Pediatric Surgical Site Infections:
Strategies For Control In Your Practice

Bridget Pearce, M.D.

University of Michigan

Disclosures

- None

Learning Objectives

- Review surgical site infection metrics
- Summarize national accountability in our practice
- Delineate team approach
- Reinforce individual responsibility

Surgical Site Infections: The Metrics

SSI Numbers

- Most common healthcare-associated infection[1]
- Up to 60% of SSIs preventable
- Each SSI is associated with 7–11 additional hospital-days
- Patients with an SSI have a 2–11-times higher risk of death
- 1.9% SSI rate[2]
- 750,000 – 1,000,000 SSI/year
- 2,500,000 hospital days
- $1 billion cost

1. *Magill, SS Infec Cont Hosp Epid 33(3): 2012: 283-291*
2. *Mu, Y et al Inf Cont Hosp Epid 32(10) 2011:970-86*
2. *CDC SSI Event 2015*

Twitter, 2015

Brief History of Surgical Infections

Evolution of SSI

- Ancient Greece: Disease as divine punishment
- Hippocrates: Disassociated mysticism and medicine
- Middle ages: Return to religious medicine
  St. Benedict banned medicine
  Practice of surgery devolved to barbers
- Renaissance: Intellectual rebirth & move toward science
  Spread of infection from poor ventilation
  Prevention - Open the windows, prevent overcrowding

Surgical site infections were 2nd leading cause of death

The History of Surgical Infections, Nespoli, A et al Surg Inf 12(1): 3-13, 2011

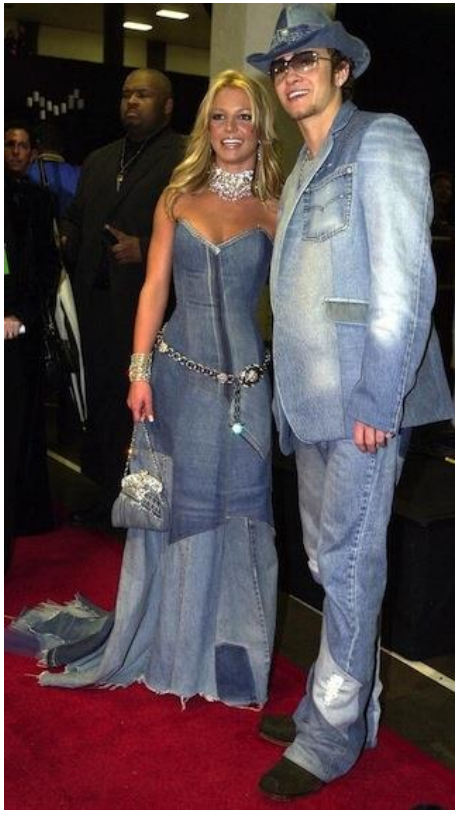
Dr. Ignaz Semmelweis

- Postpartum endometritis infection rates physicians >> midwives
- Anatomy in the morgue, straight to the OR
- ***1847 introduced hand-washing rules –***
  Postpartum mortality rates dramatically decreased
- Great resistance to his ideas
  Forced to quit medicine within 2 years
- Died in an asylum for the mentally unstable

- Pasteur – germ theory
- Lister – chemical antisepsis
- Halsted - gloves
- Fleming – Penicillin

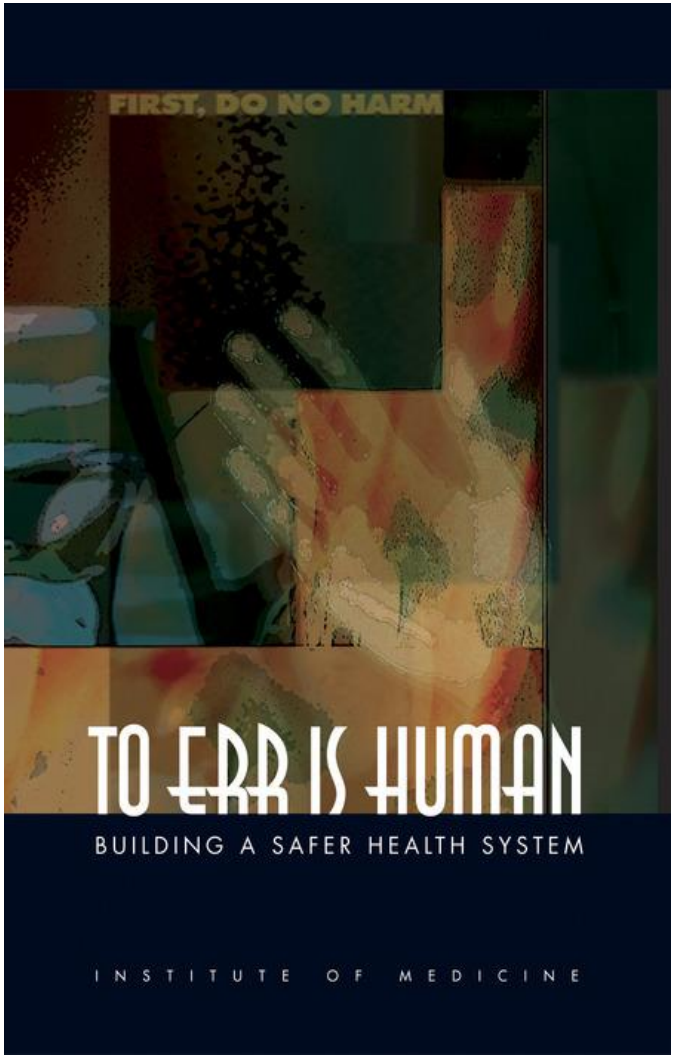
The History of Surgical Infections, Nespoli, A et al Surg Inf 12(1): 3-13, 2011

