SSI Surveillance Strategies in Under-Resourced Settings

Joseph S. Solomkin, MD, FACS, FIDSA
On behalf of the World Surgical Infection Society

Hosted by Dr. Kamal Rasa
World Surgical Infection Society, Turkey

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Objectives

- Explain the need for SSI surveillance in order to support infection prevention and safe surgery
- Outline the approaches taken to conduct SSI surveillance
- Describe the challenges and some of the proposed solutions for undertaking SSI surveillance in under-resourced settings
- Summarize the role of the World Surgical Infection Society (WSIS) in supporting surveillance and improvement in under resourced setting

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Surgical Site Infection Rates Through Time

Hand hygiene
Site preparation
Delicate technique
Antibiotic prophylaxis
Surveillance
SCIP
SUSP

Surgical Site Infection Rate

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What is a Surgical Site Infection (SSI)?

CDC/NHSN definition of SSI: “Infection occurring at the operation site within 30 days of the procedure.”

ref: Horan TC, Am J Inf Cont 2008

Less severe, but harder to reliably diagnose

COMPLEX SSI: More severe, straightforward diagnosis

SSI Rates in Low- and Middle-Income Countries According to Wound Classification

<table>
<thead>
<tr>
<th>Wound Classification</th>
<th>SSI Pooled Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean</td>
<td>11.5%</td>
</tr>
<tr>
<td>Clean-contaminated</td>
<td>16.6%</td>
</tr>
<tr>
<td>Contaminated</td>
<td>21.3%</td>
</tr>
<tr>
<td>Dirty</td>
<td>38.8%</td>
</tr>
</tbody>
</table>

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Background: Impact

Length of Hospital Stay
- 7-10 additional postoperative hospital days

Cost
- $3000-$29,000/SSI depending on procedure & pathogen
- Up to $10 billion annually
- Most estimates are based on inpatient costs at time of index operation and do not account for the additional costs of rehospitalization, post-discharge outpatient expenses, and long term disabilities
Value of Cesarean Section (CS) as a Model Operation for SSI Prevention Research

► 50-80% of surgery in Sub-Saharan Africa is CS
► CS is a highly standardized operation
► Young, typically healthy patients
Infection Rates in Cesarean Section in Sub-Saharan Africa - A Systematic Review

Key Elements in Reducing SSI

CDC classification

Ad hoc


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Challenges for SSI Surveillance and Prevention in LMIC Setting

- Excluding the highest level, national referral hospitals, many facilities in LMIC are understaffed and short on resources.
- When there is already a struggle to handle the patient load, programs such as HAI/SSI Surveillance and IPC are considered optional “extras”
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Why Bother with New Guidelines in Infection Control?

- The broad goal of health care is to safely improve the quality of life for our community
- This is now phrased as creating a culture of safety
- Guidelines are intended to establish “best practices” to achieve this
- Appropriate topics include:
  - The structure for administered services (Core Components)
  - The communication skills of health care workers
  - The details of technical care (this guideline)
<table>
<thead>
<tr>
<th><strong>HAIR REMOVAL</strong></th>
<th>In patients undergoing any surgical procedure, hair should either not be removed or, if absolutely necessary, it should be removed only with a clipper. Shaving is strongly discouraged at all times, <strong>Strong recommendation</strong> Moderate quality of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HAND PREPARATION</strong></td>
<td>Surgical hand preparation should be performed using either a suitable antimicrobial soap and water or a suitable alcohol-based hand rub. <strong>Strong recommendation</strong></td>
</tr>
<tr>
<td><strong>PREOPERATIVE BATHING</strong></td>
<td>Patients should bathe or shower before surgery; either a plain soap or an antimicrobial soap may be used for this purpose <strong>Conditional recommendation</strong> moderate quality of evidence</td>
</tr>
<tr>
<td><strong>SURGICAL SITE PREPARATION</strong></td>
<td>Alcohol-based antiseptic solutions based on CHG for surgical site skin preparation should be used in patients undergoing surgical procedures <strong>Strong recommendation</strong> moderate to low quality of evidence</td>
</tr>
</tbody>
</table>

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## ANTIBIOTIC PROPHYLAXIS

When indicated (depending on the type of operation), surgical antibiotic prophylaxis should be administered prior to the surgical incision, and within 120 minutes before incision, while considering the half-life of the agent.

