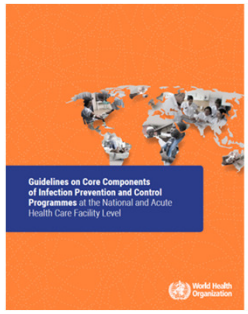
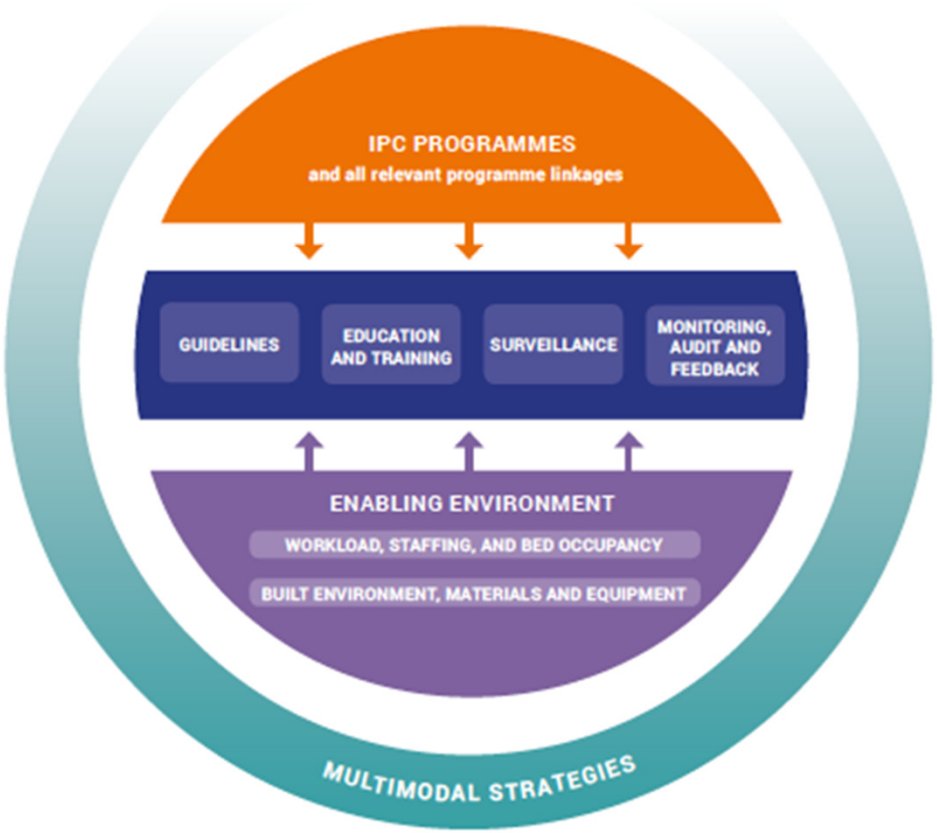
World Health Organization

WHO Guidelines on the prevention of surgical site infections

Professor Benedetta Allegranzi
Infection Prevention & Control
Global Unit, WHO HQ



WHO core components for effective IPC programmes



- **8 Core components**
  - *8 Facility level*
  - *6 National level*
- 11 evidence*-based recommendations
- 3 good practice statements

* Evidence from LMICs:
- 7 high-quality studies
- 22 lower quality

R= recommendation; GPS: good practice statement

World Health Organization

1 Awareness of the problem

STOP INFECTIONS AFTER SURGERY

World Health Organization

1

WHAT'S THE PROBLEM?

Patients develop infections when **bacteria get into incisions made during surgery**. These affect patients in both...

LOW- AND MIDDLE-INCOME COUNTRIES

More than 1 in 10 people who have surgery in low- and middle-income countries (LMICs) **get surgical site infections (SSIs)**

People's risk of SSI in LMICs is **3 TO 5 TIMES HIGHER** than in high-income countries

Up to **1 in 5 women in Africa** who deliver their baby by caesarean section get a **wound infection**

HIGH-INCOME COUNTRIES

In Europe, SSIs affect more than **500 000 PEOPLE** per year costing up to **€ 19 BILLION**

Around 1% of people who have surgery **in the USA get an SSI**

In the USA, SSIs contribute to patients spending more than **400 000 extra days** in hospital, costing **US$ 10 BILLION** per year

SSIs can be caused by bacteria that are **resistant to commonly-used antibiotics**

SSIs threaten the lives of millions of surgical patients **each year** and contribute to the spread of **antibiotic resistance**

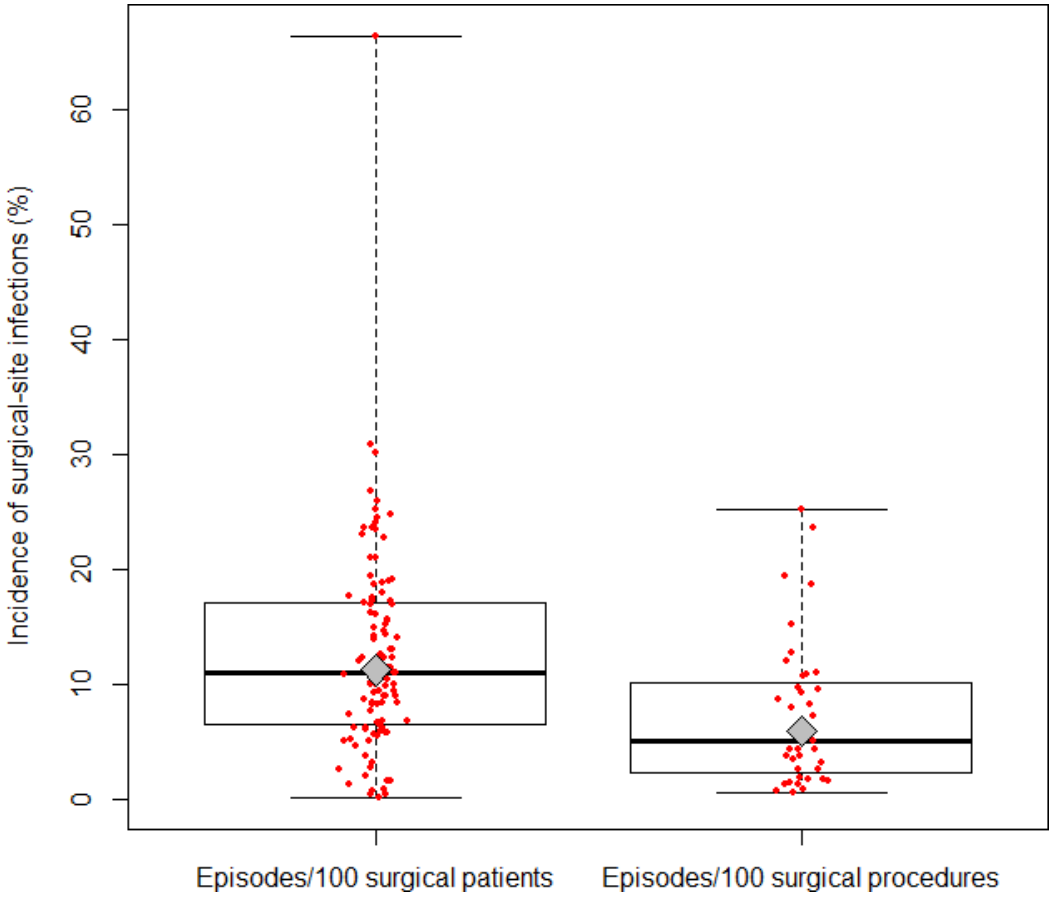
SSI epidemiology and burden

- **<u>Second and third most frequent</u> type of HAI in Europe and the USA**
- Most frequent type of HAI on admission (67% in the USA, 33% in Europe)
  - **SSI incidence** (per 100 procedures)
    - USA 2014: 1.9%
    - **Europe** 2013–14: 0.6–9.5%
      - **800 000 SSIs** leading to over **16 000 deaths, annually**
      - **EUR 1.5 billion-19 billion: total annual extra cost to health systems**
  - **AMR**: 39–51% of SSI pathogens are resistant to standard prophylactic antibiotics in the USA

Sources:

- National and state healthcare-associated infections progress report. Atlanta (GA): National Center for Emerging and Zoonotic Infectious Diseases, Centers for Disease Control and Prevention; 2016 (http://www.cdc.gov/HAI/pdfs/progressreport/ hai-progress-report.pdf, accessed 10 August 2016).
- ECDC. Annual epidemiological report 2016 – surgical site infections. Stockholm: European Centre for Disease Prevention and Control; 2016 https://ecdc.europa.eu/en/publications-data/surgical-site-infections-annual-epidemiological-report-2016-2014-data
- Cassini A. et al. "Burden of Six Healthcare-Associated Infections on European Population Health: Estimating Incidence-Based Disability-Adjusted Life Years through a Population Prevalence-Based Modelling Study", PLoS Med, Vol. 13, pp. 1-16, http://dx.doi.org/10.1371/journal.pmed.1002150
- Badia, J. et al. (2017), "Impact of surgical site infection on healthcare costs and patient outcomes: a systematic review in six European countries", J Hosp Infect 2017; 96: 1-15, http://dx.doi.org/10.1016/j.jhin.2017.03.004
- Suetens C et al. Prevalence of healthcare-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys 2016 to 2017. Euro Surveill. 2018;23(46):pii=1800516. https://doi.org/10.2807/1560-7917.ES.2018.23.46.1800516

SSI incidence in LMICs (1995–2015, 107 studies)



SSI pooled incidence in LMICs in:

– **caesarean sections:**

11.7%* (95% CI: 9.1–14.8)

– **prosthetic orthopaedic surgery:**

9.7%** (95% CI: 5.3–15.3)

* in Europe: **2.7%**

** in Europe: **0.7%** (knee prosthesis) to **1.0%** (hip prosthesis)

Pooled cumulative incidence: **11.2%** per 100 surgical patients (95% CI: 9.7–12.8)
5.9 per 100 surgical procedures (95% CI: 4.8–7.1)
$I^2 = 99.8\%$

Source: updated systematic review – WHO unpublished data, 2017.

