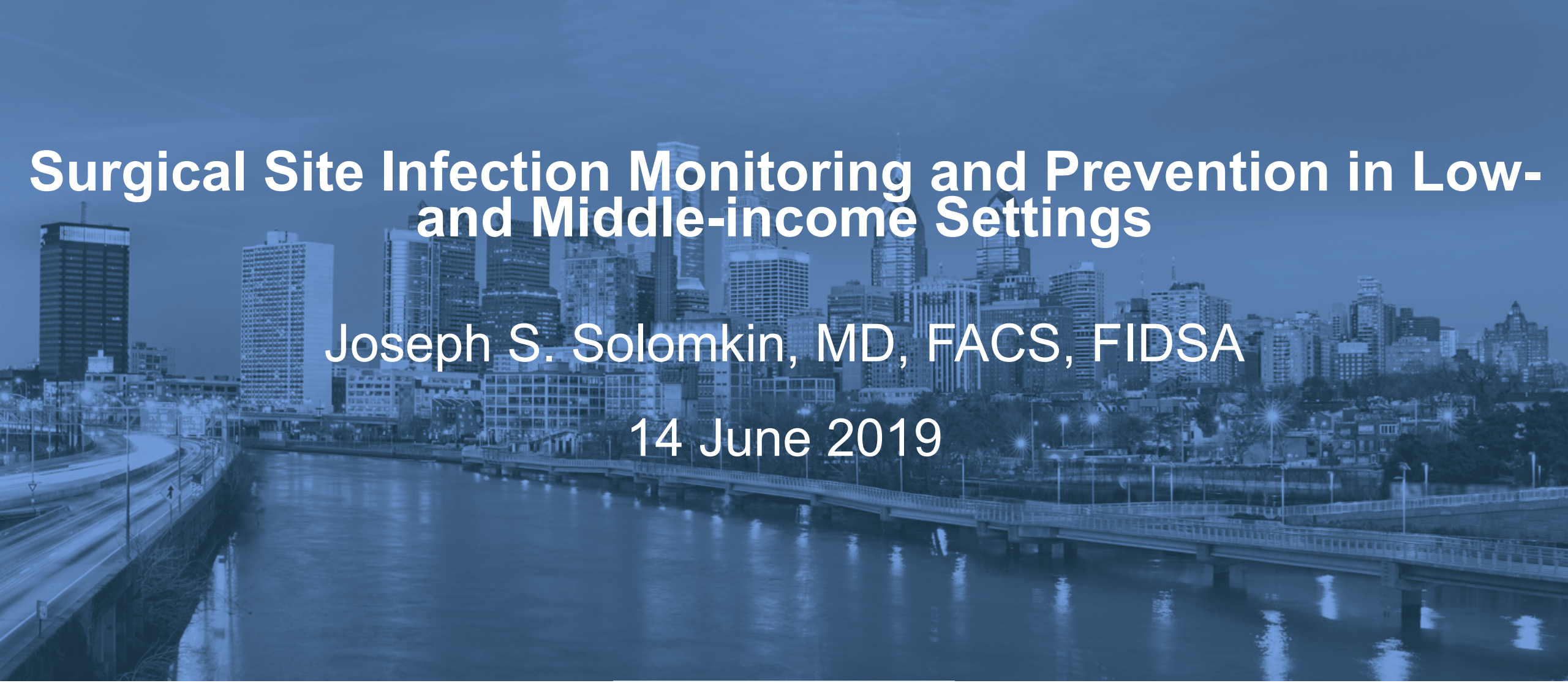


Surgical Site Infection Monitoring and Prevention in Low- and Middle-income Settings

Joseph S. Solomkin, MD, FACS, FIDSA

14 June 2019

APIC 2019
June 12-14 • Philadelphia, PA

Allegranzi B et al.
Lancet 2011;377:228-41

Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis

Benedetta Allegranzi, Sepideh Bagheri Nejad, Christophe Combescure, Wilco Graafmans, Homa Attar, Liam Donaldson, Didier Pittet

Summary

Background Health-care-associated infection is the most frequent result of unsafe patient care worldwide, but few data are available from the developing world. We aimed to assess the epidemiology of endemic health-care-associated infection in developing countries.

Methods We searched electronic databases and reference lists of relevant papers for articles published 1995–2008. Studies containing full or partial data from developing countries related to infection prevalence or incidence—including overall health-care-associated infection and major infection sites, and their microbiological cause—were selected. We classified studies as low-quality or high-quality according to predefined criteria. Data were pooled for analysis.