1999



Institute of Medicine, November 1999

- Sentinal report on hospital-associated adverse events
  Human and monetary cost
- Establish a **national focus** to enhance safety
- Identify and learn from errors
- Create a **mandatory reporting system**
- Raise **performance standards** with
  oversight organizations
- Implement **safety systems**
- PROTECT PATIENTS FROM MEDICAL MISTAKES!



The Federal Response

Executive order by Clinton administration

1. Government agencies overseeing health-care programs must implement techniques for reducing medical errors
2. Create a task force to find new strategies for reducing errors

Congressional hearings on patient safety

December 2000 - appropriated $50 million to the Agency for Healthcare Research and Quality (AHRQ) to reduce medical errors


Roadmap to a
Culture of
Quality Improvement

How Do We Implement Quality Improvement?

How Do We Implement Quality Improvement?

- Administrative leadership willing to commit energy and financial resources
- Scientific approach to improvement
- Sophisticated understanding of health care delivery systems and behavior

How Do We Implement Quality Improvement?

Joint Commission for the Accreditation of Healthcare Organizations

JCAHO

"To continuously improve the safety and quality of care provided to the public through the provision of health care accreditation and related services that support performance improvement in health care organizations."

Patient Safety Advisory Group gives input to JCAHO

- Physicians
- Nurses
- Pharmacists
- Risk managers
- Clinical engineers
- Other professionals with experience in addressing patient safety issues
- Chair Dr. Jim Bagian, UMHS

National patient safety goals

Hospital accreditation is dependent on compliance with NPSGs

NPSG, Chapter 1: Jan 1, 2003

1. Improve the accuracy of patient identification
2. Improve the effectiveness of communication among caregivers
3. Improve the safety of using high-alert medications
4. Improve the safety of using infusion pumps
5. Improve the effectiveness of clinical alarm systems
6. Eliminate wrong-site, wrong patient procedure surgery

The Joint Commission
National Patient Safety Goals Effective
January 1, 2015

1. Improve the accuracy of patient identification

2. Improve the effectiveness of communication among caregivers

3. Improve the safety of using medications

4. Reduce the harm associated with clinical alarm systems

5. Identify patient safety risks

6. Eliminate wrong-site, wrong patient procedure surgery

7. **Reduce the risk of health care-associated infections**

The Joint Commission National Patient Safety Goals Effective January 1, 2015

The Joint Commission
National Patient Safety Goals Effective
January 1, 2015

1. Improve the accuracy of patient identification

   Use at least two patient identifiers when providing care, treatment, and services
   Eliminate transfusion errors related to patient misidentification

2. Improve the effectiveness of communication among caregivers

   Get important test results to the right staff person on time

3. Improve the safety of using medications

   Label all medications, medication containers, and other solutions on and off the sterile field
   Reduce the likelihood of patient harm associated with the use of anticoagulant therapy
   Maintain and communicate accurate patient medication information

4. Reduce the harm associated with clinical alarm systems

   Make improvements to ensure that alarms on medical equipment are heard
   and responded to on time.

