SSI Surveillance Strategies in Under-Resourced Settings

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

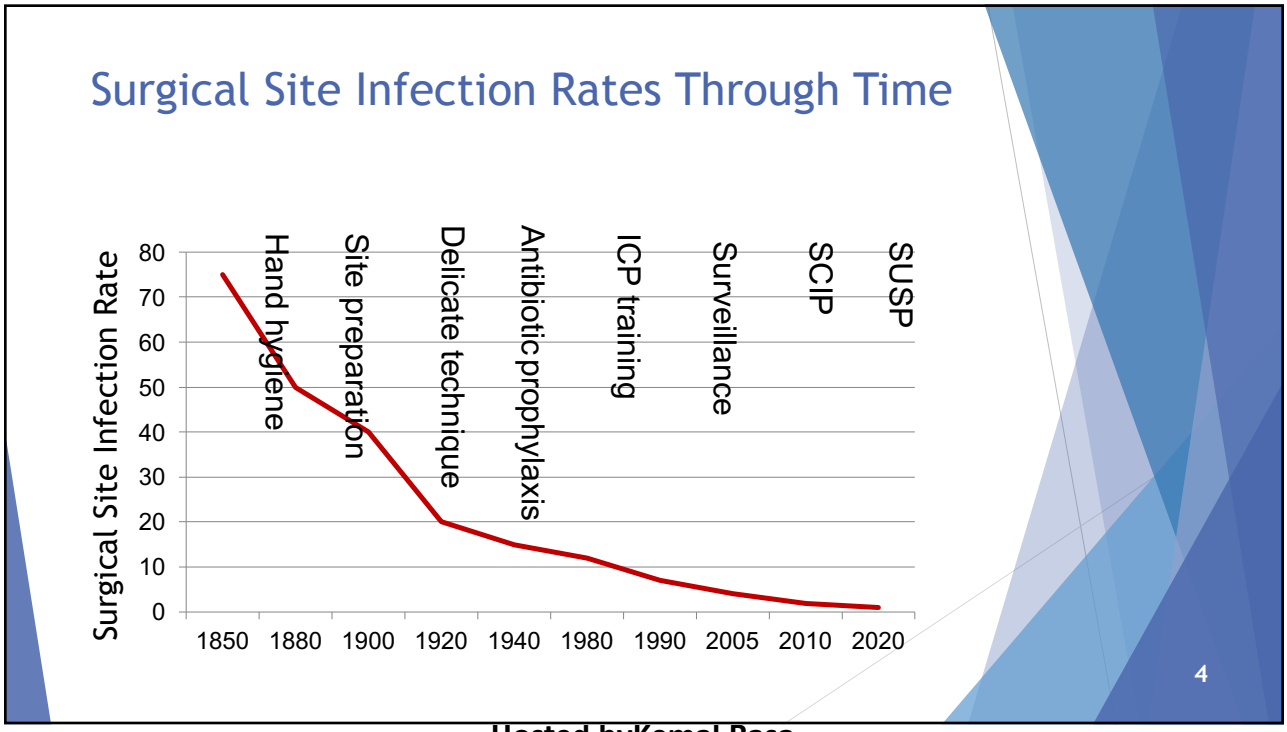
Hosted by Dr. Kamal Rasa
World Surgical Infection Society, Turkey

Sponsored by the World Surgical Infection Society (www. worldsis.org)

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

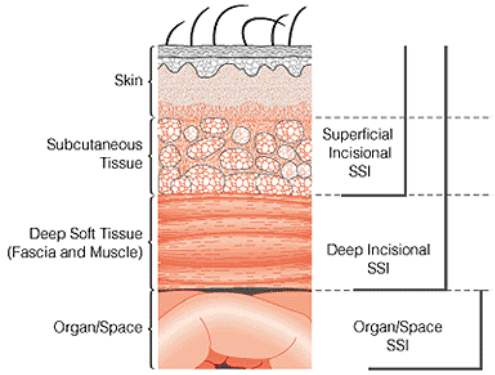

3


Surgical Site Infection Rates Through Time
Surgical Site Infection Rate
80
70
60
50
40
30
20
10
0
1850
1880
1900
1920
1940
1980
1990
2005
2010
2020
Hand hygiene
Site preparation
Delicate technique
Antibiotic prophylaxis
ICP training
Surveillance
SCIP
SUSP
4