Findings Of 271 selected articles, 220 were included in the final analysis. Limited data were retrieved from some regions and many countries were not represented. 118 (54%) studies were low quality. In general, infection frequencies reported in high-quality studies were greater than those from low-quality studies. Prevalence of health-care-associated infection (pooled prevalence in high-quality studies, 15·5 per 100 patients [95% CI 12·6–18·9]) was much higher than proportions reported from Europe and the USA. Pooled overall health-care-associated infection density in adult intensive-care units was 47·9 per 1000 patient-days (95% CI 36·7–59·1), at least three times as high as densities reported from the USA. Surgical-site infection was the leading infection in hospitals (pooled cumulative incidence 5·6 per 100 surgical procedures), strikingly higher than proportions recorded in developed countries. Gram-negative bacilli represented the most common nosocomial isolates. Apart from meticillin resistance, noted in 158 of 290 (54%) *Staphylococcus aureus* isolates (in eight studies), very few articles reported antimicrobial resistance.

Interpretation The burden of health-care-associated infection in developing countries is high. Our findings indicate a need to improve surveillance and infection-control practices.

Funding World Health Organization.

Introduction

Health-care-associated infections are deemed the most frequent adverse event threatening patients' safety worldwide.[1–3] However, reliable estimates of the global burden are hampered by a paucity of data adequately describing endemic infections at national and regional levels, particularly in resource-limited settings.[4] In countries where less than 5% of the gross national product is spent on health care, and workforce density is less than five per 1000 population,[5] other emerging health problems and diseases take priority.[6] The epidemiological gap leading to the absence of reliable estimates of the global burden is mainly because surveillance of health-care-associated infection expends time and resources and needs expertise in study design, data collection, analysis, and interpretation. Very few countries of low and middle income have national surveillance systems for health-care-associated infections. Data from the International Nosocomial Infection Control Consortium,[7] and findings of two systematic reviews on hospital-acquired neonatal infections[8] and ventilator-associated pneumonia,[9] suggested not only that risks of health-care-associated infection are significantly higher in developing countries but also that the effect on patients and health-care systems is severe and greatly underestimated.

The aim of this systematic review and meta-analysis is to assess the burden of endemic health-care-associated infection in developing countries by collation of available data from published studies on epidemiology. We also aim to investigate constraints linked to surveillance of health-care-associated infection in resource-limited settings and identify perspectives for improvement.

Methods

Search strategy and selection criteria

We undertook a literature search and review process according to a protocol designed before data collection. We aimed to identify studies on the epidemiology of health-care-associated infection in developing countries, with a particular focus on the most frequent bacterial infections—urinary-tract infection, surgical-site infection, bloodstream infection, hospital-acquired pneumonia, and ventilator-associated pneumonia. We searched Medline for reports published between January, 1995, and December, 2008, with no language restriction. We used a comprehensive list of terms (panel 1), including MeSH

www.thelancet.com Published online December 10, 2010 DOI:10.1016/S0140-6736(10)61458-4

World Health Organization | Patient Safety

Report on the Burden of Endemic Health Care-Associated Infection Worldwide

Clean Care is Safer Care

Published on 5 May 2011
http://www.who.int/gpsc/en/

Systematic reviews

Health-care-associated infection in Africa: a systematic review

Sepideh Bagheri Nejad,[a] Benedetta Allegranzi,[a] Shamsuzzoha B Syed,[b] Benjamin Ellis[c] & Didier Pittet[a]

Objective To assess the epidemiology of endemic health-care-associated infection (HAI) in Africa.

Methods Three databases (PubMed, the Cochrane Library, and the WHO regional medical database for Africa) were searched to identify studies published from 1995 to 2009 on the epidemiology of HAI in African countries. No language restriction was applied. Available abstract books of leading international infection control conferences were also searched from 2004 to 2009.

Findings The eligibility criteria for inclusion in the review were met by 19 articles, only 2 of which met the criterion of high quality. Four relevant abstracts were retrieved from the international conference literature. The hospital-wide prevalence of HAI varied between 2.5% and 14.8%; in surgical wards, the cumulative incidence ranged from 5.7% to 45.8%. The largest number of studies focused on surgical site infection, whose cumulative incidence ranged from 2.5% to 30.9%. Data on causative pathogens were available from a few studies only and highlighted the importance of Gram-negative rods, particularly in surgical site infection and ventilator-associated pneumonia.

Conclusion Limited information is available on the endemic burden of HAI in Africa, but our review reveals that its frequency is much higher than in developed countries. There is an urgent need to identify and implement feasible and sustainable approaches to strengthen HAI prevention, surveillance and control in Africa.

Abstracts in عربي, 中文, Français, Русский and Español at the end of each article.

