Why an MPH matters: How a Public Health Background Improves Surgical Quality

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Providence Health System – Oregon Region
Agenda

• Principles of quality improvement
• Surgical infection prevention
• Introduction to surgical databases
An MPH? But you’re a surgeon!

• True, but my MPH has helped me:
  – Critically analyze surgical literature
  – Design clinical outcomes projects
  – Perform my own data analysis
  – Lead quality improvement programs
  – Given me a data “bullsh**” meter
**Example**

<table>
<thead>
<tr>
<th>BMI</th>
<th># of Infections</th>
<th>Total # of Surgeries</th>
<th>Prevalence</th>
<th>OR(CI)</th>
<th>Adjusted OR</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (&lt;18.5)</td>
<td>7</td>
<td>381</td>
<td>3.4%</td>
<td>0.87(0.38,1.89)</td>
<td>0.76</td>
<td></td>
</tr>
<tr>
<td>Normal weight (18.5-24.9(ref))</td>
<td>78</td>
<td>3694</td>
<td>32.8%</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight (25-29.9)</td>
<td>107</td>
<td>3761</td>
<td>33.2%</td>
<td>1.36(1.01,1.85)</td>
<td>1.42</td>
<td>0.049</td>
</tr>
<tr>
<td>Obesity Class I (30-34.9)</td>
<td>52</td>
<td>2002</td>
<td>17.7%</td>
<td>1.24(0.79,1.64)</td>
<td>1.22</td>
<td>0.244</td>
</tr>
<tr>
<td>Obesity Class II (35-39.9)</td>
<td>21</td>
<td>886</td>
<td>7.9%</td>
<td>1.13(0.64,1.71)</td>
<td>1.15</td>
<td>0.624</td>
</tr>
<tr>
<td>Obesity Class III (&gt;=40)</td>
<td>21</td>
<td>581</td>
<td>5.1%</td>
<td>1.74(1.04,2.84)</td>
<td>1.76</td>
<td>0.034</td>
</tr>
</tbody>
</table>

**Conclusion:** In order to avoid postop infections, we should have our overweight patients gain more weight.
Why quality improvement?
Why quality improvement?
“The immediate challenge to improving the quality of surgical care is not discovering new knowledge, but rather how to integrate what we already know into practice”.

Urbach DR, Baxter NN. BMJ 2005
What is quality improvement?

• **Goal:**
  – To fix the system

• **Context:**
  – Patient safety
  – Outcomes focus

• **Methods:**
  – Team building
  – Using data

DMAIC: Six Sigma Process Improvement Model
Challenges to QI

- Applying linear logic (protocols) to an inherently chaotic system (patients)

- Old dogs can’t learn new tricks?

- Resources
Challenges to QI

- Cause-and-effect dilemma
- It’s all about the numerator and the denominator
  - What are/aren’t we measuring?
  - Ascertainment bias
QI project

- How can we reduce post-operative skin and soft tissue infections (SSIs)?
  - Major targets:
    - Colon surgery
    - Hysterectomy
SSI: Epidemiology

• **Incidence:** >500,000 in US annually

• **Clinical burden:**
  – 7-10 additional hospital days
  – 2-11 times higher risk of death
  – 3% mortality
  – $10 billion annually in inpatient costs
    • This doesn’t include readmissions or outpatient expenses

Anderson et al. ICHE, 2008, 29 (S1)
SSI: Epidemiology

• Pay-for-performance programs:
  – Measured by CMS as marker of hospital quality as part of their value-based purchasing program
  – Provides incentives to high-performing hospitals
SSI: CDC/NHSN Definitions

• Any of the following
  – Pus in wound: superficial
  – Abscess (on CT scan): deep or organ space
  – Positive wound culture
  – Surgeon opens incision 2/2 pain, swelling, redness, heat
    • UNLESS negative culture
  – Physician documentation
What causes surgical infections?
What causes surgical infections?

- It’s the surgeon’s fault
  - Bad surgery
  - Long surgery
  - Hair uncovered
  - Break in sterile field
What causes surgical infections?

• It’s the patient’s fault
  – Obese
  – Smoker
  – Poor bowel prep
  – Diabetes
  – Immunosuppression
What causes surgical infections?

• It’s anesthesia’s fault (always)
  – Hypothermia: <36 degrees
  – Antibiotic issue
    • Wrong one
    • Too little: initial dose, redose
    • Too late
What causes surgical infections?

• It’s the hospital’s fault
  – OR traffic
  – Unsterile equipment
  – Iatrogenic spread
  – Poor safety culture
What causes surgical infections?

<table>
<thead>
<tr>
<th>Intrinsic - patient-related</th>
<th>Non-Modifiable</th>
<th>Modifiable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Radiation</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Radiation</td>
<td>Previous SSI</td>
<td>Obesity</td>
</tr>
<tr>
<td>Previous SSI</td>
<td></td>
<td>Alcohol abuse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Malnutrition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Immunosuppression</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Extrinsic - procedure-related</th>
<th>Non-Modifiable</th>
<th>Modifiable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency</td>
<td></td>
<td>OR ventilation</td>
</tr>
<tr>
<td>Lengthy/complex</td>
<td>Dirty wound class</td>
<td>OR traffic</td>
</tr>
<tr>
<td>Dirty wound class</td>
<td></td>
<td>Non-sterile equipment</td>
</tr>
</tbody>
</table>
What causes surgical infections?