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

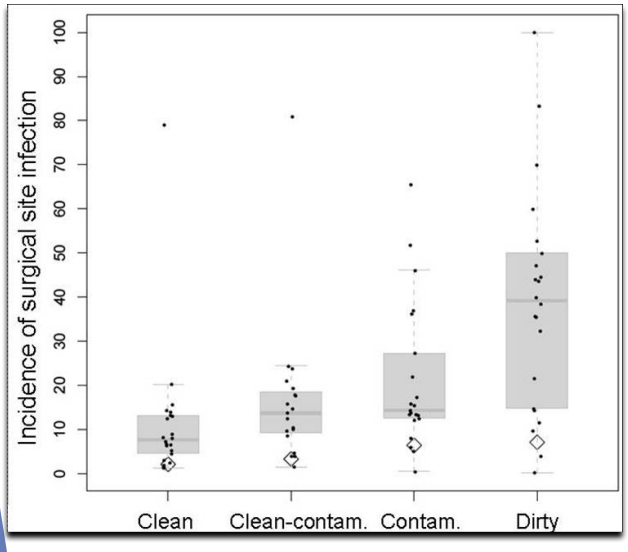


Less severe, but harder to reliably diagnose

COMPLEX SSI: More severe, straightforward diagnosis

5

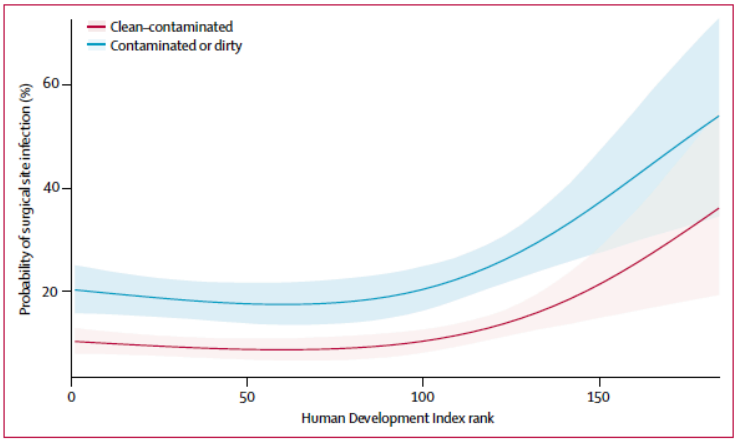
SSI Rates in Low- and Middle-Income Countries According to Wound Classification



Wound Classification	SSI Pooled Means
Clean	11.5%
Clean-contaminated	16.6%
Contaminated	21.3%
Dirty	38.8%

6

Surgical site infection after gastrointestinal surgery in high-income, middle-income, and low-income countries



The Lancet Infectious diseases 2018;18:516-25

7

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

Anderson DJ, etal. Strategies to prevent surgical site infections in acute care hospitals.
Infect Control Hosp Epidemiol 2008;29:S51-S61 for individual references

8

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

9

International Journal of Women's Health

Dovepress
open access to scientific and medical research

Open Access Full Text Article

REVIEW

Burden of surgical site infection following cesarean section in sub-Saharan Africa: a narrative review

This article was published in the following Dove Medical Press journal:
International Journal of Women's Health

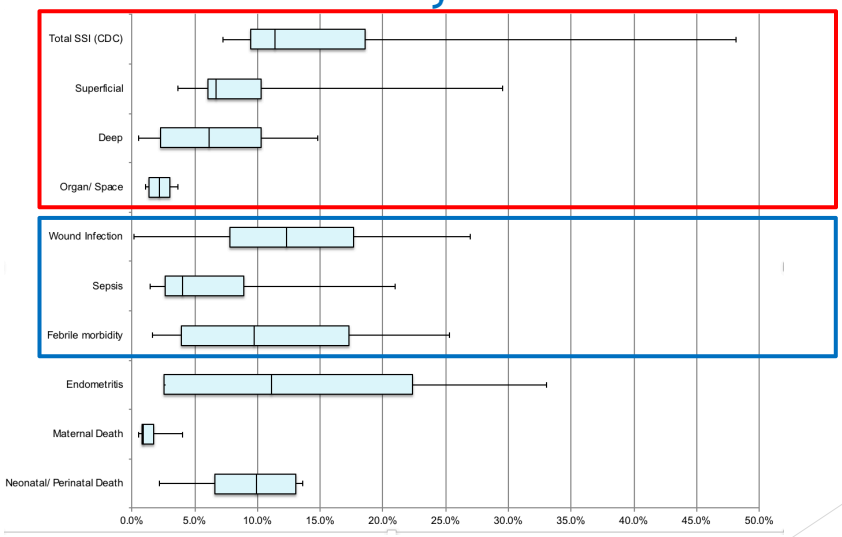
Angie Sway[1]
Peter Nthumba[2]
Joseph Solomkin[3]
Giorgio Tarchini[4]
Ronald Gibbs[5]
Yanhan Ren[6]
Anthony Wanyoro[7]

Abstract: Cesarean section (CS) is the most common operative procedure performed in sub-Saharan Africa (SSA), accounting for as much as 80% of the surgical workload. In contrast to CSs performed in high-income countries, CSs performed in SSA are accompanied by high morbidity and mortality rates. This operation is the most important known variable associated with an increased probability of postpartum bacterial infection. The objective of this review was to assess surgical outcomes related to CS in SSA. PubMed (including Medline), CINAHL, Embase, and the World Health Organization's Global Health Library were searched without date or language restrictions. A total of 26 studies reporting surgical site–infection rates after

Sway A, et al: Int J Womens Health. 2019:11 Pages 309–318 https://doi.org/10.2147/IJWH.S182362