Introduction

Health-care-associated infection (HAI) is a major global safety concern for both patients and health-care professionals.[1–3] HAI is defined as an infection occurring in a patient during the process of care in a hospital or other health-care facility that was not manifest or incubating at the time of admission. This includes infections acquired in the hospital and any other setting where patients receive health care and may appear even after discharge. HAI also includes occupational infections among facility staff.[2] These infections, often caused by multiresistant pathogens, take a heavy toll on patients and their families by causing illness, prolonged hospital stay, potential disability, excess costs and sometimes death.[4–6]

The burden of HAI is already substantial in developed countries, where it affects from 5% to 15% of hospitalized patients in regular wards and as many as 50% or more of patients in intensive care units (ICUs).[7,8] In developing countries, the magnitude of the problem remains underestimated or even unknown largely because HAI diagnosis is complex and surveillance activities to guide interventions require expertise and resources.[9] Surveillance systems exist in some developed countries and provide regular reports on national trends of endemic HAI,[8] such as the National Healthcare Safety Network of the United States of America or the German hospital infection surveillance system. This is not the case in most developing countries[10] because of social and health-care system deficiencies that are aggravated by economic problems. Additionally, overcrowding and understaffing in hospitals result in inadequate infection control practices, and a lack of infection control policies, guidelines and trained professionals also adds to the extent of the problem.

This review provides a general overview of the endemic burden of HAI in Africa based on the information available in the scientific literature. It also identifies information gaps, examines differences in HAI epidemiology between developed and developing countries and highlights the possible role of the World Health Organization (WHO) in preventing HAI.

Methods

Search strategy and selection criteria

A literature search was performed from January 1995 to December 2009 with no language restriction to retrieve publications on the epidemiology of the most common HAIs in African countries: health-care-associated urinary tract infection (HA-UTI), surgical site infection (SSI), hospital-acquired pneumonia/ventilator-associated pneumonia and health-care-associated bloodstream infection. PubMed was searched using a combination of the following keywords, including "cross-infection" as the MeSH term: "nosocomial infection", "hospital-acquired", "incidence", "prevalence" and "rate" together with the individual country names. The Cochrane Library was searched for any relevant review papers. Reference lists of retrieved articles were hand searched for additional studies.

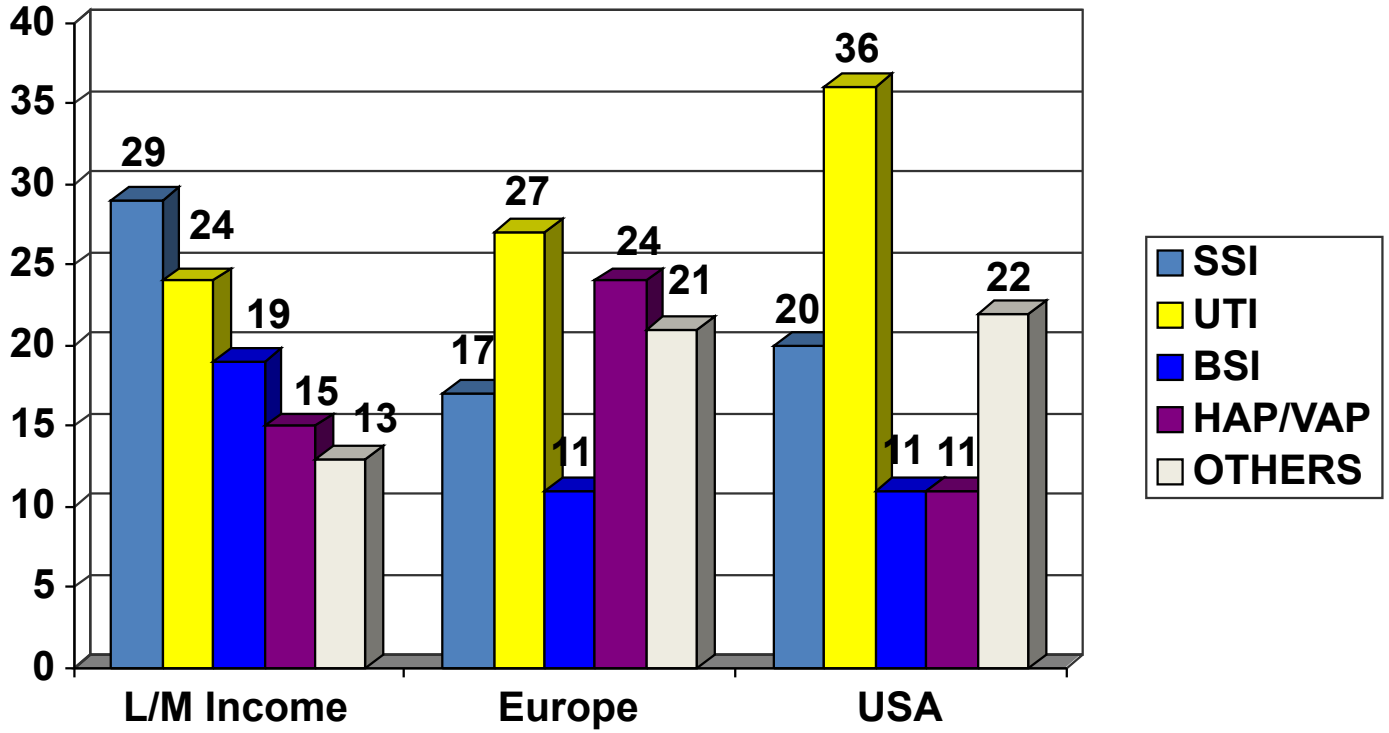
A separate search was run in the WHO regional medical database for Africa, African Index Medicus, using a shorter list of essential keywords and with no time restriction. The abstract books of the following international conferences were also searched from 2004 to 2009: Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), Annual Congress of the Society for Healthcare Epidemiology of America (SHEA), European Congress of Clinical Microbiology and Infectious Diseases (ECCMID), International Federation of Infection Control