Swiss Cheese Model of Risk/Error
What prevents SSIs?
What prevents SSIs?

Pre-hospital interventions

• Chlorhexidine wipes/baths
  – Not proven to reduce SSI in Cochrane DB

• No smoking for 4-6 weeks
  – ? Marijuana? E-cigarettes?
  – ACS supports nicotine supplements
What prevents SSIs?

Pre-hospital interventions

• Glucose control
  – No evidence that decreasing Hba1c reduces SSI

• MRSA decolonization
  – Only in joints/cardiac

• Combined oral/mechanical bowel prep
What prevents SSIs?

Periop interventions

- Minimize hair clipping
- Alcohol skin prep
- Limited data on surgical attire
- Appropriate, timely antibiotics, stopping postop
- Normothermia with preop warming
What prevents SSIs?

Periop interventions
- Wound protectors (esp. colorectal/HPB)
- Consider antibiotic sutures
- Double gloves and change prior to skin closure
- New instruments for skin closure
- Leave wound open/wound vacuum
- Wound probing in contaminated wounds
SSI Prevention Pitfalls

It’s complicated!

• The causes of SSI are myriad
• Most data are weak for any single intervention
• National guidelines vary (and change over time)
SSI Prevention Pitfalls

• Approach is often shotgun
  – Result: Hawthorne effect? Practice change?
• Is the numerator staying the same?
• Every hospital has unique patient population
  – Diagnoses, SES, smoking, nutrition, obesity

Identifying the high-risk patient is the key!
SSI Prevention Pitfalls

Antibiotic prophylaxis

- Bacterial resistance to recommended antibiotic
- Inadequate coverage for unplanned/emergent procedures
- Improper timing (pre-incision dose >1 hour)
- Forgetting to re-dose based on time or blood loss
- Inadequate dose based on body mass index
- Patient “allergies” to best antibiotics

Allergies

Sulfamethoxazole W/trimethoprim (co-trimoxazole)
Upset stomach
SSI Prevention Pitfalls

Case definitions

• What if skin is left open?
• What if the gram stain is positive, but the culture is negative?
SSI Surveillance Pitfalls

• **Under-reporting: false negatives**
  – Poor outpatient surveillance
  – SSI >30 days
  – More outpatient surgeries
  – Shorter LOS
  – Wrong procedures in denominator
    • endoscopy, perineal approaches, ileostomy closures, rectopexy

• **Over-reporting: false positives**
  – Opening a wound for a seroma (and not culturing!)
So...let’s prevent them!

BUT FIRST!

• Review the literature
• Review your own data
  – You have to trust your data to trust your progress
• What is your numerator and denominator?
• What are the risk factors?
• What is your measureable goal?
How can data lie?

• The numerator is wrong
  – Cases are missed
    • Beyond 30 days
    • Incomplete capture: relying on physician self report
    • “Juking” the stats
Asst. Principal Sampson: "All teachers will devote class time to teaching language arts sample questions. Now if you turn to page 11…"

Dect. Pryzbylewski: “I don't get it. All this so we score higher on the state tests? If we're teaching the kids the test questions, what is it assessing in them?”

S: “Nothing. It assesses us. The test scores go up, they can say the schools are improving. The scores stay down, they can't.”

P: “Juiking the stats.”

S: “Excuse me?”

P: “Making robberies into larcenies. Making rapes disappear. You juke the stats, and majors become colonels. I've been here before.”
What are we measuring?

What aren’t we measuring?

What are we missing?

What are we including incorrectly?
What databases are we using?

- Premier
- NHSN
- NSQIP
<table>
<thead>
<tr>
<th>Database</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premier</td>
<td>National</td>
<td>In hospital deaths only</td>
</tr>
<tr>
<td></td>
<td>Publicly reported</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-populates from EPIC</td>
<td></td>
</tr>
<tr>
<td>NHSN</td>
<td>CDC “gold standard”</td>
<td>Doesn’t include rectal procedures</td>
</tr>
<tr>
<td></td>
<td>Nationally used</td>
<td></td>
</tr>
<tr>
<td>NSQIP</td>
<td>30 day individual follow up</td>
<td>Expensive</td>
</tr>
<tr>
<td></td>
<td>Very granular</td>
<td>Limited/high-volume hospitals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Case sampling</td>
</tr>
</tbody>
</table>
NHSN

• National Healthcare Safety Network
• CDC program; voluntary national reporting
• Reports aggregated surveillance data from U.S. hospitals
• Standardized definitions for infection and risk-stratification methodology
• National data on pooled mean and percentiles
NHSN SSI Surveillance