**Strong recommendation**  
**Moderate quality of evidence**

Surgical antibiotic prophylaxis administration should not be prolonged after completion of the operation for the purpose of preventing SSI.

**Strong recommendation**  
**Moderate quality of evidence**

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<table>
<thead>
<tr>
<th>WHO</th>
<th>CDC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PERIOPERATIVE OXYGENATION</strong></td>
<td>For patients with normal pulmonary function undergoing general anesthesia with endotracheal intubation, administer increased FIO2 during surgery and after extubation in the immediate post-operative period. To optimize tissue oxygen delivery, maintain perioperative normothermia and adequate volume replacement. <strong>Strong recommendation</strong> Moderate quality evidence</td>
</tr>
<tr>
<td>Adult patients undergoing general anaesthesia with endotracheal intubation for surgical procedures should receive FIO2 80% intraoperatively and, if feasible, in the immediate postoperative period for 2-6 hours</td>
<td><strong>Strong recommendation</strong> Moderate quality evidence</td>
</tr>
<tr>
<td>Conditional recommendation Moderate quality of evidence</td>
<td></td>
</tr>
</tbody>
</table>

23

<table>
<thead>
<tr>
<th>WHO</th>
<th>CDC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GLYCEMIC CONTROL</strong></td>
<td>Implement perioperative glycemic control and use blood glucose target levels less than 200 mg/dL in patients with and without diabetes. <strong>Strong recommendation</strong> high to moderate-quality evidence</td>
</tr>
<tr>
<td>Protocols are suggested to be used for intensive perioperative blood glucose control for both diabetic and non-diabetic adult patients undergoing surgical procedures <strong>Conditional recommendation</strong> (low)</td>
<td></td>
</tr>
</tbody>
</table>

24

<table>
<thead>
<tr>
<th>WHO</th>
<th>CDC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NORMOTHERMIA</strong></td>
<td>Maintain perioperative normothermia <strong>Strong recommendation</strong> high to moderate-quality evidence</td>
</tr>
<tr>
<td>Warming devices are suggested for use in the operating room and during the surgical procedure for patient body warming <strong>Conditional recommendation</strong> (moderate)</td>
<td></td>
</tr>
</tbody>
</table>

24
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<tbody>
<tr>
<td><strong>ANTIMICROBIAL IRRIGATION</strong></td>
<td>Conditional 2A.1. Randomized controlled trial evidence suggested uncertain trade-offs between the benefits and harms regarding intraoperative antimicrobial irrigation</td>
</tr>
<tr>
<td>Antibiotic incisional wound irrigation before closure should not be used</td>
<td></td>
</tr>
</tbody>
</table>

**Other Recommendation Areas**

- Triclosan-coated sutures
- Antimicrobial dressings
- Laminar flow ventilation systems
- Prophylactic negative pressure wound therapy
- Wound protector devices
- Drapes and gowns
- Maintenance of adequate circulating volume control / normovolemia
- Drains
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See Your HANDS
Hand hygiene supports safe surgical care

Surgical Handrubbing Technique

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Local preparation of 2% chlorhexidine isopropanol solution
1. Isopropanol: 62.7 % g/g
2. Chlorhexidine 12.1 % g/g taken from a 18.8 % g/g chlorhexidine digluconate water solution
3. Top up with distilled water up to 100%
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New WHO SSI Prevention Implementation Package
Fact sheets and other tools on SSI recommendations

NEW IMPLEMENTATION PLATFORM
Launching Soon!
JOIN US! Contact:
clairekippypatrick.ck@gmail.com
allegranzib@who.int

https://www.who.int/infection-prevention/tools/surgical/en/

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WHO Multimodal Improvement Strategy

In other words, the WHO multimodal improvement strategy addresses these four areas:

1. Build it
2. Teach it
3. Check it
4. Sustain it

Mapping two improvement strategies

- System Change
- Training & Education
- Evaluation & Feedback
- Reminders in the workplace
- Institutional safety climate
- Evaluate
- Engage
- Educate
- Execute