[a] Clean Care is Safer Care, World Health Organization Patient Safety, Geneva, Switzerland.

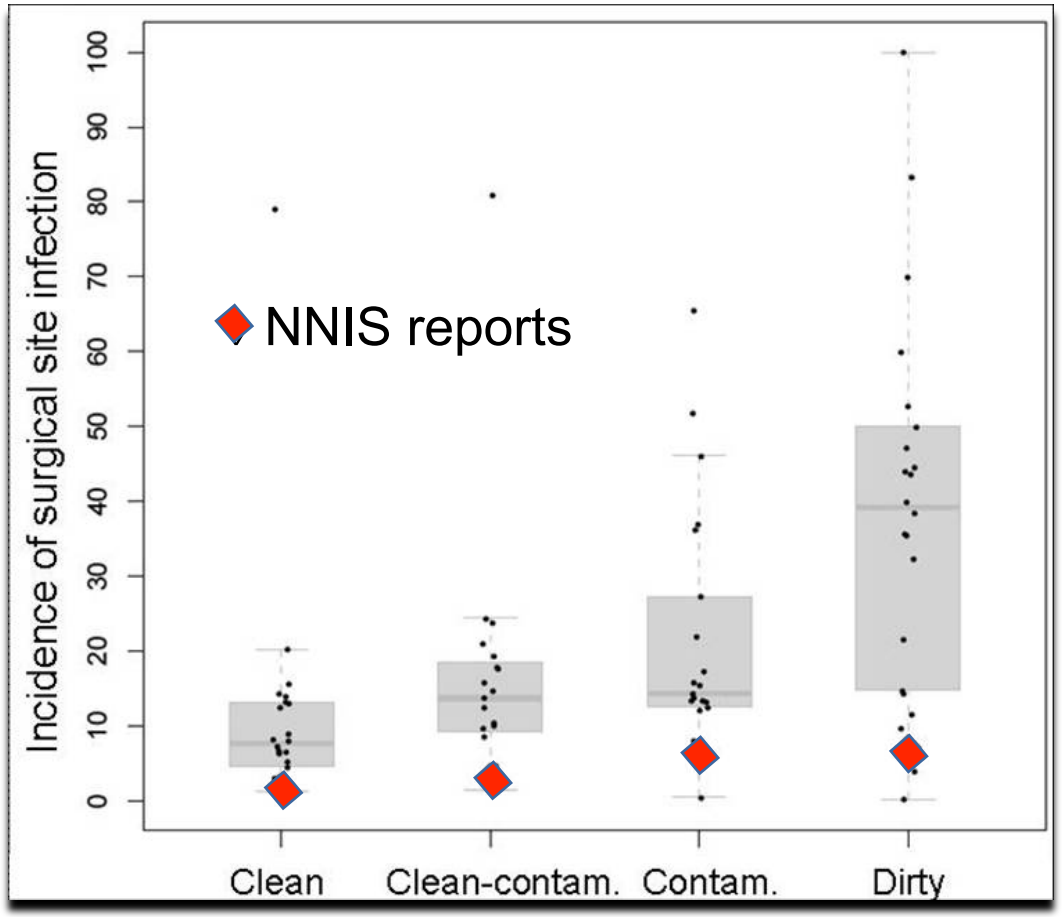
Bagheri Nejad S, et al. Bull OMS 2011;89:757-765

Why Focus on Surgical Site Infection Prevention?