Impact of increasing AMR on SSI

- Scenarios of 10% and 100% reduction in the effectiveness of surgical antibiotic prophylaxis:
  - From 44 000 to 439 000 additional postoperative infections would occur each year in the EU (increases of 5% and 50% relative to current estimates, respectively)
- 307 000 post-intervention deaths would occur each year if no effective antimicrobial treatment was available

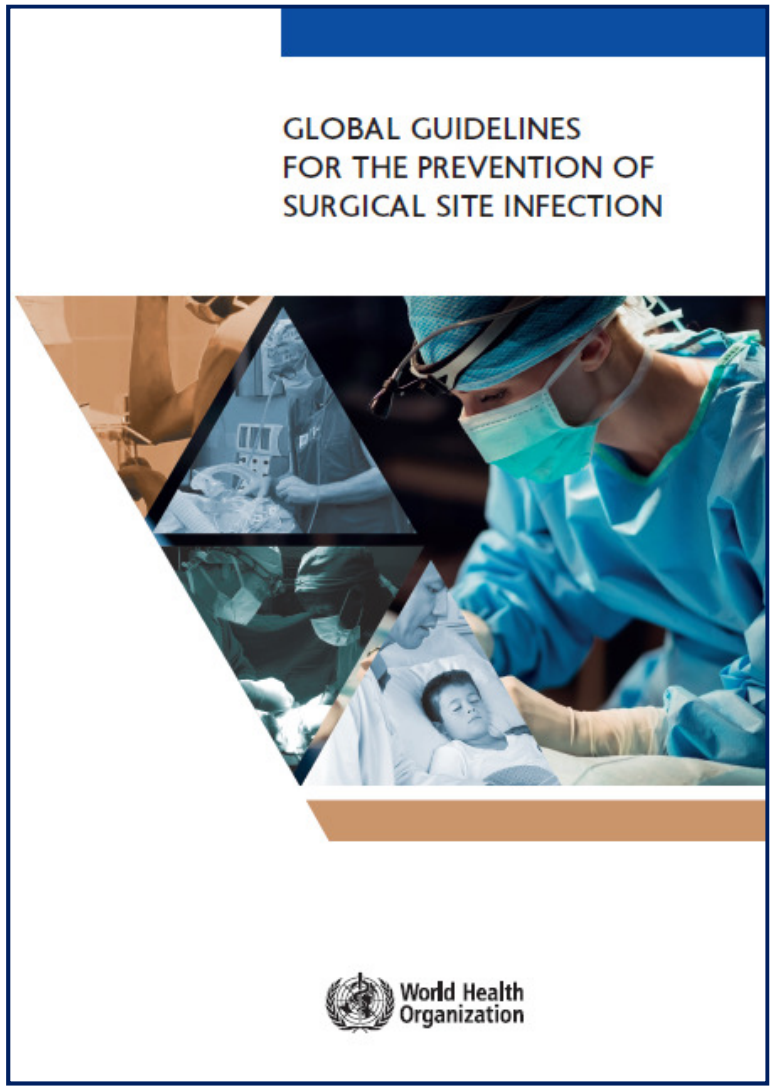
- OECD (2018), *Stemming the Superbug Tide: Just A Few Dollars More*, OECD Publishing, Paris. https://doi.org/10.1787/9789264307599-en
- Badia, J. et al. (2017), "Impact of surgical site infection on healthcare costs and patient outcomes: a systematic review in six European countries", J Hosp Infect 2017; 96: 1-15, http://dx.doi.org/10.1016/j.jhin.2017.03.004
- Surveillance of surgical site infections and prevention indicators in European hospitals HAI-Net SSI protocol, version 2.2 Surveillance of surgical site infections and prevention indicators in European hospitals, ECDC, http://dx.doi.org/10.2900/260119

World Health Organization

1 Awareness of the problem

2 Evidence-based recommendations

WHO Guidelines, updated 2018



- **28** systematic reviews & meta-analyses
- **29** recommendations
- **30** core chapters

http://apps.who.int/iris/bitstream/10665/250680/1/9789241549882-eng.pdf?ua=1
http://www.who.int/infection-prevention/publications/ssi-web-appendices/en/

Methods for recommendation development (1)

Development of recommendations

- Recommendations were based on systematic reviews and using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach, based on scientific evidence and expert consensus/country experience.
- The decision-making process involved expert discussion about the evidence of effectiveness of the preventive measure, any harms it may cause, resource implications of implementation and views of patients and professionals.

Source: Global guidelines for the prevention of surgical site infection. Geneva: World Health Organization; 2016 (http://www.who.int/infection-prevention/publications/ssi-prevention-guidelines/en/).

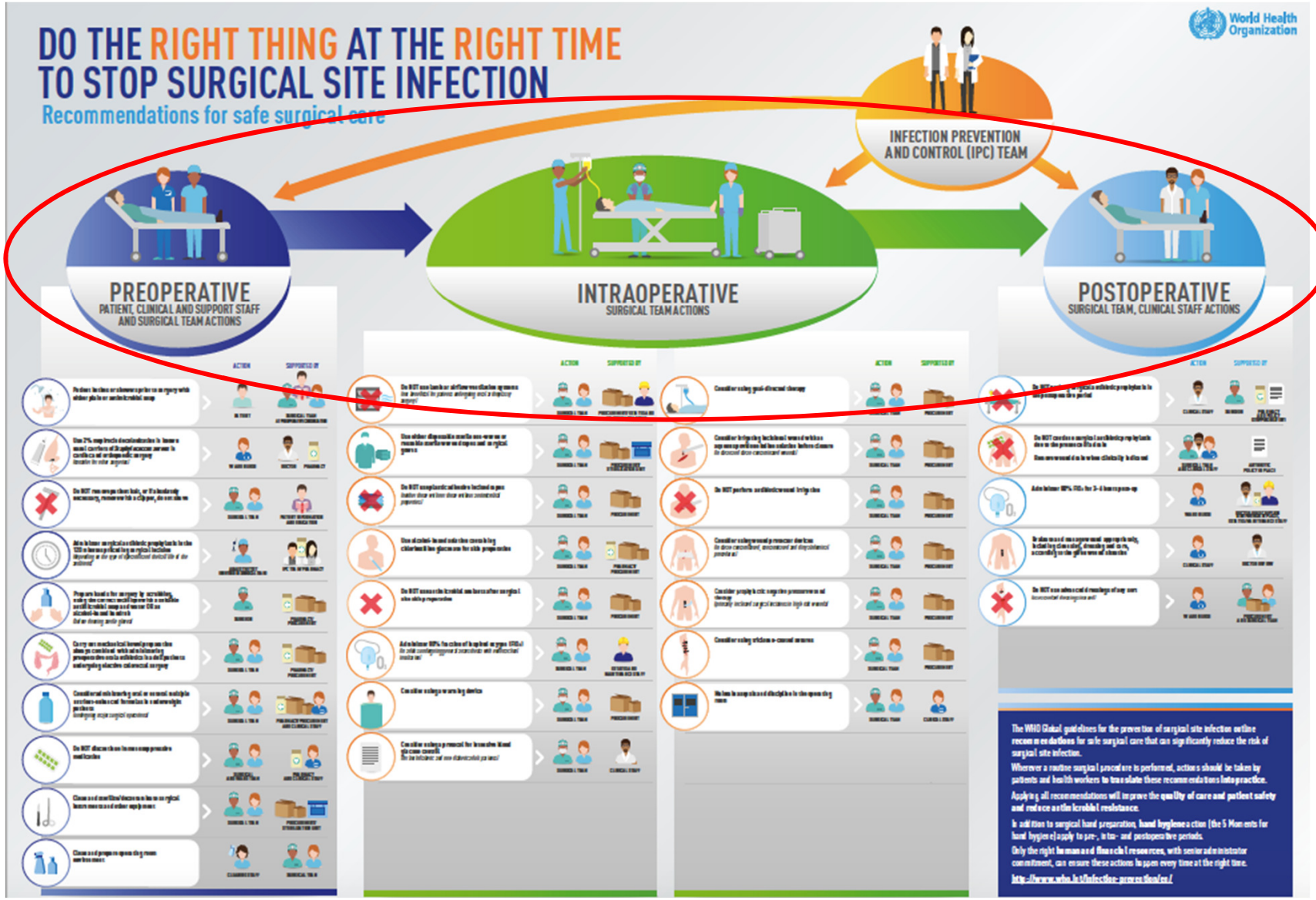
Methods for recommendation development (2)

Strength of recommendations – two types

- "Strong" – the expert panel was confident that benefits outweighed risks, that the measure was considered to be adaptable for implementation in most (if not all) situations and that patients should receive the intervention as standard.
- "Conditional" – the expert panel considered that the benefits of intervention probably outweighed the risks or that a more structured decision-making process should be undertaken, based on stakeholder consultation and involvement of patients and health care professionals.