• Infection Preventionist (IP) determines if patient meets NHSN SSI definition
• Once infections are confirmed, the IP enters data into CDC’s NHSN database
• Data are then extracted by CMS, state agencies, PHS’ Clinical Analytics
• Clinical Analytics uses data to populate the tableau dashboards
NHSN SSI surveillance

- **Data Sources**
  - Microbiology results
  - Readmissions
  - Coding data
  - Voluntary physician notification

- **Population:**
  - Inpatient only procedures, based on ICD-10 codes
ACS NSQIP

- American College of Surgeon’s National Surgical Quality Improvement Program

- Data-driven, risk-adjusted, outcomes-based program to measure and improve the quality of surgical care

- Originated at VHA (VASQIP) in 1991

- Partners with CMS to publicly report surgical outcomes on the Hospital Compare website
Quality Improvement Process

1. Hospitals abstract data
2. Data are analyzed by ACS NSQIP.
3. Data are reported back to hospitals.
4. Hospitals act on their data.
5. Hospitals monitor interventions with data.
Participating Hospitals

Number of Sites by State, Region, and Country Included in the January 2017 SAR (664)

ACS NSQIP Adult

- CANADA 61
- WEST 117
- MIDWEST 155
- NORTHEAST 134
- USA 587

- AUSTRIA 1
- AUSTRALIA 5
- LEBANON 1
- JORDAN 1
- PHILIPPINES 1
- SAUDI ARABIA 4
- UNITED ARAB EMIRATES 2
- UNITED KINGDOM 1
Hospital Characteristics

Based on U.S. hospitals with data reported to the American Hospital Association (AHA).

Licensed Beds

- 38% Under 100
- 28% 100-299
- 26% 300-499
- 8% 500 or more

Teaching Affiliation

- 35% Non-Teaching
- 34% Major
- 31% Minor

Cases by Bed Size and Hospital Type

- Non-Teaching
- Academic/Teaching

Number of Cases in Report

Bed Size

- Total
- Under 100
- 100-299
- 300-499
- 500 or more
Clinical data collection

- Surgical Clinical Reviewers (SCR)
  - fully trained, periodic audits

- 30 day follow up
  - manual review of outcomes via outpatient/inpatient charts (including paper!)

- Standardized and validated data definitions

- Advanced data analytics provide risk adjustment and smoothing (reliability adjustment for small sample sizes)
Data fields

• Demographics
• Clinical laboratory variables
• Complications
• 30-day outcomes/complications
• Discharge variables
• Custom fields: pancreatic fistulae, bowel prep
Case selection

• Systematic sampling of general, vascular, and subspecialty surgical cases
  • can request 100% capture (colorectal)

• 8-day cycle eliminates bias due to day of week
Options for data analysis/reporting

• Semiannual Reports (SARs)
  • risk-adjusted and smoothed odds ratios
  • comparison to other NSQIP hospitals
  • real-time modeling

• Participant Use Files (PUFs)
  • research file contains all cases reported since 2005
<table>
<thead>
<tr>
<th>Outlier and Decile Status</th>
<th>Number of Events / Total Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 / 40</td>
<td>T GEN Whipple Pancreatectomy Mortality</td>
</tr>
<tr>
<td>9 / 40</td>
<td>T GEN Whipple Pancreatectomy Morbidity</td>
</tr>
<tr>
<td>0 / 40</td>
<td>T GEN Whipple Pancreatectomy Cardiac</td>
</tr>
<tr>
<td>1 / 40</td>
<td>T GEN Whipple Pancreatectomy Pneumonia</td>
</tr>
<tr>
<td>2 / 40</td>
<td>T GEN Whipple Pancreatectomy Unplanned Intubation</td>
</tr>
<tr>
<td>1 / 40</td>
<td>T GEN Whipple Pancreatectomy Ventilator &gt; 48 Hrs</td>
</tr>
<tr>
<td>2 / 40</td>
<td>T GEN Whipple Pancreatectomy VTE</td>
</tr>
<tr>
<td>0 / 40</td>
<td>T GEN Whipple Pancreatectomy Renal Failure</td>
</tr>
</tbody>
</table>

Targeted - General 07/01/15 - 06/30/16

Site: 0197

<table>
<thead>
<tr>
<th>Hospital Odds Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.14</td>
</tr>
<tr>
<td>0.95</td>
</tr>
<tr>
<td>0.91</td>
</tr>
<tr>
<td>0.98</td>
</tr>
<tr>
<td>1.13</td>
</tr>
<tr>
<td>1.08</td>
</tr>
<tr>
<td>1.03</td>
</tr>
<tr>
<td>0.89</td>
</tr>
</tbody>
</table>
In summary...

• Don’t just throw a bunch of darts and see what sticks

• Know your own weaknesses
  – Hospital, data
In summary...

- Pick a bundle and stick to it
- Do what works for your institution
- Make it scalable and reproducible
- Measure it
How to make systems change

Example: Implementing an SSI bundle

1. Multidisciplinary discussions
2. Consensus on pathway specifics
3. Roll out to each caregiver team
4. Step-wise introduction of pathway
5. Track outcomes
6. Re-evaluate pathway steps
What is your passion?
Thank you!