SURGICAL INFECTIONS!

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SSI

- #1 healthcare-associated infection in surgical patients, #2 HAI overall (2nd to UTI)
- 2% to 5% of patients undergoing inpt surgery
- 3% mortality, 2-11x higher risk of death
- SSI direct cause of 75% deaths in pts with SSI
- Increases length of stay (7-10 extra days)
- Increases cost (~$10 billion/yr, underestimate)
- Lots of antibiotics used
Surgery Truths

• All surgeries are contaminated
• You will find bacteria if you look hard enough
• So, why are some surgical sites with bacteria infected and some are not?
Risks at the Surgical Site

- Hematoma, seroma or fluid collection
- Necrotic tissue
- Space
- Foreign bodies/hardware
Patient Risks

- Age
- Tobacco use
- DM/hyperglycemia
- Obesity
- Malnutrition
- Hypothermia
- Hypoxemia
Types of Surgeries by Risk

• Class I: Clean
  – No infection or inflammation
  – No entry into pulmonary, alimentary or GU

• Class II: Clean-contaminated
  – Into the pulm, alimentary or GU tract
  – Bilary tract
  – Minor violation of aseptic technique

• Class III: Contaminated
  – Fresh traumatic wounds
  – GI or pulm with major contamination
  – Acute inflammation

• Class IV: Dirty-infected
Pathogen Source

Endogenous

– Patient flora
  • skin
  • Mucous membranes
  • GI tract
– Seeding from distant focus of infection
Pathogen Source

Exogenous

– Surgical personnel
  • Soiled attire
  • Breaks in aseptic technique
  • Breaks in hand hygiene
– OR physical environment
– Tools, equipment, materials

CDC.gov
### Most common microorganisms, 2006-2007

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>30%</td>
</tr>
<tr>
<td>Coagulase-negative staphylococci</td>
<td>13.7%</td>
</tr>
<tr>
<td><em>Enterococcus</em> spp.</td>
<td>11.2%</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>9.6%</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>5.6%</td>
</tr>
<tr>
<td><em>Enterobacter</em></td>
<td>4.2%</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>3.0%</td>
</tr>
<tr>
<td><em>Candida</em> spp.</td>
<td>2.0%</td>
</tr>
<tr>
<td><em>Klebsiella oxytoca</em></td>
<td>0.7%</td>
</tr>
<tr>
<td><em>Acinetobacter baumannii</em></td>
<td>0.6%</td>
</tr>
</tbody>
</table>
Challenges

• Detection
  – Lack of standardized methods, especially in outpatient setting
  – # outpatient surgeries increasing
  – Shorter inpt stays

• Antimicrobial prophylaxis: increasing antimicrobial resistant may overcome standard prophylaxis recs
Drug-Resistance

• MDR *Bacteroides fragilis*, Seattle, 2013
  – 70ish yo man dx with met adenocarcinoma while in India, received abx while there, then returned to US and admitted to HMC
  – Received chemo, surgical resection, then developed multiple peritoneal abscesses
  – Blood cultures and abd fluid cultures grew *B. fragilis* resistant to metronidazole, imipenem, pip/tazo, clindamycin, moxi, cefotetan, amp/sulb
  – Treated with linezolid + ertapenem

• MDR NDM-1+ polymicrobial wound infection, Seattle, 2011
  – 20 yo man s/p traumatic amputation of RLE in India transferred to HMC
  – Multiple GNRs with broad drug resistance, including to carbapenems
  – Cure took 4 surgeries, neutropenia, AKI + colistin, meropenem, rifampin and tigecycline

Kalapila MMWR 2013
A Case from Portugal

• 74 yo woman with DM/CKD on HD develops critical limb ischemia
• Undergoes revascularization and amputation of 2 toes
• H/o *P aeruginosa* and MRSA from toe wounds
• May 2013 VRSA isolated (MIC >256!) along with VRE and *P aeruginosa*
• VRSA was *mecaA* and *vanA* positive
Modifiable Risks (ABCDE....)