SSI prevention throughout the surgical patient journey

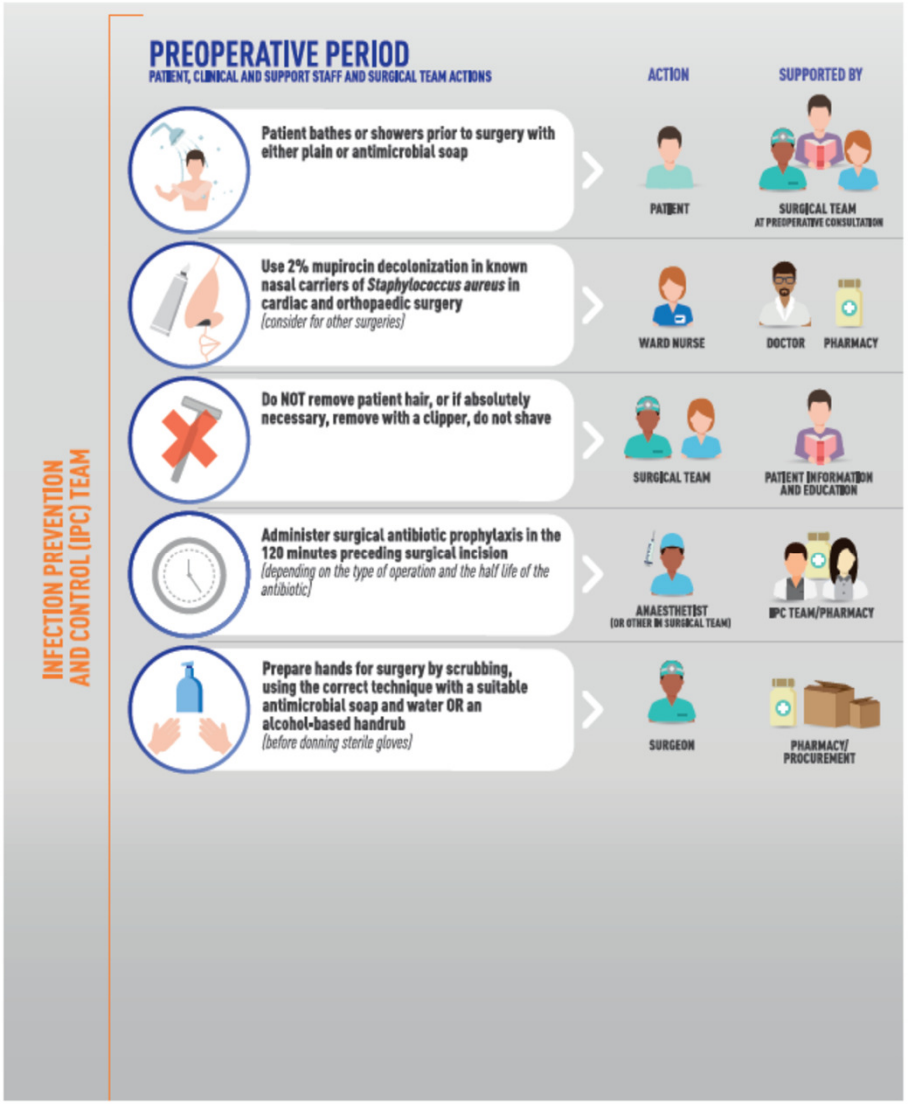
World Health Organization

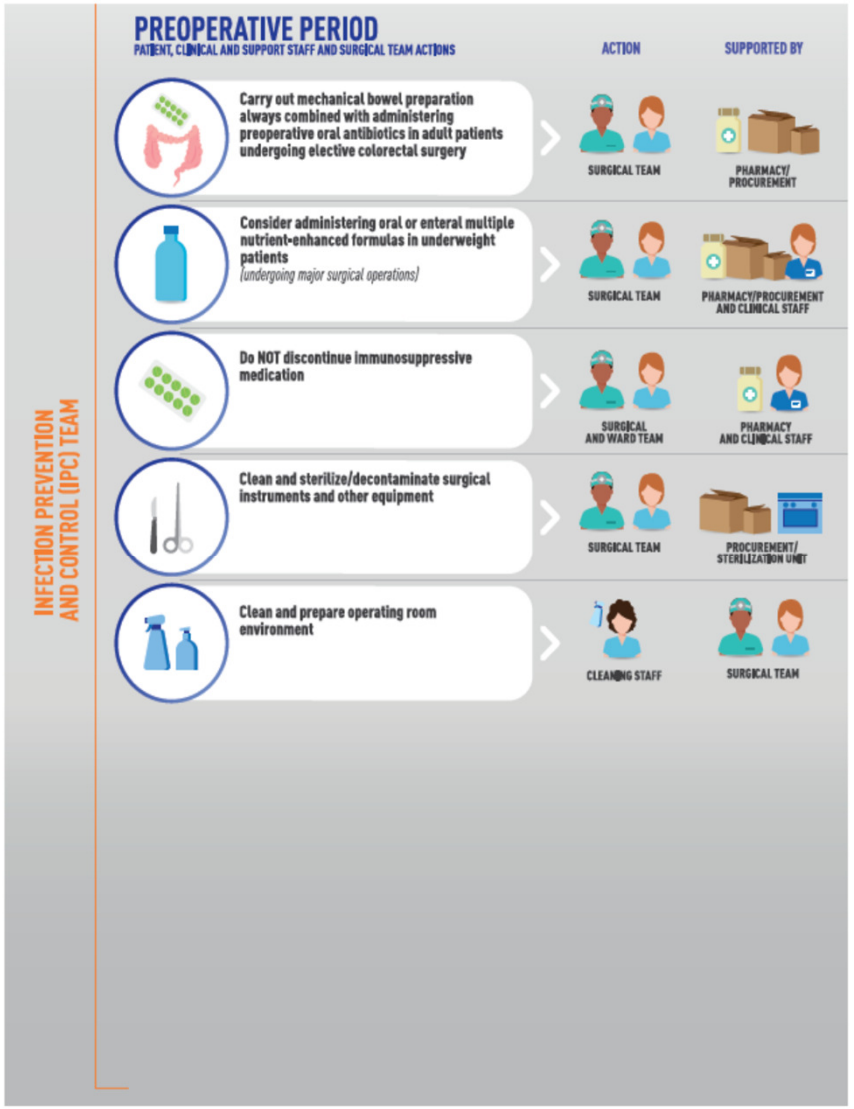


http://www.who.int/infection-prevention/tools/surgical/reminders-advocacy/en/

WHO recommendations for SSI prevention (1)