2015 NPSG, Con't.

5. Identify patient safety risks

Find out which patients are most likely to try to commit suicide

Reduce the risk of falls

Prevent health care-associated pressure ulcers

6. Prevent mistakes in surgery

Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery™

Conduct a pre-procedure verification process

Mark the procedure site

A time-out is performed before the procedure

7 . Reduce the risk of health care-associated infections **Prevent infection**

Comply with either the current CDC and/or WHO hand hygiene guidelines

Implement evidence-based practices for preventing surgical site infections

Use proven guidelines to prevent infection of the blood from central lines

Use proven guidelines to prevent infections of the urinary tract that are caused by catheters

http://www.jointcommission.org/assets/1/6/2015_NPSG_H

NPSG: Reducing Hospital Acquired Infections

1. Multidrug Resistant Organisms
2. Central Line-Associated Blood Stream Infections
3. **Surgical Site Infections**
4. Catheter-Associated Urinary Tract Infections

A Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals

Yokoe, DS, et al Infect Control Hosp Epidemiol 2008:29;S12-S21

The Compendium

- JCAHO Joint Commission For Accreditation of Hospitals
- CDC Centers for Disease Control and Prevention
- SHEA Society for Healthcare Epidemiology of America
- IDSA Infectious Diseases Society of America
- IHI Institute for Healthcare Improvement
- PIDS Pediatric Infectious Diseases Society
- SCCM Society for Critical Care Medicine
- SHM Society for Hospital Medicine
- SIS Surgical Infection Society

Literature of Acronyms

- JCAHO
- CDC
- SHEA
- IDSA
- IHI
- PIDS
- SCCM
- SHM
- SIS

Recent SSI History

2008: A Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals

Yokoe, DS, et al Infect Control Hosp Epidemiol 2008:29;S12-S21

2009: US Department of Health & Human Services – National Healthcare-associated infection action plan

2011: Centers for Medicare and Medicaid Services –

Require acute care hospital to report specific types of HAI data to CMS through CDC's National Healthcare Safety Network

Tied to reimbursement

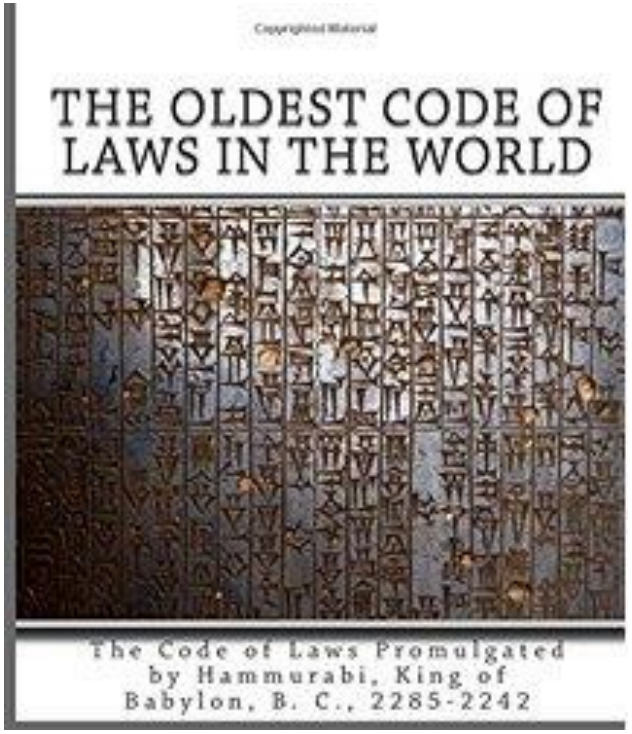
CMS Hospital Value-Based Purchasing Program: *UMHS Performance*

Code of Hammurabi

If a physician make a large incision with the operating knife, and kills him…his hands shall be cut off.

Principle of *lex talionis* – retaliation

Medicine subject to criminal jurisprudence



Implementing Evidence-Based Practices for Preventing SSIs

1. Educate staff involved in surgical procedures about prevention of SSI.
2. Educate patients and families about SSI
3. Implement policies and practices to reduce the risk of SSI.
4. Conduct periodic risk assessments for SSIs
5. Select SSI measures using evidence-based or best practice guidelines
6. Monitor compliance using evidence-based or best practice guidelines
7. Evaluate the effectiveness of prevention efforts

http://www.jointcommission.org/assets/1/6/2015_NPSG_HAP.pdf

Elements of Performance

8. Measure SSI rates for first 30 or 90 days based on National Healthcare Safety Network procedural codes

9. Provide process and outcome measure results to key stakeholders

10. Administer antimicrobial agents for prophylaxis for particular procedure or disease according to methods cited in scientific literature or endorsed by professional organizations

11. When hair removal is necessary, use a method cited in scientific literature or endorsed by professional organizations.

National Surgical Quality Improvement Program

How are we doing relative to peer institutions?