- Most common HAI in all but high income settings
- Cost estimates are striking for monetized health care systems

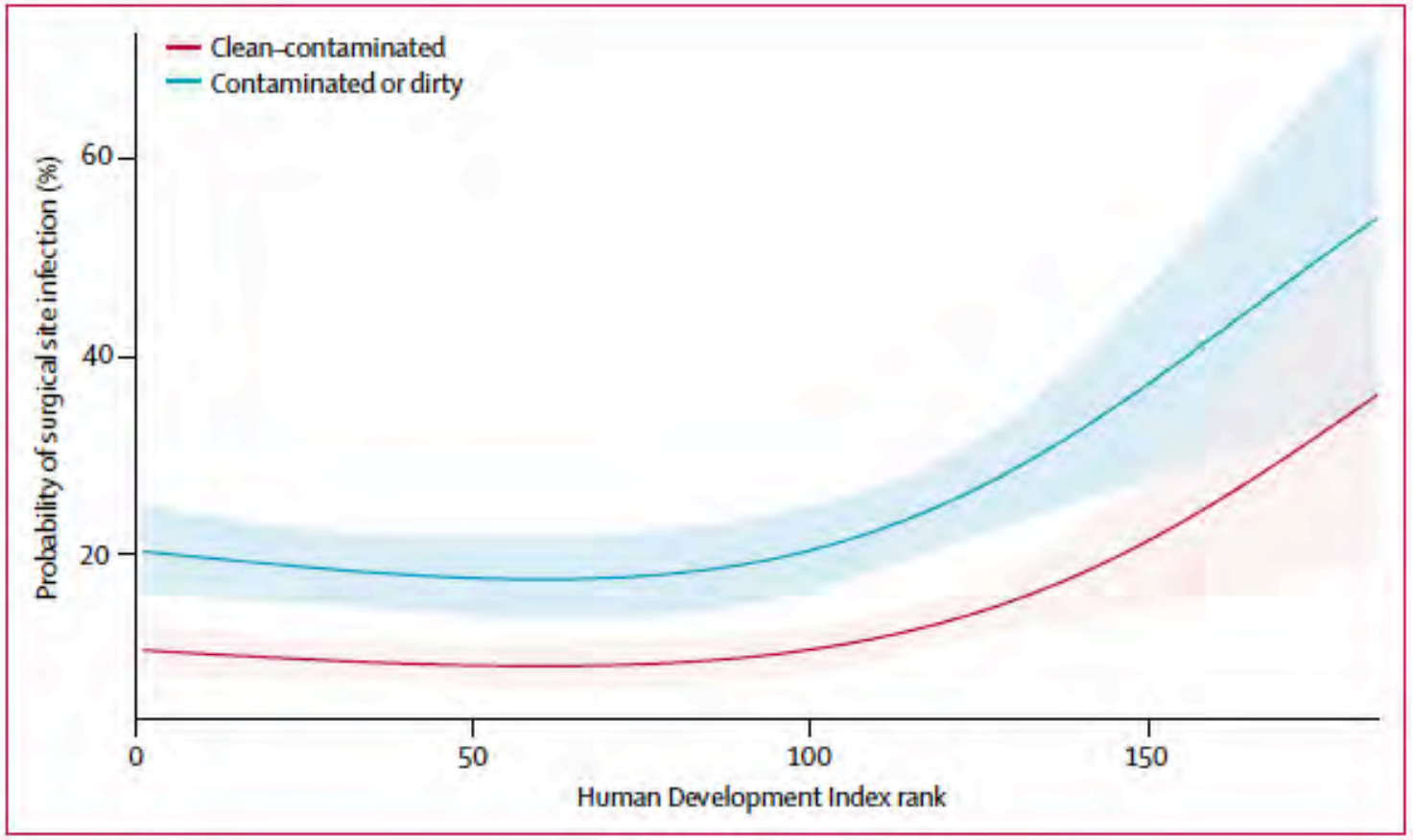


SSI in Developing Countries According to Wound Classification



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

Allegranzi B et al. Lancet 2011;377:228-41



The Lancet Infectious diseases 2018;18:516-25


Kata
Shauri

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

International Journal of Women's Health

Dovepress
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REVIEW

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

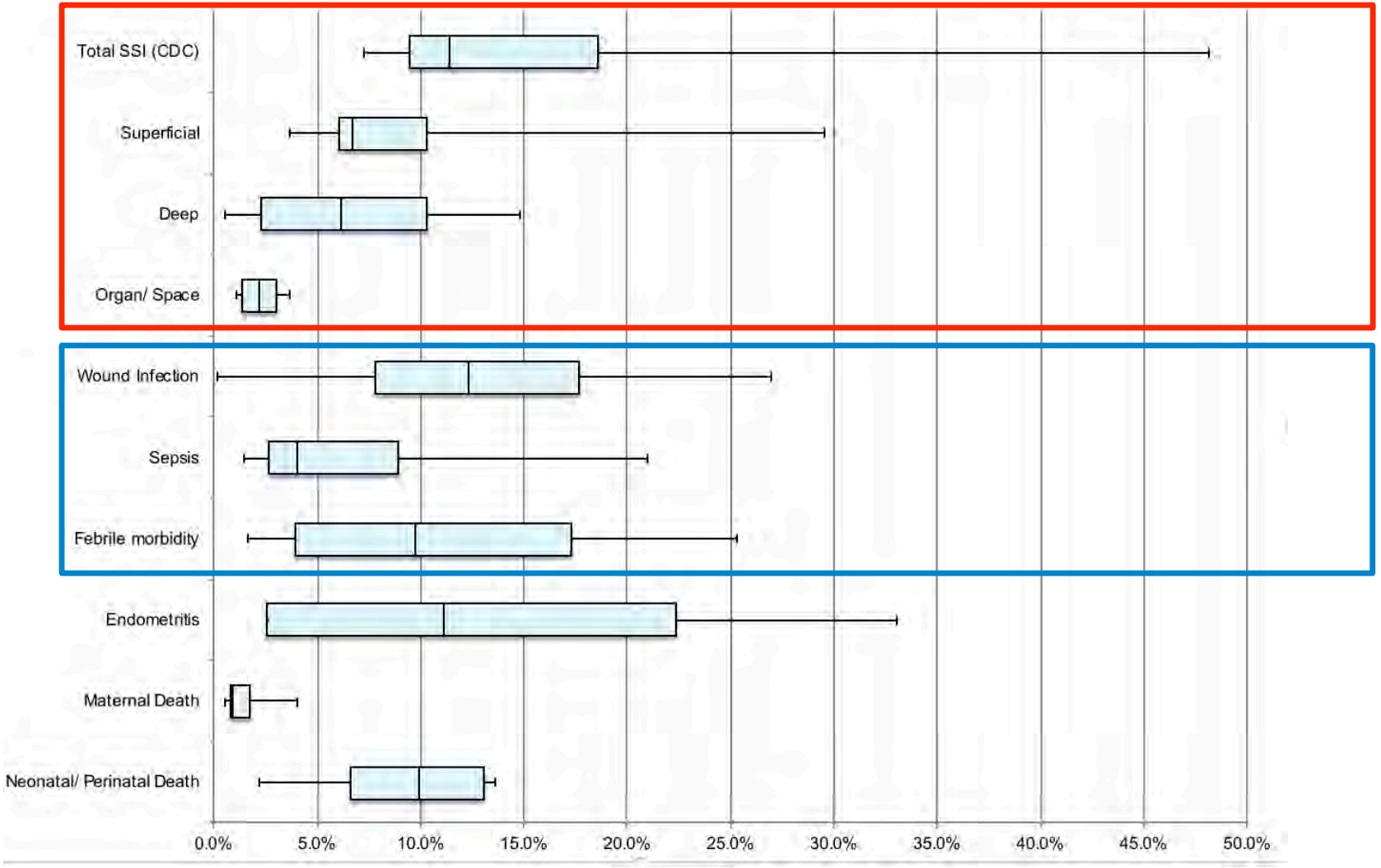