- **ABC** = airway, breathing, circulation (temperature, oxygenation, fluids)
- **ABCD** = ABC + drugs (antibiotics): choice, timing, dose (ex. for high BMI)
- **EFGH**...
  - Skin or site preparation (remove hair by clipping or depilatory agent, only if needed)
  - Colorectal procedures
    - Inadequate bowel prep/non-absorbable PO antibiotics
    - Intraoperative temperature

From Dellinger 2013 and CDC.gov
Modifiable Risks (...FCGHI....)

- OR traffic
- Wound dressing: keep sterile dressing in place 24-48hrs
- Glucose control, <200mg/dL
- Colonization with preexisting organisms
- Intraoperative oxygen levels (>49% fraction inspired O2 intra and immed post-op)

From Dellinger 2013 and CDC.gov
## Relative Benefit from Abx Prophylaxis

<table>
<thead>
<tr>
<th>Operation</th>
<th>Prophylaxis (%)</th>
<th>Placebo (%)</th>
<th>NNT*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colon</td>
<td>4-12</td>
<td>24-48</td>
<td>3-5</td>
</tr>
<tr>
<td>Other (mixed) GI</td>
<td>4-6</td>
<td>15-29</td>
<td>4-9</td>
</tr>
<tr>
<td>Vascular</td>
<td>1-4</td>
<td>7-17</td>
<td>10-17</td>
</tr>
<tr>
<td>Cardiac</td>
<td>3-9</td>
<td>44-49</td>
<td>2-3</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>1-16</td>
<td>18-38</td>
<td>3-6</td>
</tr>
<tr>
<td>Craniotomy</td>
<td>0.5-3</td>
<td>4-12</td>
<td>9-29</td>
</tr>
<tr>
<td>Spinal operation</td>
<td>2.2</td>
<td>5.9</td>
<td>27</td>
</tr>
<tr>
<td>Total joint repl</td>
<td>0.5-1</td>
<td>2-9</td>
<td>12-100</td>
</tr>
<tr>
<td>Brst &amp; hernia ops</td>
<td>3.5</td>
<td>5.2</td>
<td>58</td>
</tr>
</tbody>
</table>

From Dellinger 2013
Relative Effect of Abx Prophylaxis by Baseline Risk

Antibiotic Prophylaxis
Clean Operative Procedures

• Proportional reduction of infection is similar to other procedures
• Absolute number of infections prevented is lower with lower baseline infection rates
• Benefit of prophylaxis depends on
  – Baseline rate of infection
  – Effectiveness of prophylaxis
  – Cost of prophylaxis
  – Cost of infections prevented
Antibiotic Prophylaxis
Demonstrated Benefit: “Clean” Procedures

- Orthopedic joint replacements
- Open reduction of closed fractures
- Vascular prostheses
- Vascular procedures on the leg
- Median sternotomy
- Craniotomy
- Breast and hernia procedures
Perioperative Prophylactic Antibiotics

Timing of Administration

Infections (%)

Hours From Incision

Timing of Prophylactic Antibiotic Administration for Total Hip Arthroplasty

Timing of Prophylactic Antibiotic Administration – Cardiac, Arthroplasty, Hysterectomy

![Graph showing infection risk percentages at different times before or after surgical incision.](image)

Steinberg. TRAPE. Ann Surg 2009; 250:10
Timing of Prophylactic Vancomycin Administration & SSI Risk
Cardiac Surgery

Overall SSI Rate – 147/2048 = 7.2%

Post-Operative Antibiotic Prophylaxis

- Only 14.5% of 32,603 pts undergoing major surgery had antibiotic prophylaxis discontinued with 12hrs.
- 26.7% were still receiving this treatment 48hrs after surgery.
- A Japanese survey found that 56.4% of surgeons continue prophylaxis in clean-contaminated operations for 3-4 days.