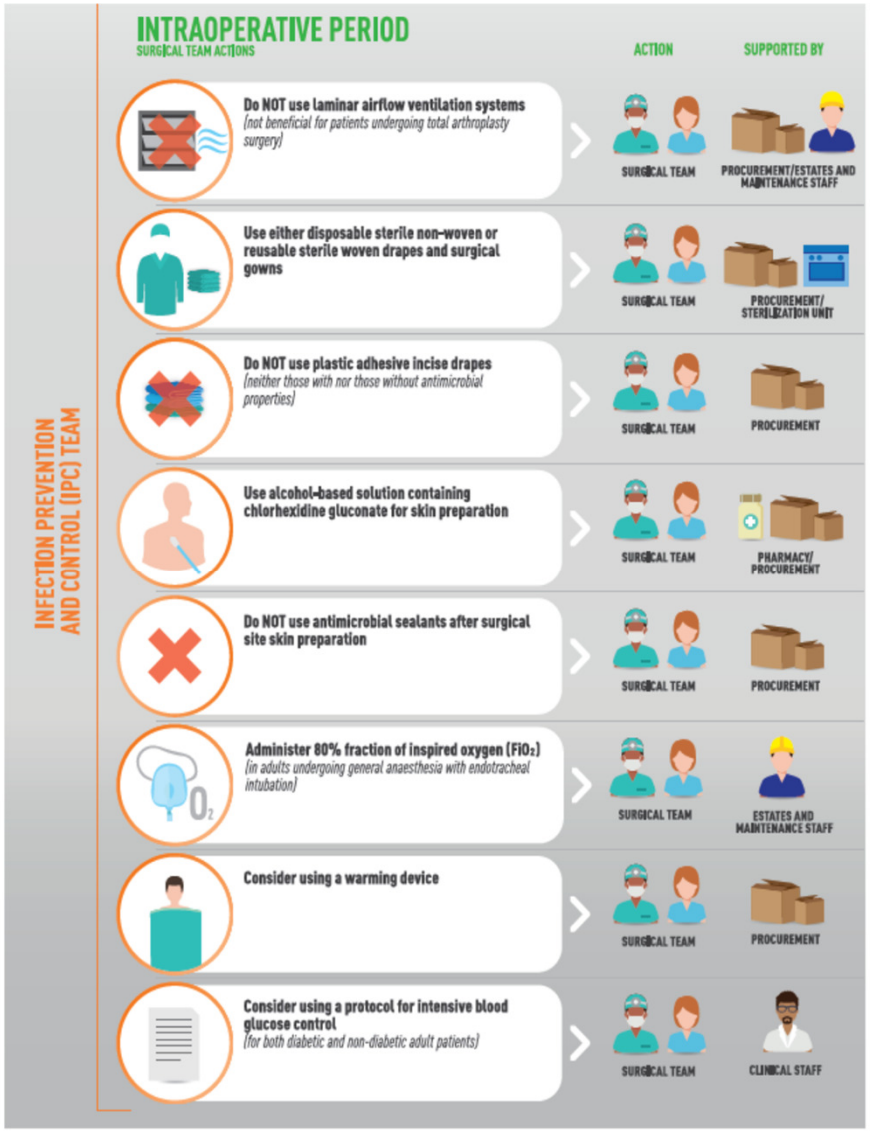
World Health Organization

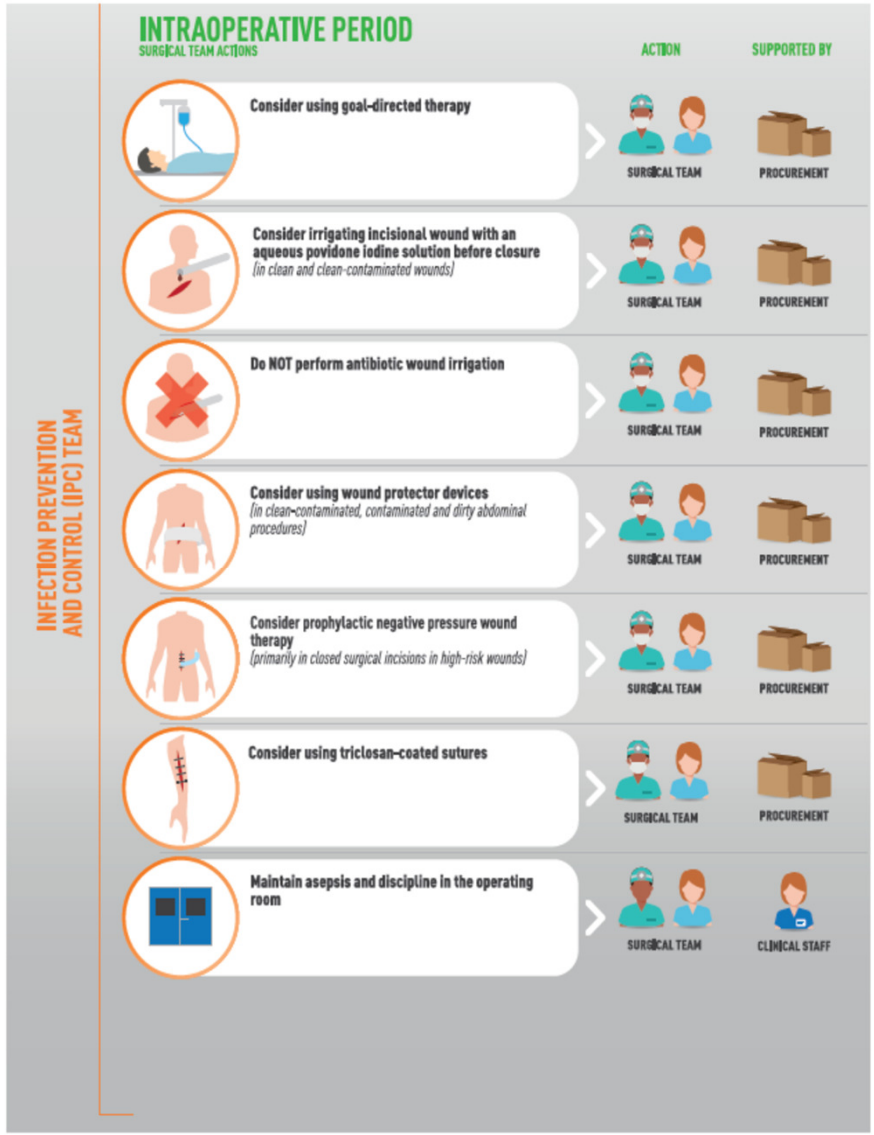




WHO recommendations for SSI prevention (2)

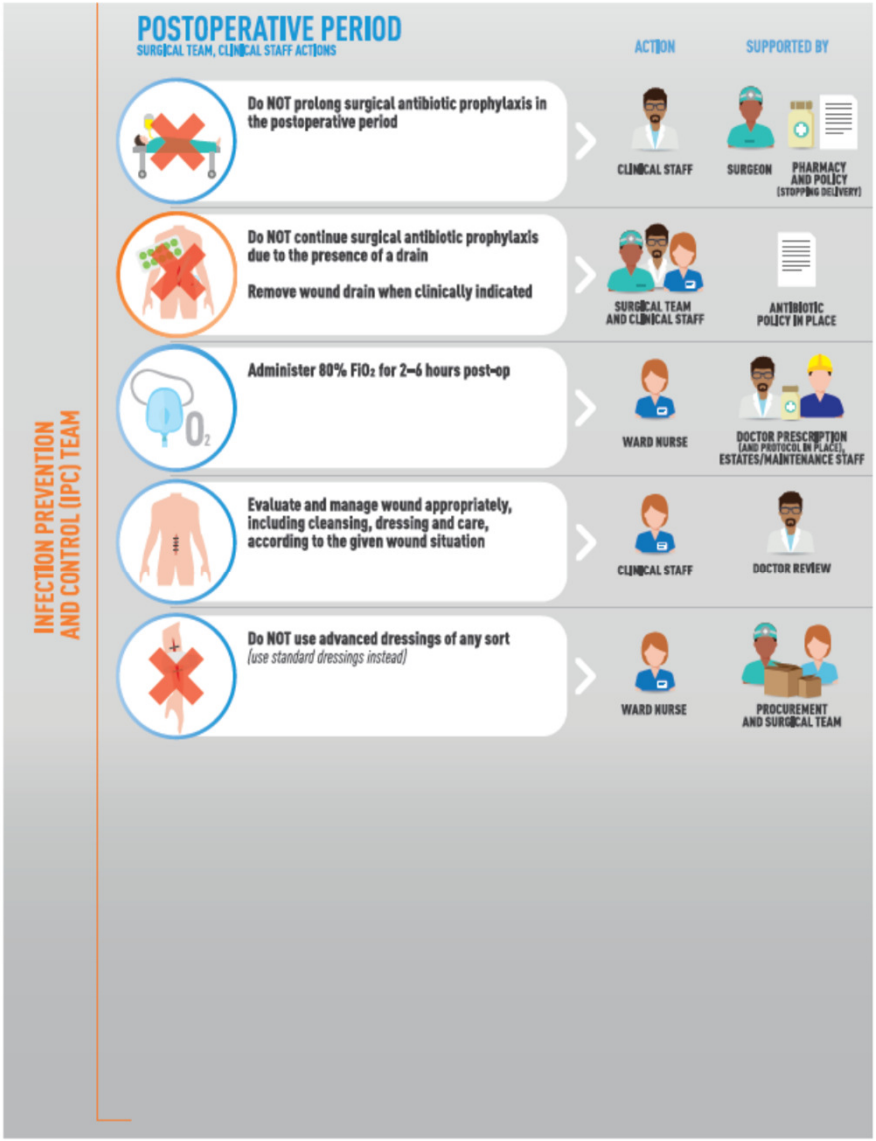
World Health Organization





WHO recommendations for SSI prevention (3)

World Health Organization



WHO Recommendations for SSI Prevention for the Preoperative Period

Carriers' decolonisation with mupirocin

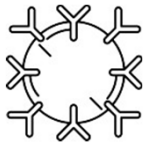
MBP with use of oral antibiotics ✗

Hair removal ✗

SAP optimal timing

Surgical hand preparation

Surgical site skin preparation



Perioperative immunosuppressive agents ✗

Enhanced nutritional support

Preoperative bathing

Antimicrobial skin sealants ✗

Strong recommendation

Conditional recommendation

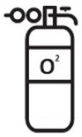
MBP: mechanical bowel preparation

SAP: surgical antibiotic prophylaxis

http://who.int/infection-prevention/publications/ssi-guidelines/en/

World Health Organization

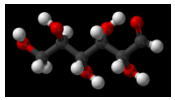
WHO Recommendations for SSI Prevention for the Pre- and/or Intraoperative Period



Peri-operative oxygenation

Normothermia

Normovolemia



Glucose control

(the right) drapes and gowns ✗

Wound protection devices

Incisional wound irrigation ✗

Prophylactic negative pressure wound therapy

Antimicrobial-coated sutures

Laminar flow ✗

http://who.int/infection-prevention/publications/ssi-guidelines/en/

World Health Organization

WHO Recommendations for SSI Prevention for the Postoperative Period

Surgical antibiotic prophylaxis prolongation ✗

Advanced dressing ✗

Antimicrobial prophylaxis in presence of a drain ✗

http://who.int/infection-prevention/publications/ssi-guidelines/en/

World Health Organization

World Health Organization

Operational manual for the WHO SSI prevention recommendations.

This implementation manual is designed to be used by all persons concerned by the prevention of SSI in all health care settings, irrespective of the country.

Launched in December 2018

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

Strong recommendation – preoperative measures: treatment of *S. aureus* nasal carriers (1)

World Health Organization

Patients undergoing cardiothoracic and orthopaedic surgery with known nasal carriage of *S. aureus* should receive perioperative intranasal applications of mupirocin 2% ointment with or without a combination of chlorhexidine gluconate (CHG) body wash.

Consider treating patients with known nasal carriage of *S. aureus* undergoing other types of surgery with perioperative intranasal applications of mupirocin 2% ointment with or without a combination of CHG body wash (associated conditional recommendation).

Strong recommendation – preoperative measures: treatment of *S. aureus* nasal carriers (2)

World Health Organization

Why

- *S. aureus* is a leading HAI pathogen worldwide.
- *S. aureus* infections impose a high burden on the patient and the health system and are a known cause of postoperative wound infections.
- Nasal carriage of *S. aureus* is a risk factor for subsequent infection in a patient. It has been shown repeatedly that a large proportion of HAIs due to *S. aureus* originate from patients' own flora.