This article was published in the following Dove Medical Press journal:
International Journal of Women's Health

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

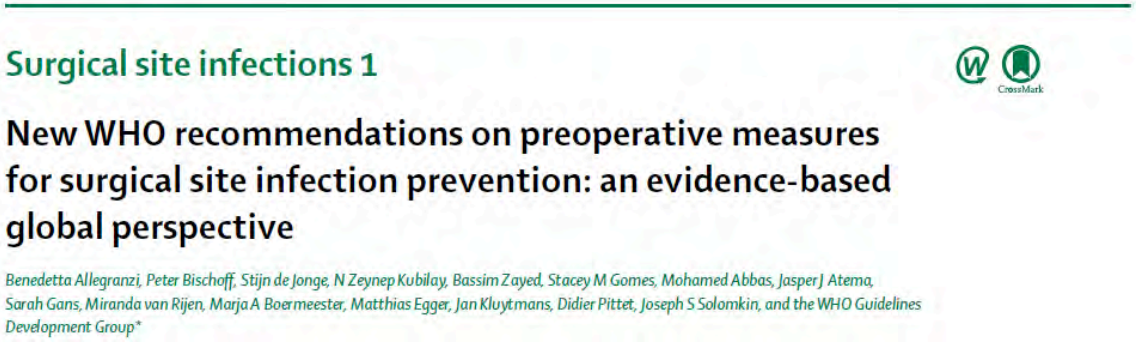
Sway A, et al: Int J Womens Health. 2019:11 Pages 309—318 https://doi.org/10.2147/IJWH.S182362

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



CDC classification

Ad hoc



Allegranzi B, et al. New WHO recommendations on intraoperative and postoperative measures for surgical site infection prevention: an evidence-based global perspective. The Lancet Infectious Diseases 2016;16:e288-e303.