10

Infection Rates in Cesarean Section in Sub-Saharan Africa – A Systematic Review



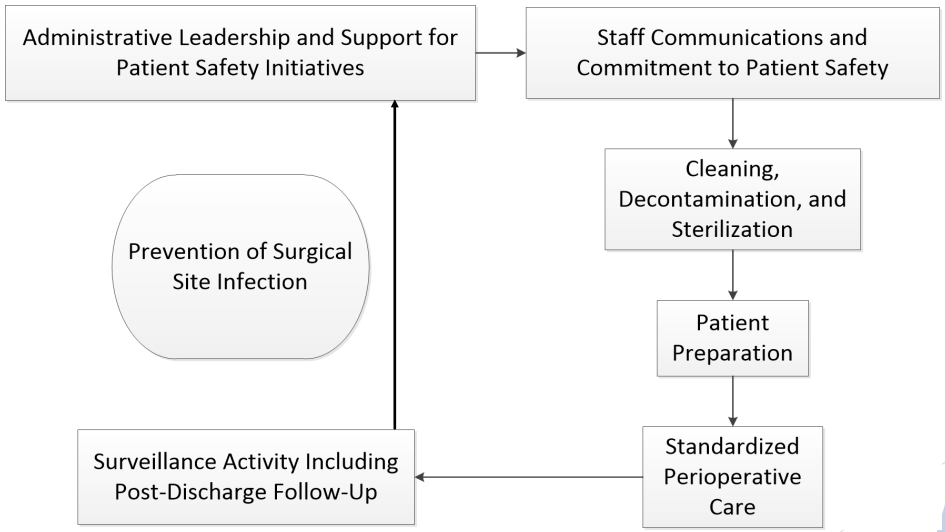
CDC classification

Ad hoc

Sway A, et al: Int J Womens Health. 2019:11 Pages 309–318

11

Key Elements in Reducing SSI

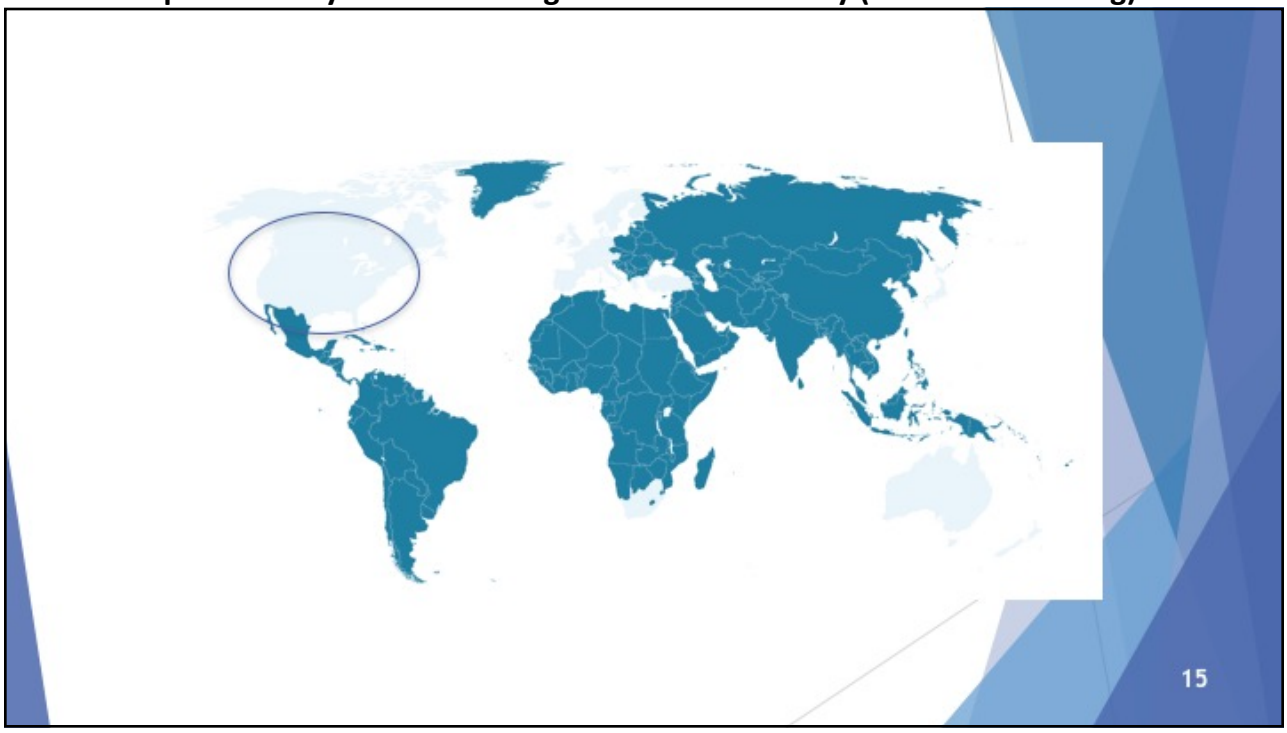


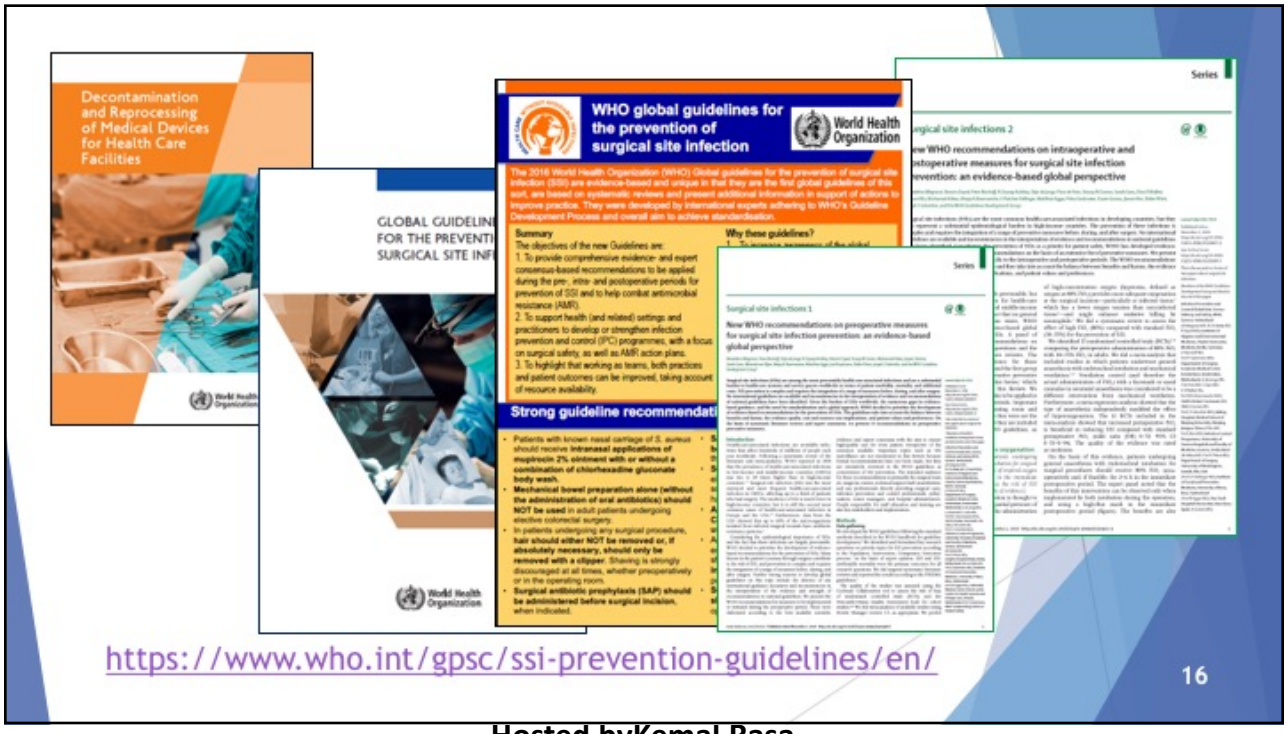
12

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"

13

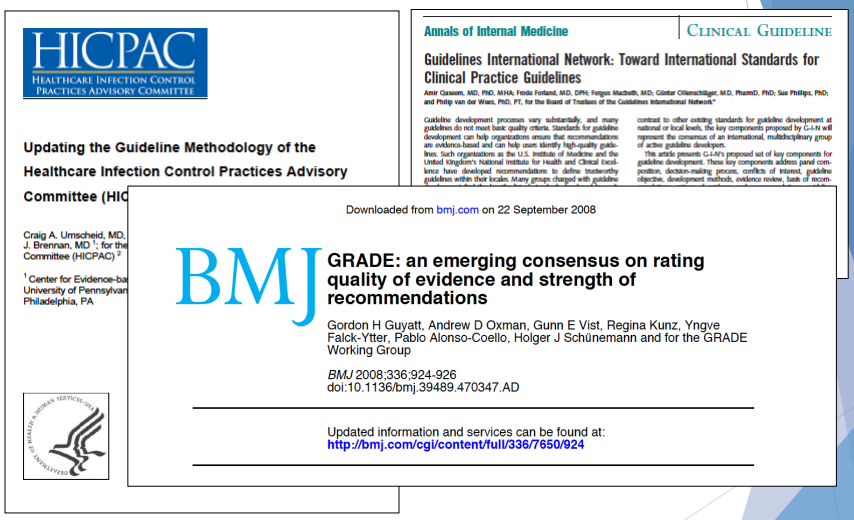

15


Decontamination and Reprocessing of Medical Devices for Health Care Facilities
WHO global guidelines for the prevention of surgical site infection
World Health Organization
https://www.who.int/gpsc/ssi-prevention-guidelines/en/
16

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)

17



18

HAIR REMOVAL	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 recommendation Moderate quality of evidence**
HAND PREPARATION	Surgical hand preparation should be performed using either a suitable antimicrobial soap and water or a suitable alcohol-based hand rub. **Strong recommendation** [19]