- 2008 American Pediatric Surgery Association + NSQIP
  Alpha phase - 4 academic institutions

- 2010 ACS - NSQIP-Pediatrics
  Beta phase - 29 institutions
  Thirty day outcomes of mortality, SSI, pneumonia, renal failure
  Compare institutional outcomes with peers

- 2011 National Anesthesia Clinical Outcomes Registry (NACOR) formed

Pediatric Surgical Site Infections

Children

SSI = 1.8%

Neonates:

SSI = 3%

Bruny, et al Journ Ped Surg (2013)48, 74-80 ACS NSQIP-Peds

Risk Factors for Pediatric SSI

- Failure to deliver surgical antimicrobial prophylaxis within 60 minutes prior to incision
- Failure to use an appropriate antiseptic agent to prepare skin at incision site
- Shaving to remove hair
- ***Younger age***
- Cardiac surgery
- Duration of central venous access
- Cyanotic heart disease

Neonates and SSIs

- Host risk factor – National Nosocomial Infections Surveillance System
- Neonates are immune naïve, susceptible to infection
- Defects in toll-like receptors and neutrophil activation predispose to infectious disease
- Med/social factors – decreased breast milk consumptions which is protective
- Age = immunodeficiency

- Casanova, JF et al Risk Factors for Surgical Site Infections in Children Infec Control Hosp Epidem 27(2006(pp 709-715

- Bucher BT et al Risk Factors and Outcomes of Surgical Site Infection in Children j of Am Coll Surgeons 212(6) 2011: 1033-1038

Risk Factors for Pediatric SSI

- ***Failure to deliver surgical antimicrobial prophylaxis within 60 minutes prior to incision***
- Failure to use an appropriate antiseptic agent to prepare skin at incision site
- Shaving to remove hair
- Younger age
- Cardiac surgery
- Duration of central venous access
- Cyanotic heart disease

Why do we fail to deliver surgical antimicrobial prophylaxis within 60 minutes prior to incision?

- Not ordered
- Not realized they're needed
- Forgot to administer
- Poor communication

Teamwork

“The team, the team, the team”

- *Bo Schembechler*

Association Between Implementation of a Medical Team Training Program and Surgical Mortality

Julia Neily, RN, MS, MPH
Peter D. Mills, PhD, MS
Yinong Young-Xu, ScD, MA, MS
Brian T. Carney, MD
Priscilla West, MPH
David H. Berger, MD, MHCM
Lisa M. Mazzia, MD
Douglas E. Paull, MD
James P. Bagian, MD, PE

Context There is insufficient information about the effectiveness of medical team training on surgical outcomes. The Veterans Health Administration (VHA) implemented a formalized medical team training program for operating room personnel on a national level.

Objective To determine whether an association existed between the VHA Medical Team Training program and surgical outcomes.

Design, Setting, and Participants A retrospective health services study with a contemporaneous control group was conducted. Outcome data were obtained from the VHA Surgical Quality Improvement Program (VASQIP) and from structured interviews in fiscal years 2006 to 2008. The analysis included 182 409 sampled procedures from 108 VHA facilities that provided care to veterans. The VHA's nationwide training program required briefings and debriefings in the operating room and included checklists as an integral part of this process. The training included 2 months of preparation, a 1-day conference, and 1 year of quarterly coaching interviews

Main Outcome Measure The rate of change in the mortality rate 1 year after facilities enrolled in the training program compared with the year before and with nontraining sites.

Results The 74 facilities in the training program experienced an 18% reduction in annual mortality (rate ratio [RR], 0.82; 95% confidence interval [CI], 0.76-0.91; $P=.01$) compared with a 7% decrease among the 34 facilities that had not yet undergone training (RR, 0.93; 95% CI, 0.80-1.06; $P=.59$). The risk-adjusted mortality rates at