Allegranzi B, et al. New WHO recommendations on preoperative measures for surgical site infection prevention: an evidence-based global perspective. The Lancet Infectious diseases 2016;16:e276-e87.

Berrios-Torres S, et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. JAMA surgery 2017.

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** **moderate quality of evidence**

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**

ANTIBIOTIC PROPHYLAXIS

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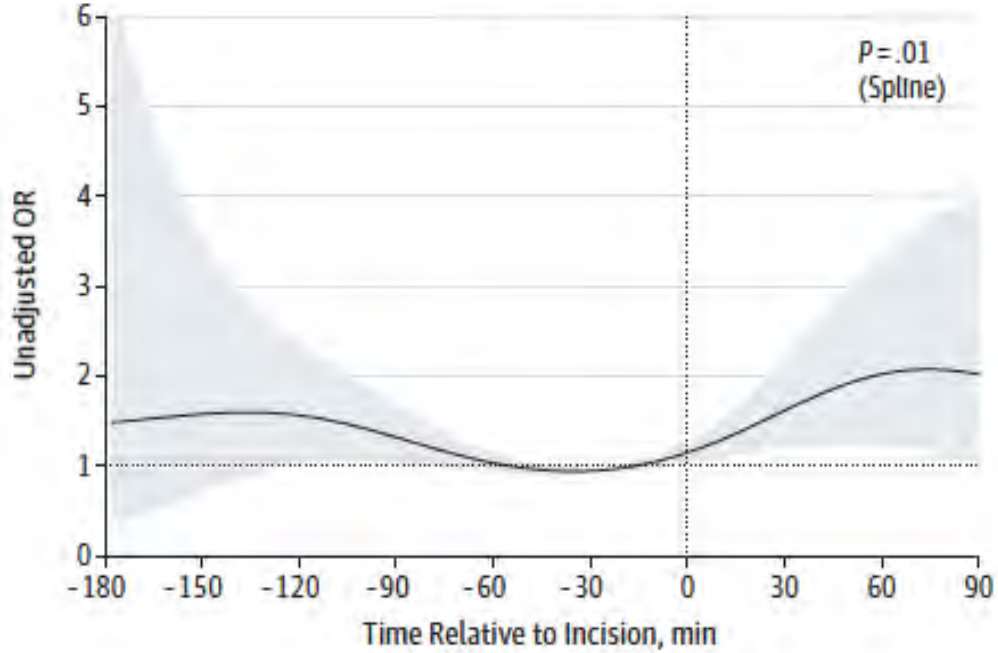
Hawn MT, Richman JS, Vick CC, et al. Timing of surgical antibiotic prophylaxis and the risk of surgical site infection. JAMA surgery 2013;148:649-57.



	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**

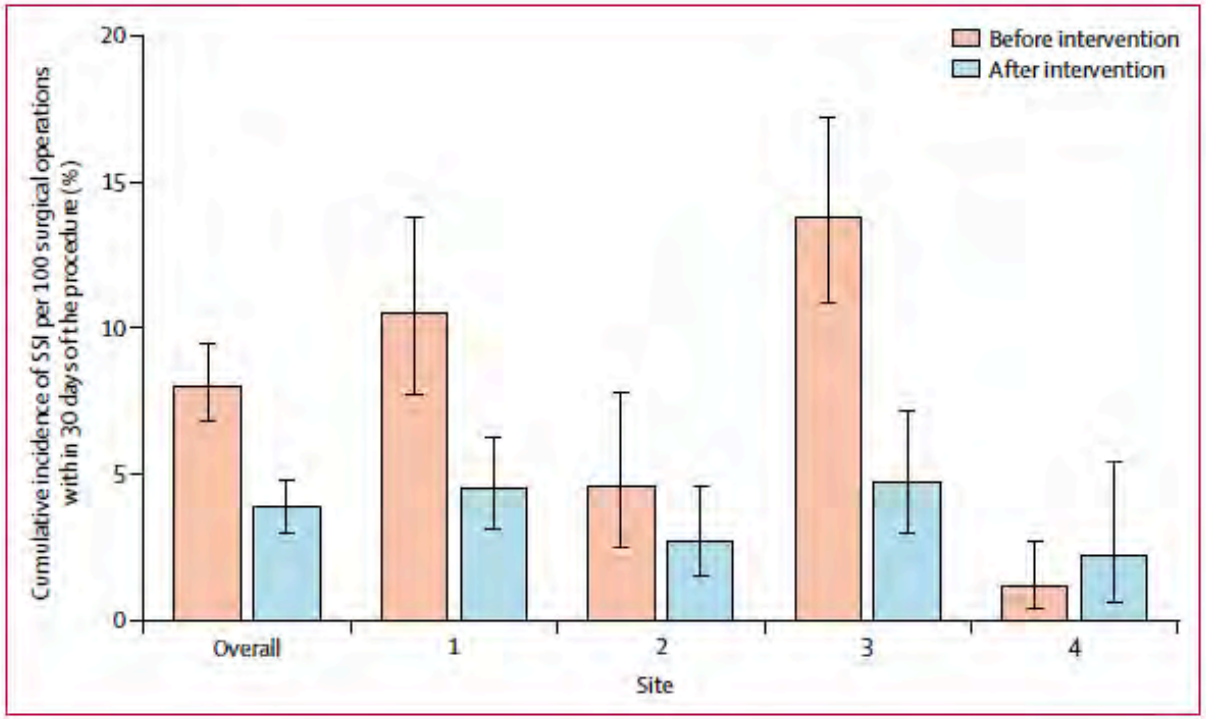
- Triclosan-coated sutures
- Antimicrobial dressings
- Laminar flow ventilation systems
- Prophylactic negative pressure wound therapy
- Wound protector devices
- Drapes and gowns
- Maintenance of adequate circulating volume control/ normovolemia
- Drains