PREOPERATIVE BATHING	Patients should bathe or shower before surgery; either a plain soap or an antimicrobial soap may be used for this purpose **Conditional recommendation moderate quality of evidence**
SURGICAL SITE PREPARATION	Alcohol-based antiseptic solutions based on CHG for surgical site skin preparation should be used in patients undergoing surgical procedures **Strong recommendation moderate to low quality of evidence**[20]

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

21

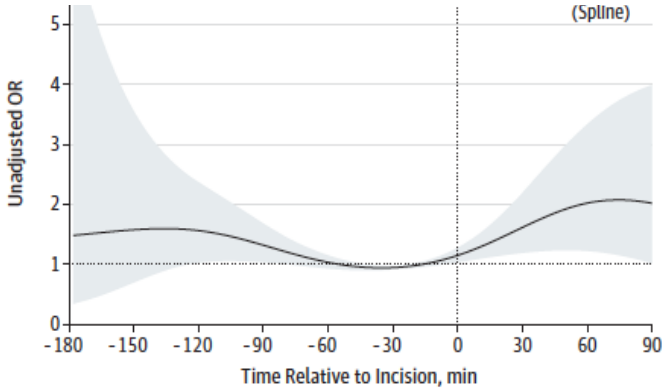
ANTIBIOTIC PROPHYLAXIS

When indicated (depending on the type of operation),
...be administered
...in 120 minutes
...half-life of the

...tration should
...the operation for

Moderate quality of evidence

Hawn MT, Richman JS, Vick CC, et al. Timing of surgical antibiotic prophylaxis and the risk of surgical site infection. JAMA surgery 2013;148:649-57.