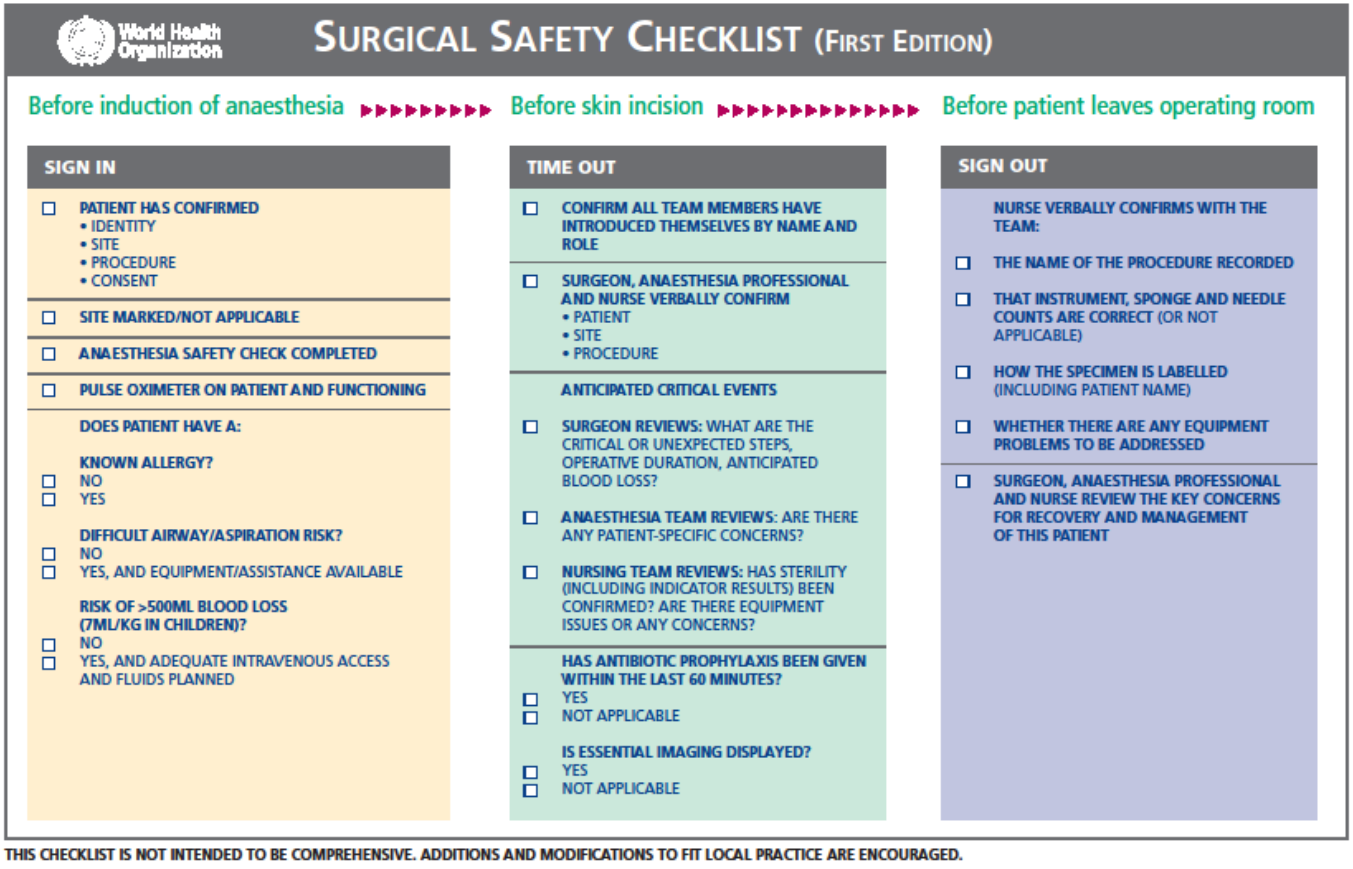
ADVERSE EVENTS RELATED TO surgery continue to occur despite the best efforts of clinicians.[1] Teamwork and effective communication are known determinates of surgical safety.[2-6] Previous efforts at demonstrating the efficacy of patient safety initiatives have been limited because of the inability to

Crew Resource Management

Pre-Flight Check

- ☐ Straighten Main and Tail Blades
- ☐ Check for Free Head Rotation
- ☐ Mount Battery and Strap down
- ☐ Turn On Transmitter
- ☐ Select Correct Model
- ☐ Turn On Throttle Hold and Lower Throttle Stick
- ☐ Set All Switches to Normal
- ☐ Plug In Battery
- ☐ Listen For ESC Initialization
- ☐ Check Receiver and Gyro Light
- ☐ Mount Canopy, Add Rubber Grommets
- ☐ Check Cyclic Movements
- ☐ Check Rudder Movement in HH and Rate Mode
- ☐ Leave Rudder Switch to HH Mode
- ☐ Check Collective Pitch Movement
- ☐ Place Model For Take-Off
- ☐ Preform Range Check
- ☐ Set Timer Switch for Countdown

2008 WHO



World Health Organization

SURGICAL SAFETY CHECKLIST (FIRST EDITION)

Before induction of anaesthesia ▶▶▶▶▶▶▶▶▶ Before skin incision ▶▶▶▶▶▶▶▶▶▶▶▶▶ Before patient leaves operating room

SIGN IN

☐ **PATIENT HAS CONFIRMED**
- IDENTITY
- SITE
- PROCEDURE
- CONSENT

☐ **SITE MARKED/NOT APPLICABLE**

☐ **ANAESTHESIA SAFETY CHECK COMPLETED**

☐ **PULSE OXIMETER ON PATIENT AND FUNCTIONING**

DOES PATIENT HAVE A:

KNOWN ALLERGY?
☐ NO
☐ YES

DIFFICULT AIRWAY/ASPIRATION RISK?
☐ NO
☐ YES, AND EQUIPMENT/ASSISTANCE AVAILABLE

RISK OF >500ML BLOOD LOSS (7ML/KG IN CHILDREN)?
☐ NO
☐ YES, AND ADEQUATE INTRAVENOUS ACCESS AND FLUIDS PLANNED

TIME OUT

☐ **CONFIRM ALL TEAM MEMBERS HAVE INTRODUCED THEMSELVES BY NAME AND ROLE**

☐ **SURGEON, ANAESTHESIA PROFESSIONAL AND NURSE VERBALLY CONFIRM**
- PATIENT
- SITE
- PROCEDURE

ANTICIPATED CRITICAL EVENTS

☐ **SURGEON REVIEWS:** WHAT ARE THE CRITICAL OR UNEXPECTED STEPS, OPERATIVE DURATION, ANTICIPATED BLOOD LOSS?

☐ **ANAESTHESIA TEAM REVIEWS:** ARE THERE ANY PATIENT-SPECIFIC CONCERNS?

☐ **NURSING TEAM REVIEWS:** HAS STERILITY (INCLUDING INDICATOR RESULTS) BEEN CONFIRMED? ARE THERE EQUIPMENT ISSUES OR ANY CONCERNS?

HAS ANTIBIOTIC PROPHYLAXIS BEEN GIVEN WITHIN THE LAST 60 MINUTES?
☐ YES
☐ NOT APPLICABLE

IS ESSENTIAL IMAGING DISPLAYED?
☐ YES
☐ NOT APPLICABLE

SIGN OUT

NURSE VERBALLY CONFIRMS WITH THE TEAM:

☐ **THE NAME OF THE PROCEDURE RECORDED**

☐ **THAT INSTRUMENT, SPONGE AND NEEDLE COUNTS ARE CORRECT** (OR NOT APPLICABLE)

☐ **HOW THE SPECIMEN IS LABELLED** (INCLUDING PATIENT NAME)

☐ **WHETHER THERE ARE ANY EQUIPMENT PROBLEMS TO BE ADDRESSED**

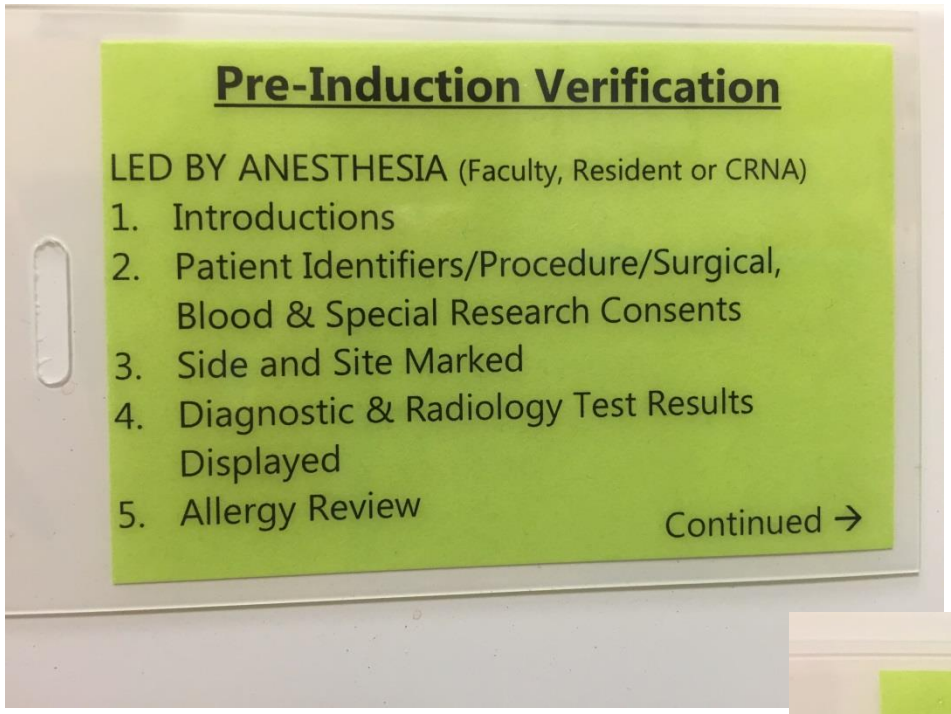
☐ **SURGEON, ANAESTHESIA PROFESSIONAL AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT**