Strong recommendation – preoperative measures: treatment of *S. aureus* nasal carriers (3)

World Health Organization

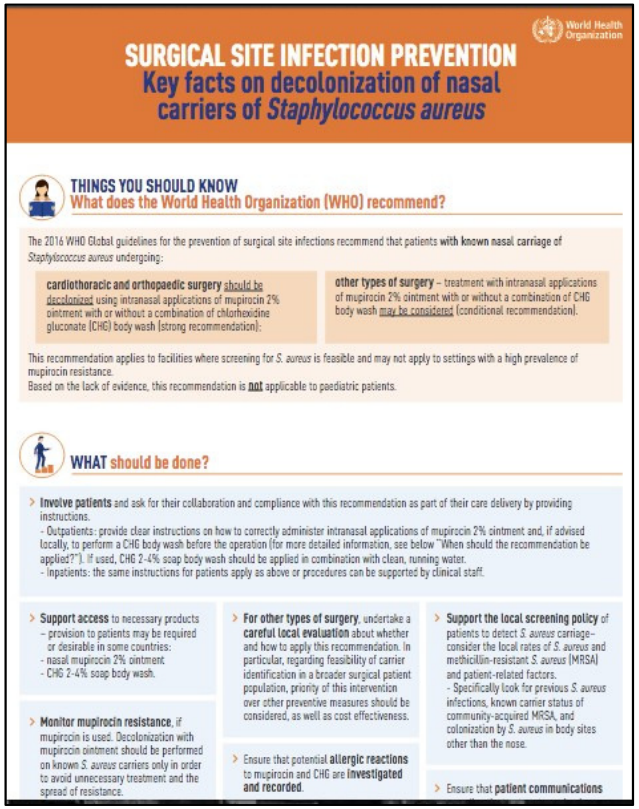
Notes

- Screening of patients for *S. aureus* varies between and within countries and is dependent on several factors including cost–effectiveness and local epidemiology.

- This recommendation only applies to facilities where screening (nasal swabs sent to a laboratory) for *S. aureus* is feasible, and may not apply to settings with high prevalence of mupirocin resistance.

Practical points

- This recommendation can be applicable to pre- and perioperative periods (depending on local conditions for treatment).
- The application of mupirocin is usually **twice a day for 5–7 days** before surgery or from the day of hospital admission to the day of surgery.
- Ensure that potential allergic reactions to mupirocin are investigated and recorded and patient communications and record keeping regarding this treatment occur.



SURGICAL SITE INFECTION PREVENTION
Key facts on decolonization of nasal carriers of *Staphylococcus aureus*

World Health Organization

THINGS YOU SHOULD KNOW
What does the World Health Organization (WHO) recommend?

The 2016 WHO Global guidelines for the prevention of surgical site infections recommend that patients **with known nasal carriage** of *Staphylococcus aureus* undergoing:

cardiothoracic and orthopaedic surgery should be decolonized using intranasal applications of mupirocin 2% ointment with or without a combination of chlorhexidine gluconate (CHG) body wash (strong recommendation);

other types of surgery – treatment with intranasal applications of mupirocin 2% ointment with or without a combination of CHG body wash may be considered (conditional recommendation).

This recommendation applies to facilities where screening for *S. aureus* is feasible and may not apply to settings with a high prevalence of mupirocin resistance.
Based on the lack of evidence, this recommendation is **not** applicable to paediatric patients.

WHAT should be done?

Involve patients and ask for their collaboration and compliance with this recommendation as part of their care delivery by providing instructions.
- Outpatients: provide clear instructions on how to correctly administer intranasal applications of mupirocin 2% ointment and, if advised locally, to perform a CHG body wash before the operation (for more detailed information, see below "When should the recommendation be applied?"). If used, CHG 2–4% soap body wash should be applied in combination with clean, running water.
- Inpatients: the same instructions for patients apply as above or procedures can be supported by clinical staff.

Support access to necessary products – provision to patients may be required or desirable in some countries:
- nasal mupirocin 2% ointment
- CHG 2–4% soap body wash.

Monitor mupirocin resistance, if mupirocin is used. Decolonization with mupirocin ointment should be performed on known *S. aureus* carriers only in order to avoid unnecessary treatment and the spread of resistance.

For other types of surgery, undertake a **careful local evaluation** about whether and how to apply this recommendation. In particular, regarding feasibility of carrier identification in a broader surgical patient population, priority of this intervention over other preventive measures should be considered, as well as cost effectiveness.

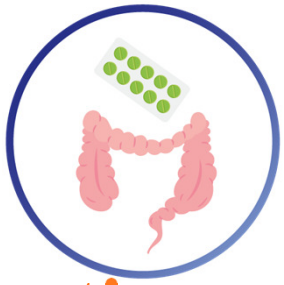
Ensure that potential **allergic reactions** to mupirocin and CHG are **investigated and recorded**.

Support the local screening policy of patients to detect *S. aureus* carriage– consider the local rates of *S. aureus* and methicillin-resistant *S. aureus* (MRSA) and patient-related factors.
- Specifically look for previous *S. aureus* infections, known carrier status of community-acquired MRSA, and colonization by *S. aureus* in body sites other than the nose.

Ensure that **patient communications**

Source: http://www.who.int/infection-prevention/tools/surgical/training_education/en/

Strong recommendation – preoperative measures: mechanical bowel preparation (MBP) and preoperative oral antibiotics



World Health Organization

1.MBP alone (*without* administration of oral antibiotics) should *not* be used in adult patients undergoing elective colorectal surgery (strong recommendation).

2.Preoperative oral antibiotics combined with MBP should be used to reduce the risk of SSI in adult patients undergoing elective colorectal surgery (conditional recommendation).

Why?

- Evidence (moderate quality) showed that preoperative MBP alone has neither benefit nor harm in reducing SSI rate when compared to performing no MBP.
- Further evidence (moderate quality) showed that **preoperative MBP combined with oral antibiotics reduced SSI when compared to MBP alone.**

Practical points

World Health Organization

- This recommendation applies only to the **preoperative period** and should not be referred to as “selective digestive decontamination”.
- **Local considerations** may determine variations in decisions about the type of MBP regimen and oral antibiotics, and the drug of choice for intravenous antibiotic prophylaxis (availability, resistance data and volume of surgical activity).
- The combination of drugs used should guarantee activity against both facultative gram-negative and anaerobic bacteria. In most studies, oral aminoglycosides were combined with metronidazole or erythromycin.

Strong recommendations – preoperative measures: hair removal

World Health Organization

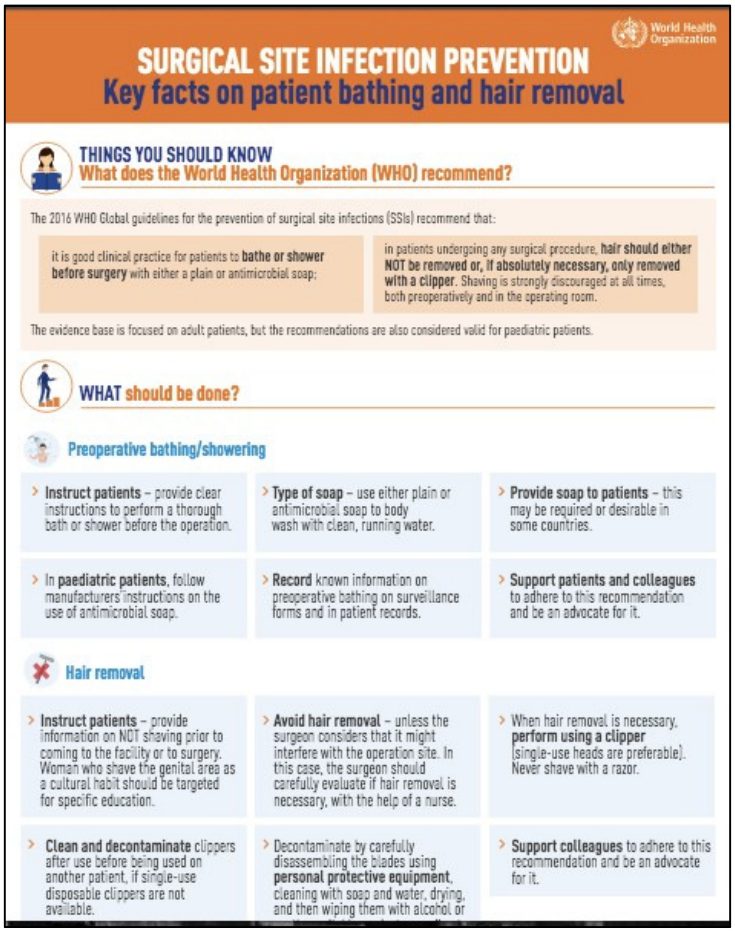
In patients undergoing any surgical procedure, hair should either *not* be removed or, if absolutely necessary, should only be removed with clippers. Shaving is strongly discouraged at all times, whether preoperatively or in the operating room.

Why?

- Removal of hair by any method has no benefit on the incidence of postoperative infection compared to no hair removal.
- The incidence of SSI is higher when hair removal is performed by razor than by clippers because shaving causes small abrasions to the skin.
- Most studies support that hair removal, if any, should be done immediately before operation.
- **Note:** the evidence showed that use of depilatory creams has no benefit (no lower SSI risk) compared with shaving; in addition, these sometimes produce hypersensitivity reactions. WHO does not recommend their use.

Practical points

- It has been noted that, when hair absolutely must be removed (when presence of hair will interfere with the operation), a single-use head should be used for electric clippers.
- Women may prefer shaving the genital area before surgery and may even come to the hospital already shaved because of cultural norms – this is something that should be avoided and should be addressed in training and education targeted at patients.



SURGICAL SITE INFECTION PREVENTION
Key facts on patient bathing and hair removal

THINGS YOU SHOULD KNOW
What does the World Health Organization (WHO) recommend?

The 2016 WHO Global guidelines for the prevention of surgical site infections (SSIs) recommend that:

it is good clinical practice for patients to **bathe or shower before surgery** with either a plain or antimicrobial soap;

in patients undergoing any surgical procedure, **hair should either NOT be removed or, if absolutely necessary, only removed with a clipper**. Shaving is strongly discouraged at all times, both preoperatively and in the operating room.

The evidence base is focused on adult patients, but the recommendations are also considered valid for paediatric patients.

WHAT should be done?