1a. System change – alcohol-based handrub at point of care
1b. System change – access to safe, accessible water supply, soap and towels

Surgical site infection surveillance peri-operative data collection form

Patient name: 

Primary diagnosis: 

Influent number: 

Surveillance number: 

Surgical procedure: 

Operating theater: 

Date of surgery: 

ASA class: 

Weight: 

Height: 

Informed consent: 

Surgical aseptic technique: 

Surgical antibiotics prophylaxis: 

Surgical skin preparation: 

Postoperative antibiotics: 

Recovery room: 

Morbidity: 

Mortality: 

Figure 5.1: The five components of the WHO multimodal hand hygiene improvement strategy

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A multimodal infection control and patient safety intervention to reduce surgical site infections in Africa: a multicentre, before–after, cohort study

- A before-after cohort study, between July 1, 2013, and Dec 31, 2015, at four African hospitals
- The multimodal intervention consisted of the implementation or strengthening of multiple SSI prevention measures
- combined with an adaptive approach aimed at the improvement of teamwork and the safety climate.

WHO Implementation Project in Sub-Saharan Africa

- A before-after cohort study, between July 1, 2013, and Dec 31, 2015, at four African hospitals
- The multimodal intervention consisted of:
  - Implementation or strengthening of multiple SSI prevention measures
  - An adaptive approach aimed at the improvement of teamwork and the safety climate.
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SUSP in Sub-Saharan Africa

From 2013 to 2015 the WHO Clean Care is Safer Care programme supported the implementation of an SSI prevention and quality improvement intervention in Surgical Departments in five African hospitals:

1. AIC Kijabe Hospital, Kenya: Level 5 tertiary referral hospital
2. Mulago Hospital, Uganda: Teaching, national referral hospital
3. Church of Uganda Kisiizi Hospital, Uganda: Private non-profit hospital
4. Ndola General Hospital, Zambia: Referral hospital

This program was successful in reducing SSI rates at participating facilities.
global health gaps that we seek to address

Surgical infections are now widely recognized as a public health issue in high income countries. They are an even more widespread problem in low- and middle-income countries. Some healthcare workers view SSI’s as an inevitability rather than a problem that can be fixed. WSIS plans to change that attitude.

Surgical infections are not the sole responsibility of a single healthcare department. WSIS is the first organization to join together surgeons, infection control experts, nurses, and other healthcare workers to target SSI reduction.

MISSION
We are an inter-professional collaboration that aims to improve patient safety where the need is greatest by bringing together regional surgical infection interest groups, creating education initiatives, and developing actionable data.

VISION
We are aiming to fill the gaps between safe surgery and infection prevention and control programs, focusing on the reduction of surgical site infection through research into best practices and implementation and working with local and regional hospitals and health care workers.
The Case for a Focus on Smaller District Hospitals

- A large majority of the operations performed in low/middle income countries are performed in smaller district-level facilities
- There is little availability of trained infection control practitioners and little infection control infrastructure

Hospital Levels in Kenya

<table>
<thead>
<tr>
<th>Level</th>
<th>Type</th>
<th>Location</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Community Units</td>
<td>Community</td>
<td>Kosirai community unit</td>
</tr>
<tr>
<td>2</td>
<td>Dispensary</td>
<td>Village Level</td>
<td>Isana Dispensary</td>
</tr>
<tr>
<td>3</td>
<td>Health Centre</td>
<td>Locational Level</td>
<td>Mosoriot Health Centre</td>
</tr>
<tr>
<td>4</td>
<td>District Hospital</td>
<td>District Headquarters</td>
<td>Kapsabet District Hospital</td>
</tr>
<tr>
<td>5</td>
<td>Provincial Hospital</td>
<td>Provincial Headquarters</td>
<td>Rift Valley Provincial General Hospital</td>
</tr>
<tr>
<td>6</td>
<td>National Hospital</td>
<td>Capital City</td>
<td>Kenyatta National Hospital</td>
</tr>
</tbody>
</table>