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.

Outcome Results from the SUSP Study



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.

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

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

WSIS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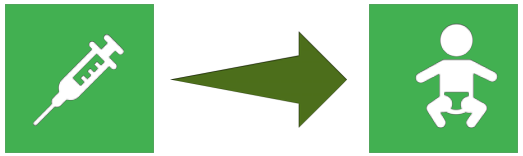
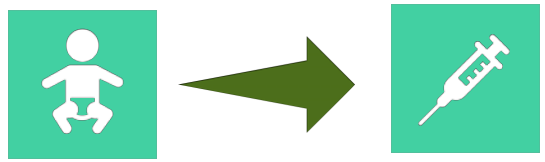
Lucina Project

Thika District Hospital



- 300 women enrolled at Thika District Hospital.
- Single shot prophylaxis antibiotic given ½ - 2 hours pre-incision.

Kiambu District Hospital



- 300 women enrolled at Kiambu District Hospital. 5-7 days antibiotics was routinely administered to ALL women following CS

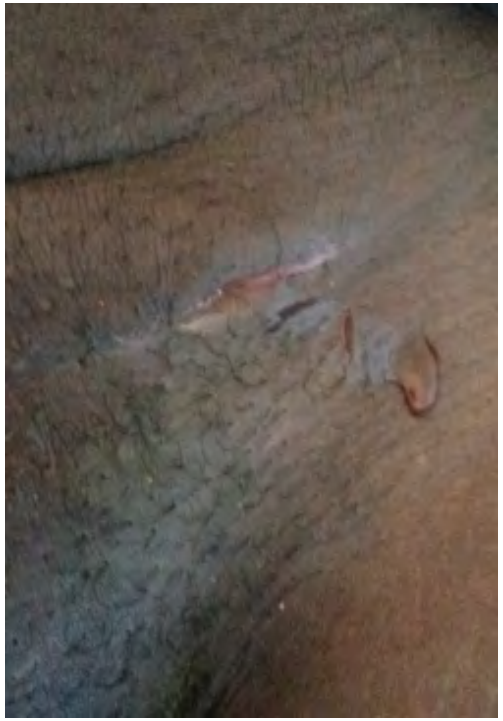
- Equivalent surgical credentials, patient demographics, indications for operation, and anesthesia, and skin preparation
- Surgical sites examined by surveyor Days 3, with clinical or cell phone contact follow up at 14 and 30 days

Results

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

Accuracy of Surveillance for Superficial Surgical Site Infection

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West Pokot
Samburu
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Baringo
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Laikipia
KIMILILI
MOLO
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Kakamega
Kenya
MALAVA
NANDI HILLS
Garissa
LURAMBI
Nyandarua
UGUNJA
BAHATI
Kirinyaga
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NAKURU TOWN EAST
Nyeri
Embu
KISUMU CENTRAL
Nakuru
GILGIL
Kiambu
NAIVASHA
HOMA BAY TOWN
Machakos
Tana River
Nairobi
SEME
Kitui
WEBUTE WEST
Narok
GEM
Lake Victoria
Makueni
Kajiado
Mara
Kilifi
Arusha
Taita Taveta
Mwanza
Kwale
Mombasa
Shinyanga
Kilimanjaro
Manyara

- 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

- **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**

- This would allow for more detailed, targeted implementation plans → therefore more effective

Conclusions

- The data shows a striking difference between SSI rates in patients who were given properly timed pre-operative antibiotics and patients who were only given post-operative antibiotics.
- Poor sterilization practices, unit cleansing, and other recognized patient- and status-dependent factors that are difficult to change without significant infrastructure and financial investment were overcome by appropriate antibiotic prophylaxis.
- This intervention is not only clinically effective, but also does not require additional labor or financial resources.

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