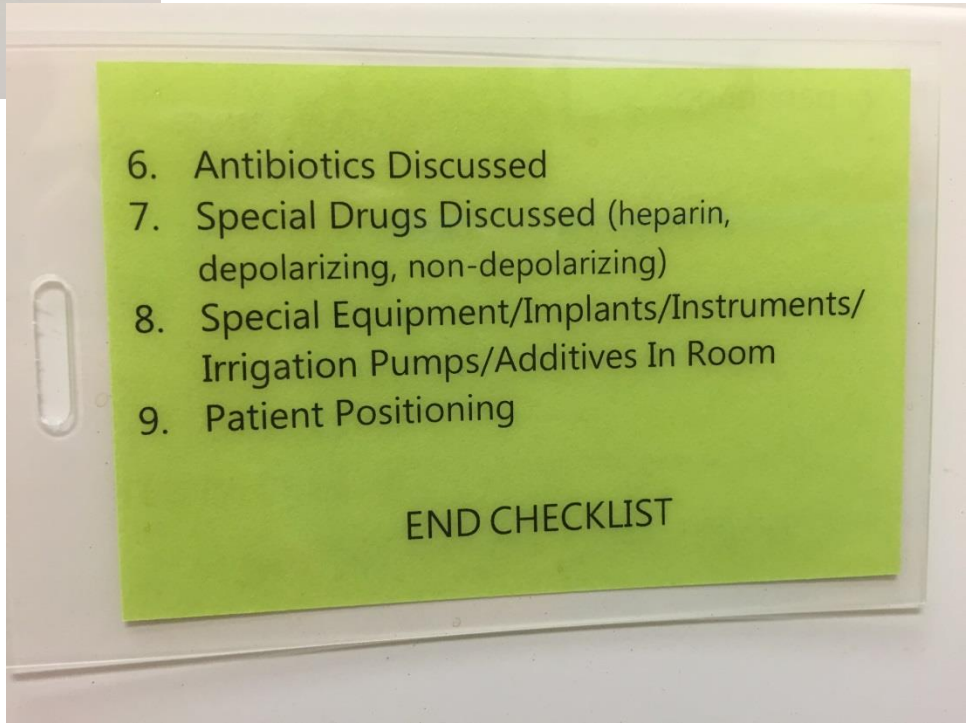
THIS CHECKLIST IS NOT INTENDED TO BE COMPREHENSIVE. ADDITIONS AND MODIFICATIONS TO FIT LOCAL PRACTICE ARE ENCOURAGED.

Pre-Induction Verification

1. Introductions
2. Patient identifiers
   Procedure, Surgical, Blood, Special Research Consents
3. Side and Site Marked
4. Diagnostic & Radiology Test Results Displayed
5. Allergy Review
6. **Antibiotics Discussed**
7. Special Drugs Discussed – heparin, depolarizing relaxants
8. Special Equipment/Implants/Instruments/Irrigation Pumps
9. Patient Positioning

End Checklist


Pre-Induction Verification
LED BY ANESTHESIA (Faculty, Resident or CRNA)
1. Introductions
2. Patient Identifiers/Procedure/Surgical, Blood & Special Research Consents
3. Side and Site Marked
4. Diagnostic & Radiology Test Results Displayed
5. Allergy Review
Continued →


6. Antibiotics Discussed
7. Special Drugs Discussed (heparin, depolarizing, non-depolarizing)
8. Special Equipment/Implants/Instruments/ Irrigation Pumps/Additives In Room
9. Patient Positioning
END CHECKLIST

Pre-Incision Time Out

1. Introductions: Name/Role/Experience
2. Patient Identifiers/Procedure/ Surgical, Blood & Research Consents
3. Side, Side, Laterality, Spine Level
4. Allergy Review
5. **Correct Antibiotics Administered**
6. Special Drugs (e.g. Heparin) Discussed
7. Special Equipment/Implants/Instruments/ Irrigation Pumps in Room
8. Specimen & Explant Handling
9. EBL & Transfusion Trigger
10. Patient Correctly Positioned
11. Fire Risk and Safety Precautions
12. Concerns About Case

Checklist Results

Surgical Outcome	Before Checklist	After Checklist
• Death	1.5%	0.8%
• Any Complication	11.0%	7.0%
• **Surgical Site Infection**	**6.2%**	**3.4%**
• Unplanned Return to OR	2.4%	1.8%

Source: "A Surgical Safety Checklist to Reduce Morbidity and Mortality in a Global Population," NEJM, Jan 20, 2009