A Prospective Cohort Study on the Timing of Antimicrobial Prophylaxis for Post-Cesarean Surgical Site Infections

WSIS Lucina Project (2017)

Thika Hospital
- 300 women enrolled
- Single shot prophylaxis antibiotic given ½ - 2 hours pre-incision.
- Equivalent surgical credentials, patient demographics, indications for operation, and anesthesia, and skin preparation
- Surgical sites examined by surveyor Days 3, with clinical or cell phone contact follow up at 14 and 30 days

Kiambu Hospital
- 300 women enrolled
- 5-7 days antibiotics was routinely administered to ALL women following CS
### WSIS Lucina Project (2017)

<table>
<thead>
<tr>
<th>Infection Category</th>
<th>Thika (306)</th>
<th>Kiambu (303)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>Deep</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Organ Space</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12 (3.9%)</strong></td>
<td><strong>28 (9.2%)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organism</th>
<th>Thika</th>
<th>Kiambu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staph aureus</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Staph epidermidis</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Klebsiella pneumonia</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Acinetobacter BC</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Other GNR</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Strep agalactiae</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

### Complex Surgical Site Infections and the Devilish Details of Risk Adjustment

Anderson DJ, Chen LF, Sexton DJ, Kaye


- Complex SSIs are serious infections that typically require rehospitalization, return to the operating room, and intravenous antibiotic therapy.
- Such infections are difficult to ignore or miss when they do occur, and they are of undoubted significance to patients and their surgeons.
What is a Surgical Site Infection (SSI)?

CDC/NHSN definition of SSI: “Infection occurring at the operation site within 30 days of the procedure.”

ref: Horan TC, Am J Inf Cont 2008

Less severe, but harder to reliably diagnose

COMPLEX SSI: More severe, straightforward diagnosis

Accuracy of Surveillance for Superficial Surgical Site Infection
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LUCINA II: First Phase of an Implementation Intervention Aimed at District Hospitals

- WSIS Survey (Unpublished Data) of Level 4 and 5 Facilities in Kenya
  - Level 4 (District and Sub-district) and Level 5 (Provincial Referral) hospitals provide much of the non-specialized surgical care, including cesarean sections, for Kenyan citizens
  - Survey of 27 facilities reported an estimated population served of over 3 million
  - Unlike national referral facilities, many of these hospitals have no more than one or two surgeons on staff, if any, and no anesthesiologists
  - Much of the surgical burden is handled by Medical Officers
  - At least one half of the surveyed hospitals did not have a functioning infection control activity
Conclusions

- There is compelling information that application of key guideline recommendations results in a substantial decrease in SSI rates in patients.
- Poor sterilization practices, unit cleansing, and other recognized patient- and status-dependent factors that are difficult to change without significant infrastructure and financial investment may have been overcome by appropriate antibiotic prophylaxis.
- Given the significant difference in settings, separate but parallel implementation work should be carried out at Level 4 and 5 hospitals in Kenya, and facilities of a similar type in other LMIC, in order to take into account the differences in workforce dynamics and resources.
- The implementation of these recommendations through tested methods will reduce the burden of SSIs and likely other healthcare associated infections.

www.webbertraining.com/schedulep1.php

(European Teleclass)
June 25, 2019
GETTING TO GRIPS WITH HEALTHCARE-ASSOCIATED GRAM-NEGATIVE BLOODSTREAM INFECTION SOURCES
Speaker: Dr. Jon Otter, Imperial College London

(European Teleclass)
July 9, 2019
MYTHS AND FACTS REGARDING INFECTION PREVENTION AND CONTROL IN OUTBREAK SETTINGS
Speaker: Prof. Adriano Duse, University of the Witwatersrand, Johannesburg, South Africa

July 16, 2019
INFECTION CONTROL IN PEDIATRICS
Speaker: Dr. Shahnaz Armin, Shahid Beheshti University of Medical Sciences, Iran

July 25, 2019
DIAGNOSTIC STEWARDSHIP: MODIFIED CULTURE TESTING TO ENHANCE ANTIBIOTIC STEWARDSHIP
Speaker: Robert Garcia, Stony Brook University Medical Center, New York City

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