Bratzler Arch Surg 2005
Sumiyama Jpn J Chemotherapy 2004
Post-Operative Antibiotic Prophylaxis

  - 7 hospitals, 355 pts, stop abx at end of surgery vs 2 days
  - SSI in 5% of the “short” group vs 9% in the “long” group (no statistical difference)
Post-Operative Antibiotic Prophylaxis

• Short duration of antibiotic prophylaxis in open fracture does not enhance risk of subsequent infection. Dunkel et al. Bone Joint J. 2013.

Antibiotic-Containing Cement in TKR

• “Risk factors associated with deep surgical site infections after primary total knee arthroplasty”
  – Observational study of 56,216 knees
  – Antibiotic-containing cement significantly associated with risk of infection
• “The use of erythromycin and colistin-loaded cement in total knee arthroplasty does not reduce the incidence of infection. A prospective randomized study of 3000 knees”
  – No difference between the 2 groups (both ~1.4%)
Antibiotic-Containing Cement in TKR

• “Risk factors associated with deep surgical site infections after primary total knee arthroplasty”
  – BMI .34
  – DM
  – Male sex
  – ASA score >2
  – Osteonecrosis
  – Post-traumatic arthritis
  – Protective: antibiotic irrigation, bilateral procedure, lower annual hospital volume

Namba  J Bone Joint Surg 2013
**S aureus Vaccination?**

- New cardiac valve or endograft, mortality ~50% with infection (mostly *S aureus*)
- 4-year, multicenter RCT of V710 to prevent bacteremia and deep sternal wounds after cardiac surgery (*n* = 7045)
- Vaccine generated excellent Ab responses
- No significant difference between the groups (22 and 27 cases)
- There were significantly more deaths in the vaccinated group who did get *S aureus* infection (mortality rates 23 vs 4.2/100py)

Fowler JAMA 2013
Oxygen and SSI
Influence of Oxygen on the Development of Wound Infection

Diameter Infectious Necrosis (mm)

Hours After Innoculation

Near InfraRed O2 Saturation in the Surgical Incision at 12 hrs

Arm Tissue $O_2$ Saturation and SSI

Govinda. Anesth & Analg 2010; 111: 946-52
Oxygen and SSI

• Oxygen tension in the wound is important.

• How to translate that into clinical practice that lowers SSI is less obvious.
Less Obvious Risk Factors for SSI

• Blood transfusion after cardiac surgery
  – 5,128 pts prospectively enrolled
  – 31% bypass, 30% valve, 19% re-operations
  – Each unit of PRBC was associated with a 29% increase in crude risk of major infection (pneumonia and BSI)

Horvath Ann Thorac Surg 2013
MRSA Colonization

- *S aureus* colonization is common (~20-30% with persistent colonization)
- Higher rates in hospitalized pts, HIV+, IVDU, HD
- Nose, throat, perineum, GI tract, wounds
- Colonization confers 2-12x greater risk of infection, bacterial density may also play a role in SSI risk
- MRSA colonizatin may confer > risk than MSSA
MRSA DE-colonization

• Many topical agents: bacitration, chlorexidine, fusidic acid, medicinal honey, mupirocin, neomycin, triclosan, etc
• Systemic: rifampicin, vancomycin, TMP/SMX
• Other: photodynamic therapy, phages, vaccination
• Decolonization with mupirocin or chlorhexidine, alone or together, decreased colonization and a decrease in nosocomial infection, esp SSI, compared to placebo (ARR 6.4%, p=0.002)