22

	WHO	CDC
PERIOPERATIVE OXYGENATION	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 **Conditional recommendation** **Moderate quality of evidence**	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 recommendation** **Moderate quality evidence**
		23

	WHO	CDC
GLYCEMIC CONTROL	Protocols are suggested to be used for intensive perioperative blood glucose control for both diabetic and non-diabetic adult patients undergoing surgical procedures **Conditional recommendation (low)**	Implement perioperative glycemic control and use blood glucose target levels less than 200 mg/dL in patients with and without diabetes. **Strong recommendation** **high to moderate- quality evidence**
NORMOTHERMIA	Warming devices are suggested for use in the operating room and during the surgical procedure for patient body warming **Conditional recommendation (moderate)**	Maintain perioperative normothermia **Strong recommendation** **high to moderate-quality evidence**
		24

	WHO	CDC
ANTIMICROBIAL IRRIGATION	Antibiotic incisional wound irrigation before closure should not be used **Conditional**	2A.1. Randomized controlled trial evidence suggested uncertain trade-offs between the benefits and harms regarding intraoperative antimicrobial irrigation

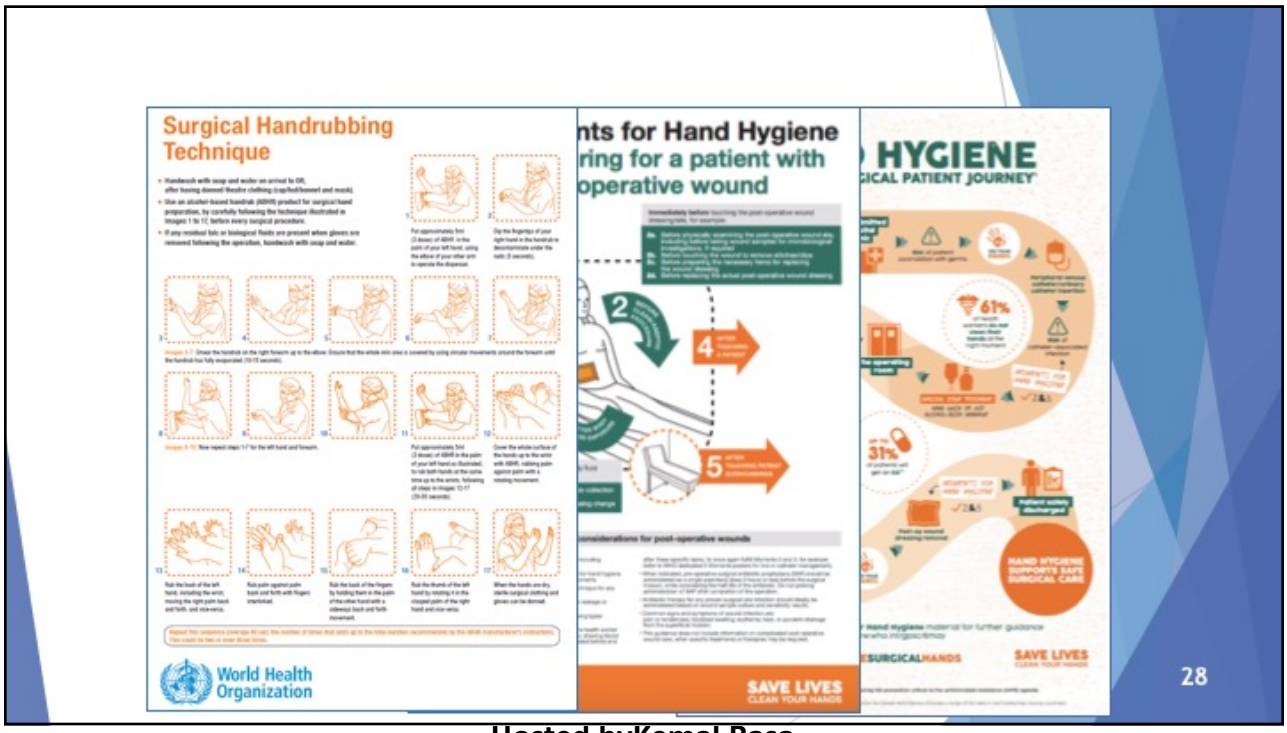
25

Other Recommendation Areas

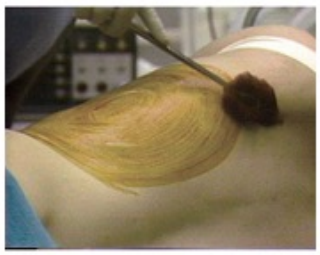
- Triclosan-coated sutures
- Antimicrobial dressings
- Laminar flow ventilation systems
- Prophylactic negative pressure wound therapy
- Wound protector devices
- Drapes and gowns
- Maintenance of adequate circulating volume control/ normovolemia
- Drains