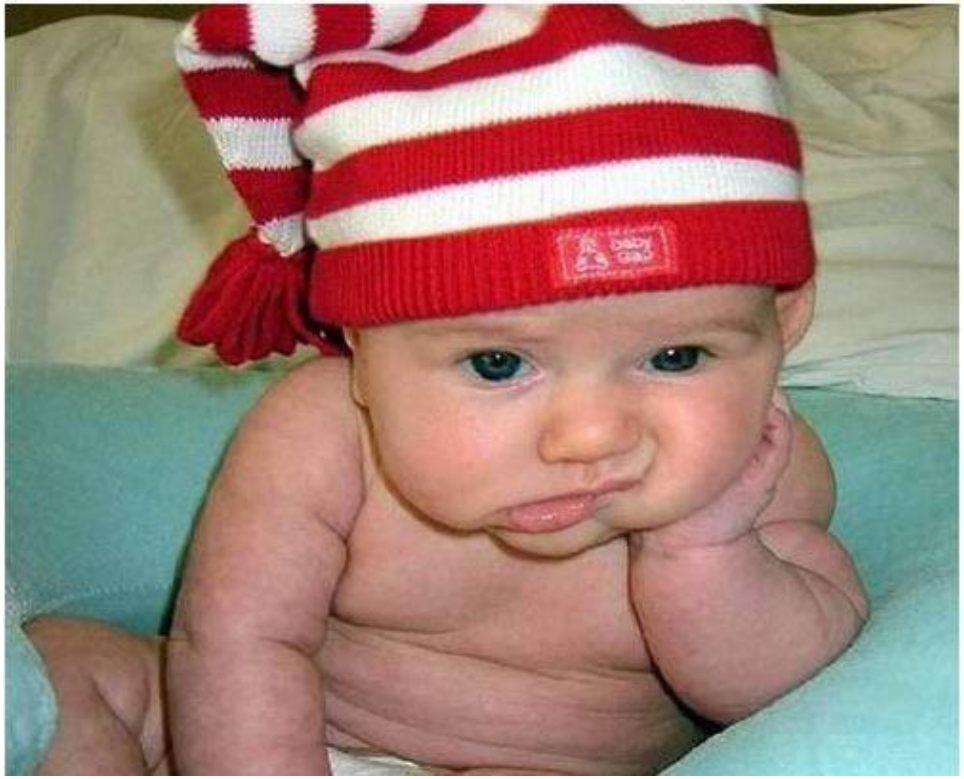
Individual Responsibility

Question:

- What is the compliance rate for hand washing by physicians at Mott Children's Hospital OR in June, 2015?

Answer:

20%



Why Don’t We Wash Our Hands?

- Old school thinking/Outmoded education
- Logistical issues/Access to sink
- Dry skin
- Systems problem but ultimately personal responsibility


World Health Organization


CDC
CENTERS FOR DISEASE
CONTROL AND PREVENTION

Your 5 Moments for Hand Hygiene

1	BEFORE TOUCHING A PATIENT	WHEN?	Clean your hands before touching a patient when approaching him/her.
		WHY?	To protect the patient against harmful germs carried on your hands.
2	BEFORE CLEAN/ ASEPTIC PROCEDURE	WHEN?	Clean your hands immediately before performing a clean/aseptic procedure.
		WHY?	To protect the patient against harmful germs, including the patient's own, from entering his/her body.
3	AFTER BODY FLUID EXPOSURE RISK	WHEN?	Clean your hands immediately after an exposure risk to body fluids (and after glove removal).
		WHY?	To protect yourself and the health-care environment from harmful patient germs.
4	AFTER TOUCHING A PATIENT	WHEN?	Clean your hands after touching a patient and her/his immediate surroundings, when leaving the patient's side.
		WHY?	To protect yourself and the health-care environment from harmful patient germs.
5	AFTER TOUCHING PATIENT SURROUNDINGS	WHEN?	Clean your hands after touching any object or furniture in the patient's immediate surroundings, when leaving – even if the patient has not been touched.
		WHY?	To protect yourself and the health-care environment from harmful patient germs.

World Health Organization

Patient Safety

A World Alliance for Safer Health Care

SAVE LIVES
Clean **Your** Hands

WHO acknowledges the Hôpitaux Universitaires de Genève (HUG), in particular the members of the Infection Control Programme, for their active participation in developing this material.

May 2009

www.who.int/gpsc/tools/Five-moments/en/

Joint Commission Targeted Solutions Tool

- JCAHO provides standards & let's us know what we're not doing correctly
  How do we improve?

- Joint Commission Center for Transforming Healthcare (CTH)

- Targeted Solutions Tool (TST ™) offers strategies to improve patient safety

- Provides improvement measures, tools to allow organizations to create safety processes
  1. Measures magnitude of the problem
  2. Identify why the process fails
  3. Create solutions to eliminate barriers to success

Ignaz Semmelweis

1847: Introduced hand washing

Learning Objectives

- Review surgical site infection metrics
- Summarize national accountability in our practice
- Delineate team approach
- Reinforce individual responsibility

The End