Preoperative bathing/showering

- **Instruct patients** – provide clear instructions to perform a thorough bath or shower before the operation.
- **Type of soap** – use either plain or antimicrobial soap to body wash with clean, running water.
- **Provide soap to patients** – this may be required or desirable in some countries.
- In **paediatric patients**, follow manufacturers' instructions on the use of antimicrobial soap.
- **Record** known information on preoperative bathing on surveillance forms and in patient records.
- **Support patients and colleagues** to adhere to this recommendation and be an advocate for it.

Hair removal

- **Instruct patients** – provide information on NOT shaving prior to coming to the facility or to surgery. Woman who shave the genital area as a cultural habit should be targeted for specific education.
- **Avoid hair removal** – unless the surgeon considers that it might interfere with the operation site. In this case, the surgeon should carefully evaluate if hair removal is necessary, with the help of a nurse.
- When hair removal is necessary, **perform using a clipper** (single-use heads are preferable). Never shave with a razor.
- **Clean and decontaminate** clippers after use before being used on another patient, if single-use disposable clippers are not available.
- Decontaminate by carefully disassembling the blades using **personal protective equipment**, cleaning with soap and water, drying, and then wiping them with alcohol or
- **Support colleagues** to adhere to this recommendation and be an advocate for it.

Key resource

Source: http://www.who.int/infection-prevention/tools/surgical/training_education/en/

Strong recommendations – preoperative measures: Surgical antibiotic prophylaxis (SAP) timing (1)

World Health Organization

SAP should be administered before the surgical incision, when indicated.

SAP should be administered within 120 minutes before incision, while considering the half-life of the antibiotic.

Why?

- Correct preoperative administration timing to achieve adequate concentration of drug at the site of incision at the beginning of the operation (highest risk of surgical site contamination) is critical. Incorrect (before 120 minutes or after incision) timing can lead to an increased risk of SSI.
- Correct antibiotic type according to the procedure and patient history aims to destroy the bacteria most frequently found at the operation site and to be safe for the patient.

Strong recommendations – preoperative measures: SAP timing (2)

World Health Organization

Notes

- Correct dosage is important to have the right antibiotic concentration at the operation site throughout the entire operation.

- Correct use of SAP is important not only to prevent SSI but also to avoid emergence of antimicrobial-resistant pathogens that can cause more serious disease to the patient.

Practical points

World Health Organization

- **Half-life of antibiotics** may affect serum and tissue concentrations – half-life of administered antibiotics should be taken into account in order to establish the exact time of administration within the 120-minute recommendation.
- Antibiotics with a short half-life (e.g. cefazolin, cefoxitin and penicillins in general) should be administered closer to the incision time (<60 minutes).
- Underlying factors in patients may also affect drug disposition (e.g. malnourishment, obesity, cachexia or renal disease with protein loss may result in suboptimal antibiotic exposure through increased antibiotic clearance in the presence of normal or augmented renal function).
- An example of surgery not requiring SAP is clean orthopaedic surgery not involving implantation of foreign materials.
- There are recommendations about **redosing** if a procedure exceeds two half-lives of the drug or if there is excessive blood loss, but not enough evidence is available to make this confirmed protocols.

Strong recommendations – preoperative measures: surgical hand preparation

World Health Organization

Surgical hand preparation should be performed by either scrubbing with a suitable antimicrobial soap and water or using a suitable alcohol-based handrub (ABHR) before donning sterile gloves.

Why?

- It is vitally important to maintain the lowest possible contamination of the surgical field (even when sterile gloves are worn – glove punctures can occur). Hand preparation should reduce the release of skin bacteria from the hands to the open wound.
- Surgical hand preparation should eliminate transient flora and reduce resident flora.
- Moderate-quality evidence shows the equivalence of ABHR and use of antimicrobial soap and water.
- **Note:** the hands of the surgical team should be clean upon entering the operating room.

Practical points

World Health Organization

- Once in the operating area, repeating handrubbing or scrubbing without an additional prior handwash is recommended before switching to the next procedure.
- Surgical handscrub and surgical handrub with an alcohol-based product should not be combined sequentially.
- Alcohol-based handrubs can be produced locally (more on this later).
- The use of alcohol on patients or health workers who for religious reasons may object has been addressed in the WHO guidelines on hand hygiene in health care, with cultural and religious leaders providing supporting statements to overcome barriers.
- Skin irritation can happen and health facilities should be alert to deal with such situations.

Source: WHO guidelines on hand hygiene in health care. Geneva: World Health Organization; 2009 (http://www.who.int/infection-prevention/tools/core-components/en/).

Strong recommendations – preoperative measures: surgical site skin preparation

World Health Organization

Alcohol-based antiseptic solutions based on CHG for surgical site skin preparation should be used in patients undergoing surgical procedures.

Why?

- This measure reduces the microbial load on the patient's skin as much as possible before incision.
- Alcohol-based CHG is more effective in reducing SSI rates compared to alcohol-based povidone-iodine.
- **Notes:** intact skin prep should be done prior to incision in the operating room. This recommendation is not proven for paediatric patients.

Practical points

- Alcohol-based solutions should **not** be in contact with mucosa or eyes and should not be used on newborns.
- Ensure operating and ward staff are aware that CHG can cause skin irritation.
- The use of alcohol on patients or health workers who for religious reasons may object has been addressed in the WHO guidelines on hand hygiene in health care, with cultural and religious leaders providing supporting statements to overcome barriers.
- Alcohol/CHG-based skin preparation solutions can be produced locally if needed (more on this later).

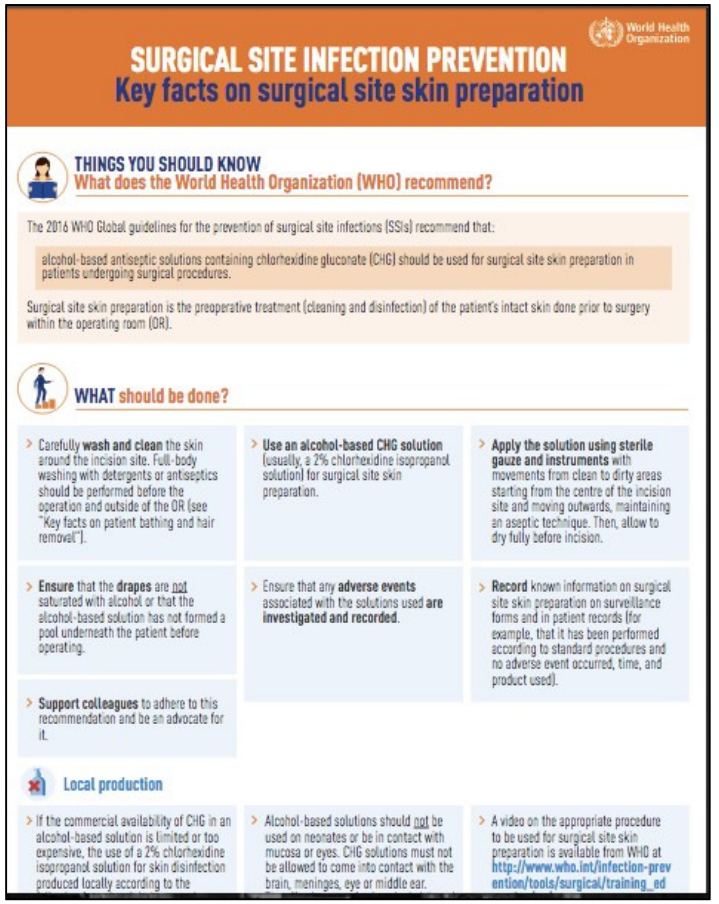
World Health Organization

In the operating room:

- ensure correct placement of patient (to avoid movement after skin prep but considering areas of skin that might be prone to breaking down due to the pressure of being in one position for too long) and skin examine;
- protect health workers against splashing – gloves should be worn but changed once the skin prep is complete;
- ensure skin preparation is **not** removed/washed off before draping.

Surgical skin preparation in practice: key resources

World Health Organization



SURGICAL SITE INFECTION PREVENTION
Key facts on surgical site skin preparation

THINGS YOU SHOULD KNOW
What does the World Health Organization (WHO) recommend?

The 2016 WHO Global guidelines for the prevention of surgical site infections (SSIs) recommend that:

alcohol-based antiseptic solutions containing chlorhexidine gluconate (CHG) should be used for surgical site skin preparation in patients undergoing surgical procedures.

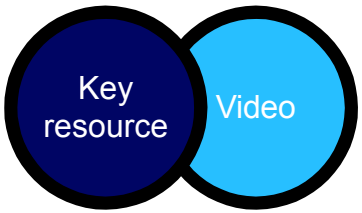
Surgical site skin preparation is the preoperative treatment (cleaning and disinfection) of the patient's intact skin done prior to surgery within the operating room (OR).

WHAT should be done?

- Carefully **wash and clean** the skin around the incision site. Full-body washing with detergents or antiseptics should be performed before the operation and outside of the OR (see "Key facts on patient bathing and hair removal").
- **Use an alcohol-based CHG solution** (usually, a 2% chlorhexidine isopropanol solution) for surgical site skin preparation.
- **Apply the solution using sterile gauze and instruments** with movements from clean to dirty areas starting from the centre of the incision site and moving outwards, maintaining an aseptic technique. Then, allow to dry fully before incision.
- **Ensure** that the **drapes** are not saturated with alcohol or that the alcohol-based solution has not formed a pool underneath the patient before operating.
- Ensure that any **adverse events** associated with the solutions used **are investigated and recorded.**
- **Record** known information on surgical site skin preparation on surveillance forms and in patient records (for example, that it has been performed according to standard procedures and no adverse event occurred, time, and product used).
- **Support colleagues** to adhere to this recommendation and be an advocate for it.