26


WHAT'S THE SOLUTION?
A range of precautions - before, during and after surgery - reduces the risk of infection
BEFORE SURGERY
Ensure patients bathe or shower
Do not shave patients
Only use antibiotics when recommended
Use chlorexidine alcohol-based antiseptic solutions to prepare skin
Surgical scrub technique: hand wash or alcohol-based handrub
DURING SURGERY
Limit the number of people and doors being opened
Ensure all surgical equipment is sterile and maintain asepsis throughout surgery
AFTER SURGERY
Do not continue antibiotics to prevent infection – this is unnecessary and contributes to the spread of antibiotic resistance
Check wounds for infection and use standard dressings on primary wounds
SEE YOUR HANDS
HAND HYGIENE SUPPORTS SAFE SURGICAL CARE
Surgical patients are IN your hands. See what's ON your hands.
Practice hand hygiene for surgical patients FROM ADMISSION TO DISCHARGE.
World Health Organization
#SAFESURGICALHANDS
SAVE LIVES CLEAN YOUR HANDS
27


Surgical Handrubbing Technique
World Health Organization
nts for Hand Hygiene
ring for a patient with
operative wound
SAVE LIVES CLEAN YOUR HANDS
HYGIENE
CAL PATIENT JOURNEY
61%
31%
SAVE LIVES CLEAN YOUR HANDS
28

System change - surgical skin preparation



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%

29

The Importance of SSI Surveillance for IPC and Safe Surgery

Reduction of Surgical Site Infection Rates Associated With Active Surveillance

C. Brandt, MD; D. Sohr, PhD; M. Behnke; F. Daschner, MD; H. Rüden, MD; P. Gastmeier,

Reduction of surgical site infections after Caesarean delivery using surveillance

S. Bärwolff [a,d,*], D. Sohr [a,d], C. Geffers [a,d], C. Brandt [a,d], R.-P. Vonberg [b,d], H. Halle [c], H. Rüden [a,d], P. Gastmeier [b,d]

Impact of a six-year control programme on surgical site infections in France: results of the INCISO surveillance

C. Rioux [a], B. Grandbastien [a,b]

25-57% reduction

Reduced risk of surgical site infections through surveillance in a network

EVELINE L. P. E. GEUBBELS[1], NICO J. D. NAGELKERKE[2], A. JOKE MINTJES-DE GROOT[3], CHRISTINA M. J. E. VANDENBROUCKE-GRAULS[4], DIEDERICK E. GROBBEE[5] AND ANNETTE S. DE BOER[1]

30

New WHO SSI Prevention Implementation Package

Fact sheets and other tools on SSI recommendations

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

31

New WHO SSI Prevention Implementation Package

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

32

WHO Multimodal Improvement Strategy

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

1a. System change – alcohol-based handrub at point of care
+
1b. System change – access to safe, ter supply, soap and towels
+
ning and education
+
uation and feedback
+
ders in the workplace
+
itional safety climate

33

Surgical site infection surveillance peri-operative data collection form

World Health Organization

ID	Patient name	Age/ Date of birth .../.../.....	inPatient number	Date of admission .../.../.....
	Primary diagnosis	Sex ☐ F ☐ M	Surveillance number	

1 Surgical procedure..... Operating theater [ ]
Date of surgery..... Lead surgeon name.....
Grade.....

2 CDC - NNIS Risk Index Variables
ASA class
☐ 1. Normal healthy person
☐ 2. Mild systemic disease (e.g. hypertension, well controlled diabetes)
☐ 3. Severe systemic disease not incapacitating (e.g. moderate COPD, d
☐ 4. Incapacitating systemic disease that is a constant threat to life (e.g.
☐ 5. Moribund patient, not expected to survive with or without operation

Weight.....kg
Height.....cm

3 Surgical wound class
Clean ☐ = Sterile tissue with no resident bacteria
Clean-contaminated ☐ = CONTROLLED entry to tissue with resi
Contaminated ☐ = UNCONTROLLED entry to tissue with
Dirty / infected ☐ = Heavy contamination (e.g. soil in woun

4 Start time (knife to skin)
[:] 24h clock
End time (skin closure)
[:] 24h clock
Duration =.....hrs .....mins

Urgency of operation
☐ Emergency – must be done imm
☐ Urgent – must be done within 24
☐ Semi-elective – must be done wi
☐ Elective – no time constraints

PRE/PERI-OPERATIVE PROCESS MEASURES

Patient preparation
Pre-op bath / shower (full body) [Y / N] Date .../.../.....
Antimicrobial soap used [Y / N] Plain soap used [Y / N]
Hair removal (HR): ☐ Razor ☐ Clippers ☐ None
HR Date ..... ☐ Home ☐ Ward ☐ Theatre

Surgical antibiotic prophylaxis
☐ No prophylaxis required
Required but not given due to: ☐ Unavailable
☐ Other .....

Antibiotic given:
☐ Co-amoxiclav ☐ Cefazolin ☐ Cloxacillin ☐ Vancomycin
☐ Ciprofloxacin ☐ Gentamicin ☐ Metronidazole ☐ Penicillin
☐ Other antibiotic..... Dose.....(mg)
Time given [:] 24h clock Time re-dosed [:] 24h clock

Postoperative antibiotics
Were antibiotics ceased at completion of surgery? [Y / N]
If not, what antibiotics were prescribed?
Drug..... Dose.....(mg)
Doses / day..... Duration (days).....

