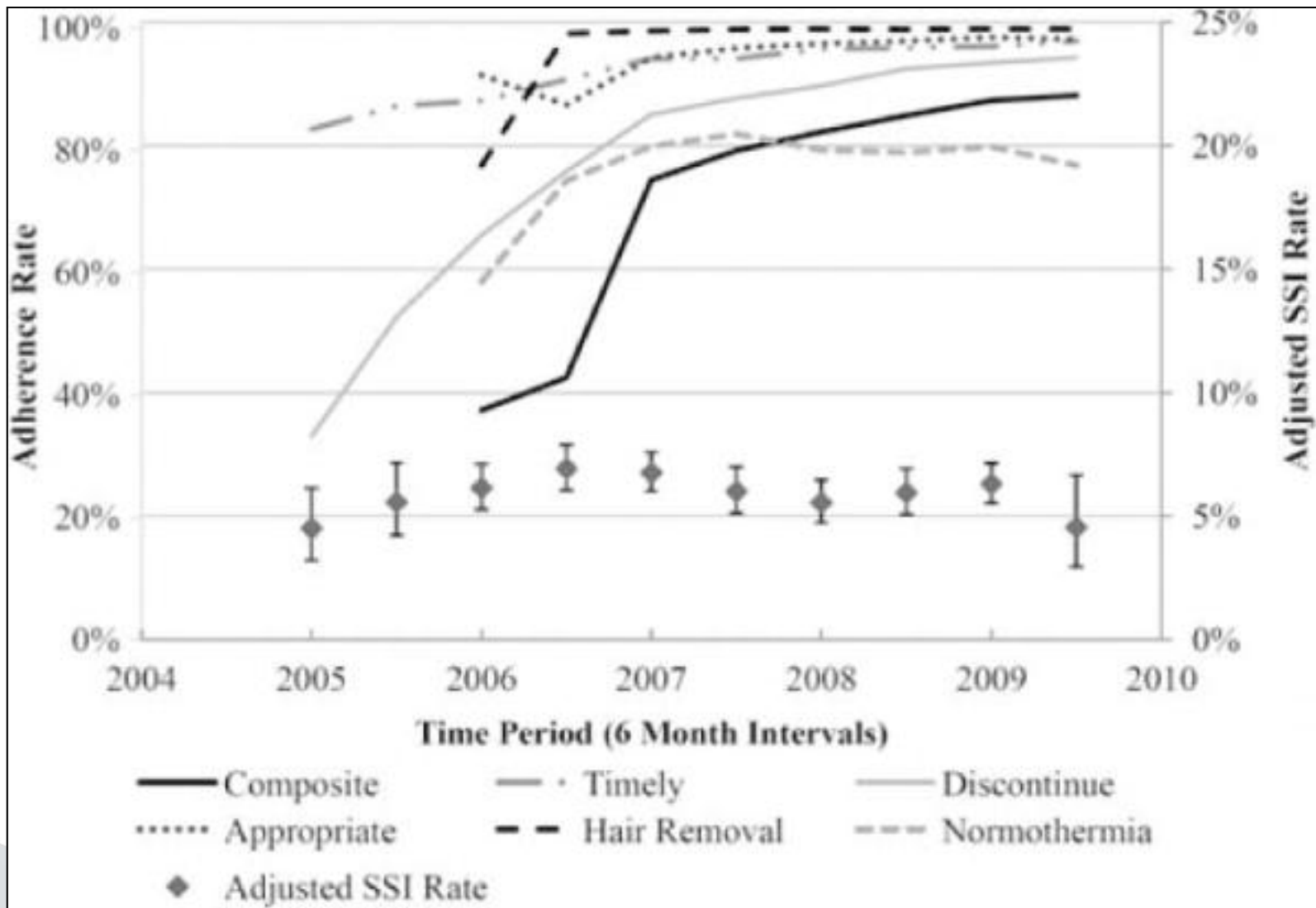
oratz, 1/10/2010

# How SCIP Works

- For each patient undergoing operation, hospitals report to the government (CMS/CDC) if SCIP measures were met
  - If hospitals have <90% compliance, payment from CMS is reduced by 1-3%
  - Compliance rates are reported to the public through the internet
- 