Segers JAMA 2006
A Bundled Approach

• De-colonization plus....
<table>
<thead>
<tr>
<th>Study</th>
<th>No of events/total</th>
<th>Risk ratio (95% CI)</th>
<th>Weight (%)</th>
<th>Risk ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention</td>
<td>Control</td>
<td>M-H, random</td>
<td>M-H, random</td>
</tr>
<tr>
<td>Jog 2008</td>
<td>8/765</td>
<td>13/697</td>
<td>12.4</td>
<td>0.56 (0.23 to 1.34)</td>
</tr>
<tr>
<td>Acebedo 2009</td>
<td>9/1072</td>
<td>16/909</td>
<td>14.4</td>
<td>0.48 (0.21 to 1.07)</td>
</tr>
<tr>
<td>Kim 2010</td>
<td>13/7019</td>
<td>24/5293</td>
<td>20.9</td>
<td>0.41 (0.21 to 0.80)</td>
</tr>
<tr>
<td>Hadley 2010</td>
<td>3/1644</td>
<td>1/414</td>
<td>1.9</td>
<td>0.76 (0.08 to 7.24)</td>
</tr>
<tr>
<td>Rao 2011</td>
<td>5/1440</td>
<td>11/741</td>
<td>8.6</td>
<td>0.23 (0.08 to 0.67)</td>
</tr>
<tr>
<td>Sporer 2011</td>
<td>18/3180</td>
<td>17/1693</td>
<td>21.8</td>
<td>0.56 (0.29 to 1.09)</td>
</tr>
<tr>
<td>Walsh 2011</td>
<td>10/2496</td>
<td>42/2766</td>
<td>20.1</td>
<td>0.26 (0.13 to 0.52)</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>66/17 616</td>
<td>124/12 513</td>
<td>100.0</td>
<td>0.41 (0.30 to 0.56)</td>
</tr>
</tbody>
</table>

Test for heterogeneity: $\tau^2=0.00$, $\chi^2=4.50$, df=6, $P=0.61$, $I^2=0\%$

Test for overall effect: $z=5.65$, $P<0.001$

Bundle intervention to prevent surgical site infections caused by Gram positive bacteria
Nasal decolonization to prevent SSI by Gram positive bacteria

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>No of events/total</th>
<th>Risk ratio (95% CI) M-H, random</th>
<th>Weight (%)</th>
<th>Risk ratio (95% CI) M-H, random</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Randomized controlled trials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bode 2010⁷⁷</td>
<td>3/278 17/227</td>
<td>4.4 0.14 (0.04 to 0.49)</td>
<td>5.0</td>
<td>5.0 0.59 (0.20 to 1.79)</td>
</tr>
<tr>
<td>Kalmeijer 2002²⁸</td>
<td>5/315 8/299</td>
<td>4.0 1.22 (0.34 to 4.44)</td>
<td>6.6</td>
<td>6.6 0.80 (0.34 to 1.91)</td>
</tr>
<tr>
<td>Konvalinka 2006²⁴</td>
<td>5/130 4/127</td>
<td>0.4 1.22 (0.34 to 4.44)</td>
<td>6.6</td>
<td>6.6 0.80 (0.34 to 1.91)</td>
</tr>
<tr>
<td>Perl 2002²⁵</td>
<td>24/285 11/346</td>
<td>11.0 0.82 (0.53 to 1.28)</td>
<td>31.0</td>
<td>31.0 0.63 (0.36 to 1.13)</td>
</tr>
<tr>
<td>Segers 2006²⁶</td>
<td>34/485 40/469</td>
<td>0.4 1.22 (0.34 to 4.44)</td>
<td>6.6</td>
<td>6.6 0.80 (0.34 to 1.91)</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>56/1561 80/1468</td>
<td>0.4 1.22 (0.34 to 4.44)</td>
<td>6.6</td>
<td>6.6 0.80 (0.34 to 1.91)</td>
</tr>
<tr>
<td><strong>Observational studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cimochowski 2001²⁹</td>
<td>5/854 19/992</td>
<td>5.8 0.31 (0.11 to 0.82)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Coskun 2004³⁵</td>
<td>9/2329 14/920</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Coskun 2005³⁰</td>
<td>27/7555 27/4511</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Gemaat-van der Sluis 1998³⁶</td>
<td>7/1044 14/1260</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Graf 2009³¹</td>
<td>9/154 22/154</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Hacek 2009³⁸</td>
<td>10/912 15/583</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Kluytmans 1996³²</td>
<td>11/752 6/116</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Martorell 2004³³</td>
<td>3/469 11/466</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Nicholson 2006³⁴</td>
<td>4/1077 16/954</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Price 2008³⁷</td>
<td>0/43 2/41</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Sankar 2005⁴⁰</td>
<td>0/231 1/164</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Wilcox 2003³⁹</td>
<td>11/2959 26/1161</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>96/18 379 173/11 322</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
<td>6.9</td>
<td>6.9 0.25 (0.11 to 0.58)</td>
</tr>
</tbody>
</table>