Reason given
☐ Post-op prophylaxis ☐ Drain / implant inserted
☐ Treating suspected / known infection ☐ Other .....

Surgical skin preparation (under sterile conditions)
☐ Chlorhex-alc ☐ Iodine-alc ☐ Chlorhex-aq ☐ Iodine-aq
Appropriate skin preparation technique [Y / N]
Allowed to fully dry [Y / N]

Surgical hand preparation
☐ Alcohol-based hand rub ☐ Antimicrobial soap+water
☐ Plain soap+water
Time spent on procedure [ ] mins [ ] secs
Appropriate hand preparation technique: [Y / N]

Theatre traffic
Headcount at start of operation..... total .....
Number of entries during operation.....
Door openings during operation..... total .....

Drain / implant
Location.....
Drain inserted? [Y / N]
If YES, type of drain: ☐ Open ☐ Closed
Antibiotic given in presence of drain but no infection? [Y / N]
Implant used? [Y / N]
☐ Metal (Ortho) ☐ Skin graft ☐ Mesh ☐ Other

6 **Other measure(s) – decided at local level**.....

Date form completed ...../...../..... Database entry [Y / N] Signature.....

34

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

Benedetta Allegranzi, Alexander M Aiken, Nejla Zeynep Kubilay, Peter Nthumba, Jack Barasa, Gabriel Okumu, Robert Mugarura, Alexander Elobu, Josephat Jombwe, Mayaba Maimbo, Joseph Musowoya, Angèle Gayet-Ageron, Sean M Berenholtz

- 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.

35

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.

36

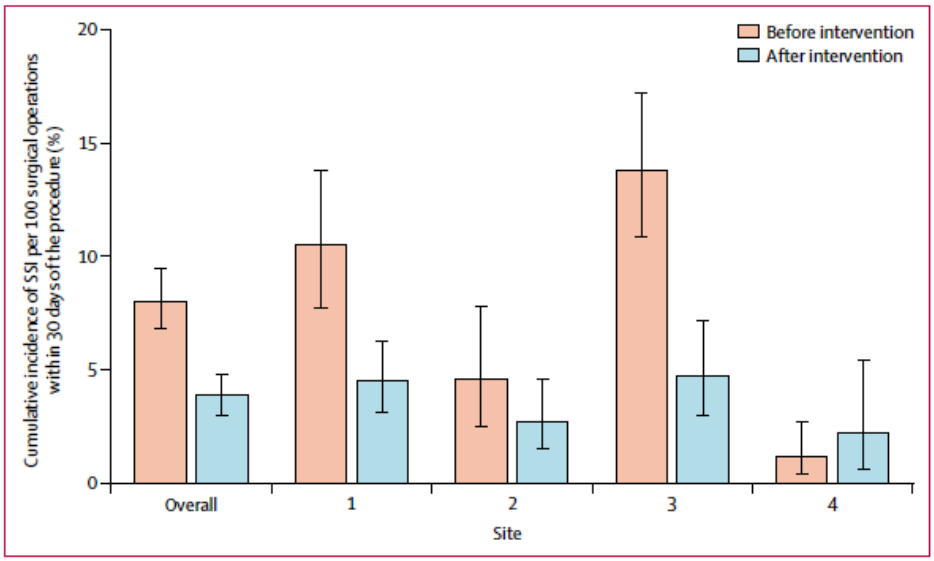
SUSP in Sub-Saharan Africa

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

37



Allegranzi B, Aiken AM, Zeynep Kubilay N, et al. A multimodal infection control and patient safety intervention to reduce surgical site infections in Africa: a multicentre, before-after, cohort study. The Lancet Infectious diseases 2018;18:507-15.

38

WSIS

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.

39

WSIS

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

40

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

41

Hospital Levels in Kenya

Level	Type	Location	Examples
1	Community Units	Community	Kosirai community unit
2	Dispensary	Village Level	Isana Dispensary
3	Health Centre	Locational Level	Mosoriot Health Centre
4	District Hospital	District Headquarters	Kapsabet District Hospital
5	Provincial Hospital	Provincial Headquarters	Rift Valley Provincial General Hospital
6	National Hospital	Capital City	Kenyatta National Hospital

https://en.wikipedia.org/wiki/Healthcare_in_Kenya

42

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

WSIS

WSIS Lucina Project (2017)

Thika Hospital

- 300 women enrolled
- Single shot prophylaxis antibiotic given ½ - 2 hours pre-incision.

Kiambu Hospital

- 300 women enrolled
- 5-7 days antibiotics was routinely administered to ALL women following CS

- 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

44

WSIS Lucina Project (2017)

Infection Category	Thika (306)	Kiambu (303)
Superficial	11	17
Deep	0	7
Organ Space	1	3
Unknown	0	1
Total	**12 (3.9%)**	**28 (9.2%)**

Organism	Thika	Kiambu
Staph aureus	4	6
Staph epidermidis	1	
Klebsiella pneumoniae	4	5
Acinetobacter BC	2	4
Other GNR		2
Strep agalactiae		1

45

Complex Surgical Site Infections and the Devilish Details of Risk Adjustment

Anderson DJ, Chen LF, Sexton DJ, Kaye
Infection control and hospital epidemiology
2008;29:941-6.