Local production

- If the commercial availability of CHG in an alcohol-based solution is limited or too expensive, the use of a 2% chlorhexidine isopropanol solution for skin disinfection produced locally according to the
- Alcohol-based solutions should not be used on neonates or be in contact with mucosa or eyes. CHG solutions must not be allowed to come into contact with the brain, meninges, eye or middle ear.
- A video on the appropriate procedure to be used for surgical site skin preparation is available from WHO at http://www.who.int/infection-prevention/tools/surgical/training_ed



Source: http://www.who.int/infection-prevention/tools/surgical/training_education/en/

Strong recommendations – intra- and postoperative measures:
SAP prolongation

World Health Organization

SAP administration should *not* be prolonged after completion of the operation.

Why?

- Moderate-quality evidence shows that prolonged SAP postoperatively has no benefit in reducing SSI after surgery compared to a single (preoperative) dose.
- Discontinuation of SAP after surgery avoids unnecessary extra costs, potential side-effects and emergence of AMR.

Practical points

World Health Organization

- This recommendation is applicable to the peri- and postoperative periods.
- A relevant harm linked to SAP prolongation is the intestinal spread of *Clostridium difficile*, with higher risk of clinical manifestation of infection.
- It can be challenging to ensure SAP is not continued or confused with the need for antibiotics due to an infection.

HANDLE ANTIBIOTICS WITH CARE IN SURGERY

Misuse of antibiotics puts all surgical patients at risk

World Health Organization

Up to **33%** of surgical patients get a postoperative infection, of which **51%** can be antibiotic resistant

Up to **15%** of women around the world get an infection after a caesarean section

43% of patients have surgical antibiotic prophylaxis (SAP) inappropriately continued after the operation

REDUCE

the risk of surgical site infection (SSI) by improving SAP and infection prevention and control practices

IMPROVE

quality of care and patient safety and reduce antimicrobial resistance (AMR) through SSI reduction

WHAT SHOULD HEALTH WORKERS DO TO PREVENT AMR IN SURGERY?

Give intravenous SAP
- when recommended, depending on the type of operation
- within 120 minutes preceding surgical incision

For effective SAP, adequate antibiotic tissue concentrations should be present at the time of surgical incision and throughout the procedure. Thus, antibiotics with a short half-life should be administered closer to incision time.

Improvement of antibiotic use in surgical services should be part of the antimicrobial stewardship programme

WHAT SHOULD YOU NOT DO?

Avoid prolonging SAP postoperatively

Avoid antibiotic wound irrigation

Avoid continuing antibiotic prophylaxis because there is a drain (evaluate each case)

Avoid giving antibiotic treatment unless there is a proven or suspected SSI or other infection

These recommendations are based on evidence from studies in adult patients, but they are considered valid also for paediatric patients

WHO SHOULD BE INVOLVED IN ENSURING APPROPRIATE ANTIBIOTIC USE IN SURGERY

SURGEONS

ANAESTHETISTS

OPERATING ROOM NURSES

INFECTIOUS DISEASES DOCTORS

INFECTION PREVENTION & CONTROL TEAM

SURGICAL WARD STAFF

PHARMACISTS

SENIOR MANAGERS AND PROCUREMENT STAFF

PATIENTS AND THEIR FAMILIES (CIVIL SOCIETY)

HEALTH CARE WITHOUT AVOIDABLE INFECTIONS

www.who.int/infection-prevention/publications/ssi-guidelines/en

http://www.who.int/infection-prevention/tools/focus-amr/en/

WHO conditional recommendations for SSI prevention

Conditional recommendations are also important recommendations for which the expert panel considered that the benefits of intervention probably outweighs the risks; however, when considering them for adoption, a more structured decision-making process should be undertaken, based on stakeholder consultation and involvement of patients and health care professionals.

This involves considering local priorities for improvement, feasibility, resource (both human and financial) implications and local culture.

WHO conditional recommendations for SSI prevention – preoperative period (1)

Topic	Research question	Recommendation	Strength Quality
Perioperative discontinuation of immunosuppressive agents	Should immunosuppressive agents be discontinued perioperatively and does this affect the incidence of SSI?	Immunosuppressive medication should not be discontinued prior to surgery for the purpose of preventing SSI.	Conditional recommendation --- Very low quality of evidence
Enhanced nutritional support	In surgical patients, should enhanced nutritional support be used for the prevention of SSI?	Consider the administration of oral or enteral multiple nutrient-enhanced nutritional formulas for the purpose of preventing SSI in underweight patients who undergo major surgical operations.	Conditional recommendation --- Very low quality of evidence
Preoperative bathing	1. Is preoperative bathing using an antiseptic soap more effective in reducing the incidence of SSI in surgical patients when compared to bathing with plain soap? 2. Is preoperative bathing with CHG-impregnated cloths more effective in reducing the incidence of SSI in surgical patients when compared to bathing with antiseptic soap?	It is good clinical practice for patients to bathe or shower before surgery. Either a plain soap or an antiseptic soap could be used for this purpose. Due to very low quality evidence, the panel decided not to formulate a recommendation the use of CHG-impregnated cloths for the purpose of reducing SSI.	Conditional recommendation --- Moderate quality of evidence

Source: Global guidelines for the prevention of surgical site infection. Geneva: World Health Organization; 2016 (http://www.who.int/infection-prevention/publications/ssi-prevention-guidelines/en/).

WHO conditional recommendations for SSI prevention – preoperative period (2)

World Health Organization

Topic	Research question	Recommendation	Strength Quality
Decolonisation with mupirocin ointment with or without CHG body wash for the prevention of *S. aureus* infection in nasal carriers undergoing surgery	Is mupirocin nasal ointment in combination with or without a CHG body wash effective in reducing the number of *S. aureus* infections in nasal carriers undergoing surgery?	Patients undergoing cardiothoracic and orthopaedic surgery with known nasal carriage of *S. aureus* should receive perioperative intranasal applications of mupirocin 2% ointment with or without a combination of CHG body wash. Consider also treating patients with known nasal carriage of *S. aureus* undergoing other types of surgery with perioperative intranasal applications of mupirocin 2% ointment with or without a combination of CHG body wash.	**Strong recommendation** --- Moderate quality of evidence Conditional recommendation --- Moderate quality of evidence
MBP and the use of oral antibiotics	Is MBP combined with or without oral antibiotics effective for the prevention of SSI in colorectal surgery?	Preoperative oral antibiotics combined with MBP should be used to reduce the risk of SSI in adult patients undergoing elective colorectal surgery. MBP alone (without the administration of oral antibiotics) should not be used for the purpose of reducing SSI in adult patients undergoing elective colorectal surgery.	Conditional recommendation --- Moderate quality of evidence **Strong recommendation** --- Moderate quality of evidence

WHO conditional recommendations for SSI prevention – preoperative period (3)

World Health Organization

Topic	Research question	Recommendation	Strength Quality
Antimicrobial skin sealants	In surgical patients, should antimicrobial sealants (in addition to standard surgical site skin preparation) versus standard surgical site skin preparation be used for the prevention of SSI?	Antimicrobial sealants should not be used after surgical site skin preparation for the purpose of reducing SSI.	Conditional recommendation ---------- Very low quality of evidence
Perioperative oxygenation	How safe and effective is the perioperative use of an increased fraction of inspired oxygen in reducing the risk of SSI?	The panel suggests that adult patients undergoing general anaesthesia with endotracheal intubation for surgical procedures should receive an 80% fraction of inspired oxygen intraoperatively and, if feasible, in the immediate postoperative period for 2-6 hours to reduce the risk of SSI.	Conditional recommendation ---------- Moderate quality of evidence

WHO conditional recommendations for SSI prevention – intraoperative period (1)

World Health Organization

Topic	Research question	Recommendation	Strength Quality
Maintaining normal body temperature (normothermia)	In surgical patients, should systemic body warming versus no warming be used for the prevention of SSI?	Warming devices should be used in the operating room and during the surgical procedure for patient body warming with the purpose of reducing SSI.	Conditional recommendation --- Moderate quality of evidence
Use of protocols for intensive perioperative blood glucose control	1. Do protocols aiming to maintain optimal perioperative blood glucose levels reduce the risk of SSI? 2. What are the optimal perioperative glucose target levels in diabetic and non-diabetic patients?	Protocols for intensive perioperative blood glucose control should be used for both diabetic and non-diabetic adult patients undergoing surgical procedures.	Conditional recommendation --- Low quality of evidence
Maintenance of adequate circulating volume control/ normovolaemia	Does the use of specific fluid management strategies during surgery affect the incidence of SSI?	Goal-directed fluid therapy should be used intraoperatively for the purpose of the reduction of SSI.	Conditional recommendation --- Low quality of evidence

WHO conditional recommendations for SSI prevention – intraoperative period (2)

World Health Organization

Topic	Research question	Recommendation	Strength Quality
Drapes and gowns	1. Is there a difference in SSI rates depending on the use of disposable non-woven drapes and gowns vs. reusable, woven drapes and gowns? 2. Does changing drapes during operations affect the risk of SSI? 3. Does the use of disposable adhesive incise drapes reduce the risk of SSI?	Either sterile disposable non-woven or sterile reusable woven drapes and surgical gowns can be used during surgical operations for the purpose of preventing SSI. Plastic adhesive incise drapes with or without antimicrobial properties should not be used for the purpose of preventing SSI.	Conditional recommendation --- Moderate to very low quality of evidence Conditional recommendation --- Low to very low quality of evidence
Wound protector devices	Does the use of wound protector devices reduce the rate of SSI in open abdominal surgery?	Consider the use of wound protector devices in clean-contaminated, contaminated and dirty abdominal surgical procedures for the purpose of reducing the rate of SSI.	Conditional recommendation --- Very low quality of evidence

WHO conditional recommendations for SSI prevention – intraoperative period (3)