- Test for heterogeneity: \( \chi^2 = 11.88, \) df = 11, \( P = 0.37, I^2 = 7\%
- Test for overall effect: \( z = 7.64, P < 0.001 \)

**Total (95% CI)**

<table>
<thead>
<tr>
<th>Study or subgroup</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>152/19 940 253/12 790</td>
<td>100.0 0.41 (0.30 to 0.55)</td>
<td>100.0</td>
<td>100.0 0.41 (0.30 to 0.55)</td>
</tr>
</tbody>
</table>

- Test for heterogeneity: \( \chi^2 = 30.21, \) df = 16, \( P = 0.02, I^2 = 47\%
- Test for overall effect: \( z = 5.73, P < 0.001 \)
- Test for subgroup differences: \( \chi^2 = 3.34, \) df = 1, \( P = 0.07, I^2 = 70.1\% \)
Surgical team behaviors and patient outcomes

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Kenneth T. Fong, M.S.\textsuperscript{c}, Doug Bonacum, M.B.A.\textsuperscript{c}, John Brookey, M.D.\textsuperscript{d},
Suzanne Graham, R.N., Ph.D.\textsuperscript{e}, Robert E. Lasky, Ph.D.\textsuperscript{f}, J. Bryan Sexton, Ph.D.\textsuperscript{g},
Eric J. Thomas, M.D., M.P.H.\textsuperscript{f}

\textsuperscript{a}Sharp Metropolitan Medical Campus, Sharp Healthcare, Patient Relations and Concierge Services, San Diego, CA USA; \textsuperscript{b}Arizona State University, Tempe, AZ, USA; \textsuperscript{c}Kaiser Permanente Program Offices, Oakland, CA, USA; \textsuperscript{d}Kaiser Permanente Southern California, Pasadena, CA, USA; \textsuperscript{e}Kaiser Permanente Northern California, Oakland, CA, USA; \textsuperscript{f}University of Texas Medical School, Houston, TX, USA; \textsuperscript{g}Johns Hopkins School of Medicine, Baltimore, MD, USA
Resources for Implementation
WHO Surgical Safety Checklist

Surgical Safety Checklist

Before Induction of anaesthesia
(with at least nurse and anaesthetist)

- Has the patient confirmed his/her identity, site, procedure, and consent?
  - Yes
  - No

- Is the site marked?
  - Yes
  - Not applicable

- Is the anaesthesia machine and medication check complete?
  - Yes

- Does the patient have:
  - Known allergy?
    - No
    - Yes
  - Difficult airway or aspiration risk?
    - No
    - Yes, and equipment/assistance available
  - Risk of >500ml blood loss (7ml/kg in children)?
    - No
    - Yes, and two IVs, central access and fluids planned

Before skin incision
(with nurse, anaesthetist and surgeon)

- Confirm all team members have introduced themselves by name and role.
- Confirm the patient’s name, procedure, and where the incision will be made.
- Has antibiotic prophylaxis been given within the last 60 minutes?
  - Yes
  - Not applicable

Anticipated Critical Events

To Surgeon:
- What are the critical or non-routine steps?
- How long will the case take?
- What is the anticipated blood loss?

To Anaesthetist:
- Are there any patient-specific concerns?

To Nursing Team:
- Has sterility (including indicator results) been confirmed?
- Are there equipment issues or any concerns?