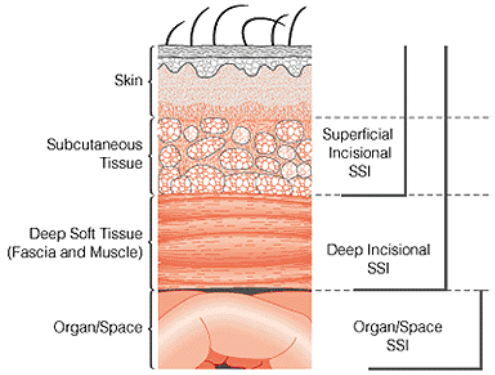
- Complex SSIs are serious infections that typically require rehospitalization, return to the operating room, and intravenous antibiotic therapy.
- Such infections are difficult to ignore or miss when they do occur, and they are of undoubted significance to patients and their surgeons.

46

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

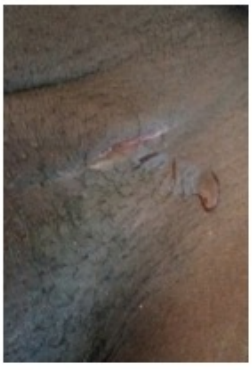


Less severe, but harder to reliably diagnose

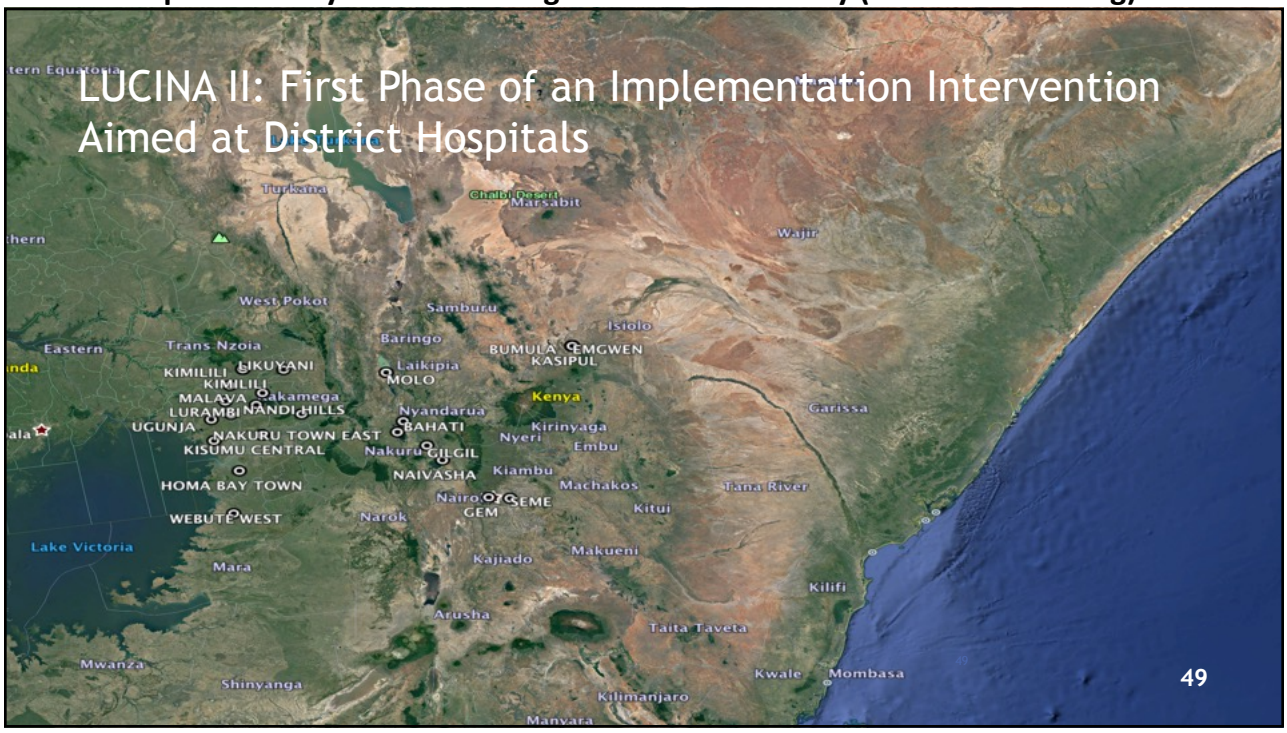
COMPLEX SSI: More severe, straightforward diagnosis

47

Accuracy of Surveillance for Superficial Surgical Site Infection


48



- 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

50

Conclusions

- There is compelling information that application of key guideline recommendations results in a substantial decrease in SSI rates in patients s.
- 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

51

www.webbertraining.com/schedulep1.php

June 25, 2019	*(European Teleclass)* GETTING TO GRIPS WITH HEALTHCARE-ASSOCIATED GRAM-NEGATIVE BLOODSTREAM INFECTION SOURCES Speaker: **Dr. Jon Otter**, Imperial College London
July 9, 2019	***(European Teleclass)*** 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

Hosted byKemal Rasa
A Webber Training Teleclass
www.webbertraining.com


Thanks to Teleclass Education
PATRON SPONSORS
Diversey
www.diversey.com
VIROX
www.virox.com
World Health Organization
Infection Prevention and Control Global Unit
www.who.int/gpsc/en