# University Hospital Antibiotic Prophylaxis

<b>Surgical Service</b>	<b>Routine Antibiotic</b>	<b>Penicillin or Cephalosporin Allergy</b>
Burns	Cefazolin	Clindamycin
Cardiac	Cefazolin <b>plus</b> Vancomycin	Vancomycin
Thoracic	Cefazolin	Vancomycin <b>OR</b> Clindamycin
Colorectal	Cefazolin <b>plus</b> Metronidazole Ertapenem	Gentamicin <b>plus</b> Clindamycin
General Surgery/ Endocrine	Cefazolin	Clindamycin
Hepatobiliary (complicated)	Ceftriaxone	Aminoglycoside <b>plus</b> Vancomycin
Plastics, Reconstructive & Hand Surgery	Cefazolin	Clindamycin <b>or</b> Vancomycin
Vascular/TJR	Cefazolin (add Vancomycin if screen positive)	Vancomycin



**Surgical Site Infection Prevention: Time to Move Beyond the Surgical Care Improvement Program.**

Hawn, Mary; Vick, Catherine; Richman, Joshua; et al:  
Annals of Surgery. 254(3):494-501, September 2011.

# How to Improve SSI Rates

- OR Committee
  - Standardize surgical checklist
  - Specify skin preparation and hair removal
  - Develop infection reporting scheme by surgeon
- Pre-Operative Care Unit (PCU)
  - All patients scheduled for surgery go to PCU
  - Seen by anesthesiologist and nurse
  - Based on the operation planned, appropriate antibiotics are given when patient is called to the OR

## Special Report

# 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



Centers for Disease Control and Prevention


CDC 24/7: Saving Lives. Protecting People.™

# Preoperative Care

- Require 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)**
- Perform intraoperative skin preparation with an alcohol-based antiseptic agent, unless contraindicated. **(Category IA)**



# ANTIMICROBIAL PROPHYLAXIS- PARENTERAL

- Optimal timing for administration is begin the infusion within 60 minutes of the incision
  - Adjust dose based upon actual body weight
  - In clean and clean-contaminated procedures, do not administer additional prophylactic antimicrobial agent doses after the surgical incision is closed in the operating room, even in the presence of a drain.  
**(Category IA)**
- 




# What to Put In or On the Wound

- Consider intraoperative irrigation of deep or subcutaneous tissues with aqueous iodophor solution for the prevention of surgical site infection.
- Do not apply topical antimicrobial agents to the surgical incision for the prevention of surgical site infection
- Application of antiseptic agents to the skin immediately prior to closing the surgical incision is not necessary for the prevention of surgical site infection.



# Glucose, Temperature, Oxygen

- Implement perioperative glycemic control and use blood glucose target levels  $<200\text{mg/dL}$  in diabetic and non-diabetic patients. **(Category IA)**
  - Maintain perioperative normothermia **(Category IA)**
  - In patients with normal pulmonary function and undergoing general anesthesia with endotracheal intubation, administer increased fraction of inspired oxygen ( $\text{FiO}_2$ ) both intraoperatively and post-extubation in the immediate postoperative period. **(Category IA)**
- 

# Surgical Site Infection Prevention Collaboration



**World Health  
Organization**

International Surgical Infections Study Group

# ISIS SSI Period Prevalence Survey

- Utilize surgical champions as principal investigators
- Identify individual at the approximate level of a surgical ward nurse
- Provide appropriate (IPNet/ICAN) training
- 5-7 day prevalence survey for gen surg, peds surg, ortho, ob/gyn
- Use Android app for data capture and transmission