Is essential imaging displayed?
- Yes
- Not applicable

Before patient leaves operating room
(with nurse, anaesthetist and surgeon)

Nurse Verbally Confirms:
- The name of the procedure
- Completion of instrument, sponge and needle counts
- Specimen labelling (read specimen labels aloud, including patient name)
- Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- What are the key concerns for recovery and management of this patient?
Prior to Skin Incision:

Briefing

Nursing/Tech reviews:
- Equipment issues (instruments ready, trained on, requested implants available, gas tanks full)
- Sharps management plan
- Other patient concerns

Anesthesia reviews:
- Airway or other concerns
- Special meds (beta blockers, etc.)
- Allergies
- Conditions affecting recovery

All Team Members (Attending Surgeon Leads):
- Each person introduces self by name and role
- Surgeon, Anesthesia team and Nurse confirm patient (at least 2 identifiers), site, procedure
- Personnel exchanges: timing, plan for announcing changes
- Description of procedure and anticipated difficulties
- Expected duration of procedure
- Expected blood loss & blood availability
- Need for instruments/supplies/IV access beyond those normally used for the procedure
- Questions/issues from any team member and invitation to speak up at any time in the procedure
Prior to Skin Incision:

**Surgeon** reviews (as applicable):

- Essential imaging displayed; right and left confirmed
- Antibiotic prophylaxis given in last 60 minutes
- Active warming in place
- Special instruments and/or implants

*If case expected to be ≥ 1 hour, add:*

**Surgeon** reviews:

- Glucose checked for diabetics
- Insulin protocol initiated if needed
- DVT/PE chemoprophylaxis and/or mechanical prophylaxis plan in place
- If patient on beta blocker, post-op plan formulated
- Re-dosing plan for antibiotics
- Specialty-specific checklist
After Skin Closure Complete:

No Retained Objects, Debriefing, Care Transition

Surgeon and Anesthesia:

- Key concerns for patient recovery
- What is the plan for pain mgmt?
- What is the plan for prevention of PONV?
- Does patient need special monitoring (time in RR, ICU, tele?)
- If patient has elevated blood glucose, plan for insulin drip formulated
- If patient on beta blocker, post-op continuation plan formulated

All Team Members
(Attending Surgeon Leads):

- Confirm final needles/sponges/instruments count correct
- Nursing/Tech show Surgeon and Anesthesia all sponges and laps in holders (“Show Me Ten”)
- Confirm name of procedure
- If specimen, confirm label and instructions (e.g., orientation of specimen, 12 lymph nodes for colon CA)
- Equipment issues to be addressed?
- Response planned (who/when)
- What could have been better?
- Improvement planned (who/when)
## Checklist and Complications

<table>
<thead>
<tr>
<th></th>
<th>Before (n=3773)</th>
<th>After (n=3955)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI</td>
<td>6.2%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Unplan Return-O.R.</td>
<td>2.4%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Any Complic</td>
<td>11.0%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Death</td>
<td>1.5%</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

Haynes. NEJM 2009; 360: 491-9
## Checklist and Complications

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=3760</td>
<td>n=3820</td>
</tr>
<tr>
<td>SSI</td>
<td>3.8%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Complic/100 pts</td>
<td>27.3</td>
<td>16.7</td>
</tr>
<tr>
<td>Pts with Complic</td>
<td>15.4%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Death</td>
<td>1.5%</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

de Vries. NEJM 2010; 363: 1928-37
Checklist Completion and Complications

- Checklist Completion
  - Above median: 7.1%
  - Below median: 11.7%

de Vries. NEJM 2010; 363: 1928-37
Effect of Noise in the O.R. on SSI Risk

Preventing SSI

• Have good teamwork at all times
• Prewarm the patient
• Enough of the right antibiotic at the right time and repeat if necessary
• Don’t shave
• Thorough skin prep
• Warm the patient in the O.R.
• High FiO$_2$
• Control glucose
• Good teamwork
More Information

• www.scoap.org
• www.safesurg.org
• www.who.int/patientsafety/safesurgery/en.index.html