World Health Organization

Topic	Research question	Recommendation	Strength Quality
Incisional wound irrigation	Does intraoperative wound irrigation reduce the risk of SSI?	There is insufficient evidence to recommend for or against saline irrigation of incisional wounds for the purpose of preventing SSI. Consider the use of irrigation of the incisional wound with an aqueous povidone iodine solution before closure for the purpose of preventing SSI, particularly in clean and clean-contaminated wounds. Antibiotic incisional wound irrigation before closure should not be used for the purpose of preventing SSI.	Conditional recommendation --- Low quality of evidence Conditional recommendation --- Low quality of evidence Conditional recommendation --- Low quality of evidence
Prophylactic negative pressure wound therapy	Does prophylactic negative pressure wound therapy reduce the rate of SSI compared to the use of conventional dressings?	Prophylactic negative pressure wound therapy may be used on primarily closed surgical incisions in high-risk wounds and, taking resources into account, for the purpose of preventing SSI.	Conditional recommendation --- Low quality of evidence

WHO conditional recommendations for SSI prevention – intraoperative period (4)

World Health Organization

Topic	Research question	Recommendation	Strength Quality
Antimicrobial-coated sutures	Are antimicrobial-coated sutures effective to prevent SSI? If yes, when and how should they be used?	Triclosan-coated sutures may be used for the purpose of reducing the risk of SSI, independent of the type of surgery.	Conditional recommendation --- Moderate quality of evidence
Laminar flow ventilation systems in the context of operating room ventilation	1. Is the use of laminar air flow in the operating room associated with the reduction of overall or deep SSI? 2. Does the use of fans or cooling devices increase SSIs? 3. Is natural ventilation an acceptable alternative to mechanical ventilation?	Laminar airflow ventilation systems should not be used to reduce the risk of SSI for patients undergoing total arthroplasty surgery.	Conditional recommendation --- Low to very low quality of evidence

WHO conditional recommendations for SSI prevention – postoperative period

World Health Organization

Topic	Research Question	Recommendation	Strength Quality
Antimicrobial prophylaxis in the presence of a drain and optimal timing for wound drain removal	1. In the presence of drains, does prolonged antibiotic prophylaxis prevent SSI? 2. When using drains, how long should they be kept in place to minimise SSI as a complication?	Perioperative surgical antibiotic prophylaxis should not be continued due to the presence of a wound drain for the purpose of preventing SSI. The wound drain should be removed when clinically indicated. No evidence was found to allow making a recommendation on the optimal timing of wound drain removal for the purpose of the prevention of SSI.	Conditional recommendation --- Low quality of evidence Conditional recommendation --- Very low quality of evidence
Advanced dressings	In surgical patients, should advanced dressings vs. standard sterile wound dressings be used for the prevention of SSI?	Advanced dressing of any type should not be used over a standard dressing on primarily closed surgical wounds for the purpose of preventing SSI.	Conditional recommendation --- Low quality of evidence

2014 systematic review & 2016 WHO guidelines

Results:

- 15 RCT, 7237 patients
- Range of procedures
- General & Neuraxial anesthesia

- OR: 0.84 (95% CI, 0.66 to 1.06)
- Chi^2 P-value: 0.01, I^2: 51%

*See WHO Guidelines chapter 4.12 pages 110-115 and Web Appendix 13 at http://www.who.int/gpsc/appendix13.pdf?ua=1

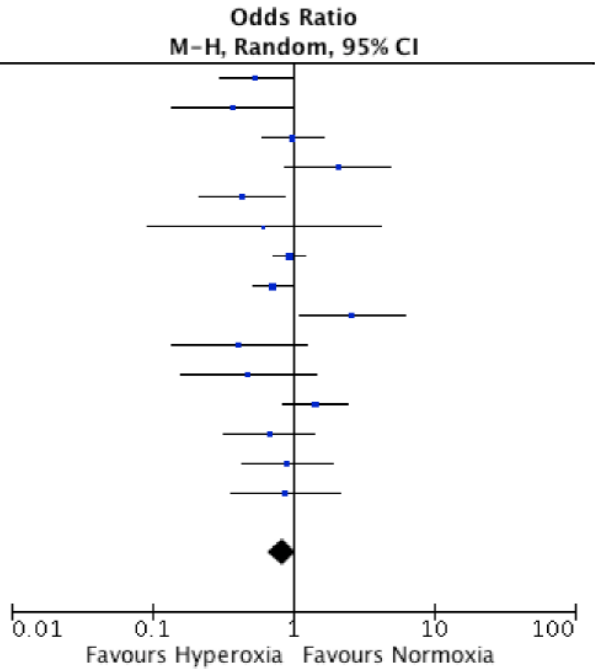
2014 systematic review & 2016 WHO guidelines
Overall analysis

15 RCT, 7237 patients
Range of procedures
General & Neuraxial anesthesia

1) Administration of increased FiO2 vs. standard oxygenation

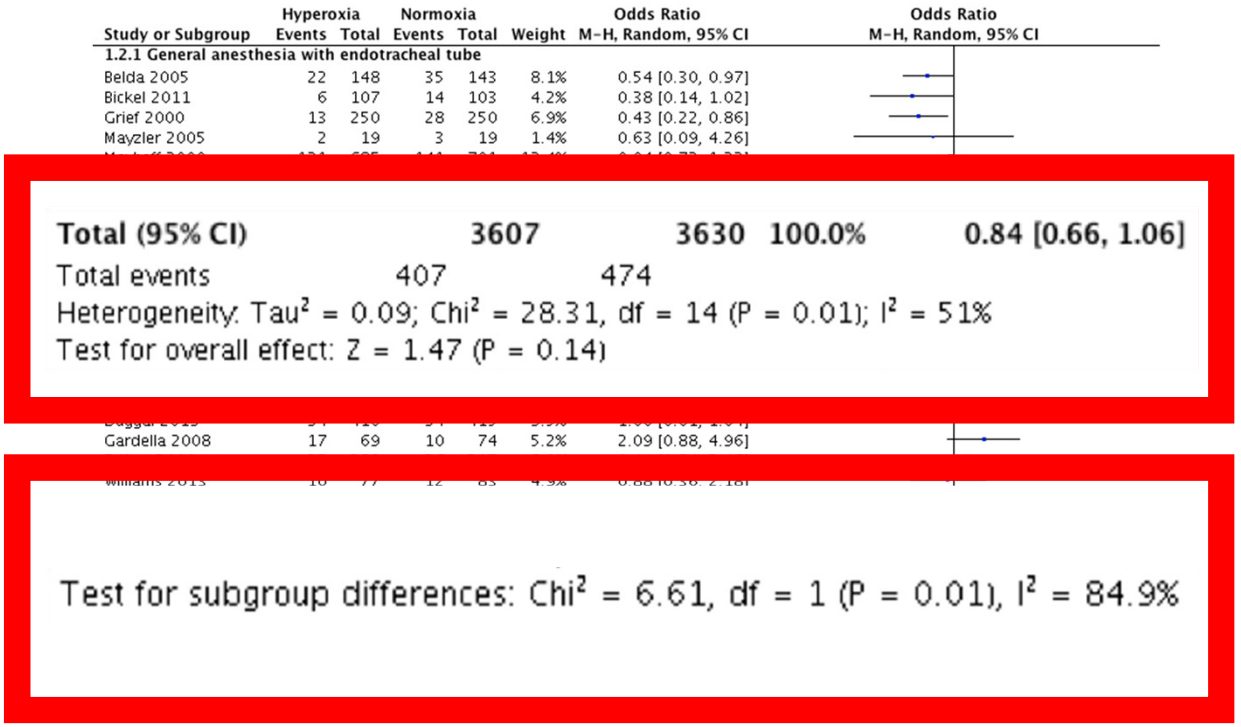
Study or Subgroup	Hyperoxia Events	Hyperoxia Total	Normoxia Events	Normoxia Total	Weight	Odds Ratio M-H, Random, 95% CI
Belda 2005	22	148	35	143	8.1%	0.54 [0.30, 0.97]
Bickel 2011	6	107	14	103	4.2%	0.38 [0.14, 1.02]
Duggal 2013	34	416	34	415	9.5%	1.00 [0.61, 1.64]
Gardella 2008	17	69	10	74	5.2%	2.09 [0.88, 4.96]
Grief 2000	13	250	28	250	6.9%	0.43 [0.22, 0.86]
Mayzler 2005	2	19	3	19	1.4%	0.63 [0.09, 4.26]
Meyhoff 2009	131	685	141	701	13.4%	0.94 [0.72, 1.22]
Myles 2007	77	997	106	1015	12.6%	0.72 [0.53, 0.98]
Pryor 2004	20	80	9	80	5.2%	2.63 [1.11, 6.20]
Schietroma 2013	5	86	11	85	3.6%	0.42 [0.14, 1.25]
Schietroma 2014	6	40	11	41	3.6%	0.48 [0.16, 1.46]
Scifres 2011	35	288	26	297	8.9%	1.44 [0.84, 2.46]
Stall 2013	14	119	19	116	6.3%	0.68 [0.32, 1.43]
Thibon 2012	15	226	15	208	6.3%	0.91 [0.44, 1.92]
Williams 2013	10	77	12	83	4.9%	0.88 [0.36, 2.18]
Total (95% CI)		**3607**		**3630**	**100.0%**	**0.84 [0.66, 1.06]**
Total events	407		474			

Heterogeneity: $Tau^2 = 0.09$; $Chi^2 = 28.31$, df = 14 (P = 0.01); $I^2 = 51\%$
Test for overall effect: Z = 1.47 (P = 0.14)



M-H: Mantel-Haenszel (test); CI: confidence interval

2014 systematic review & 2016 WHO guidelines
Overall analysis

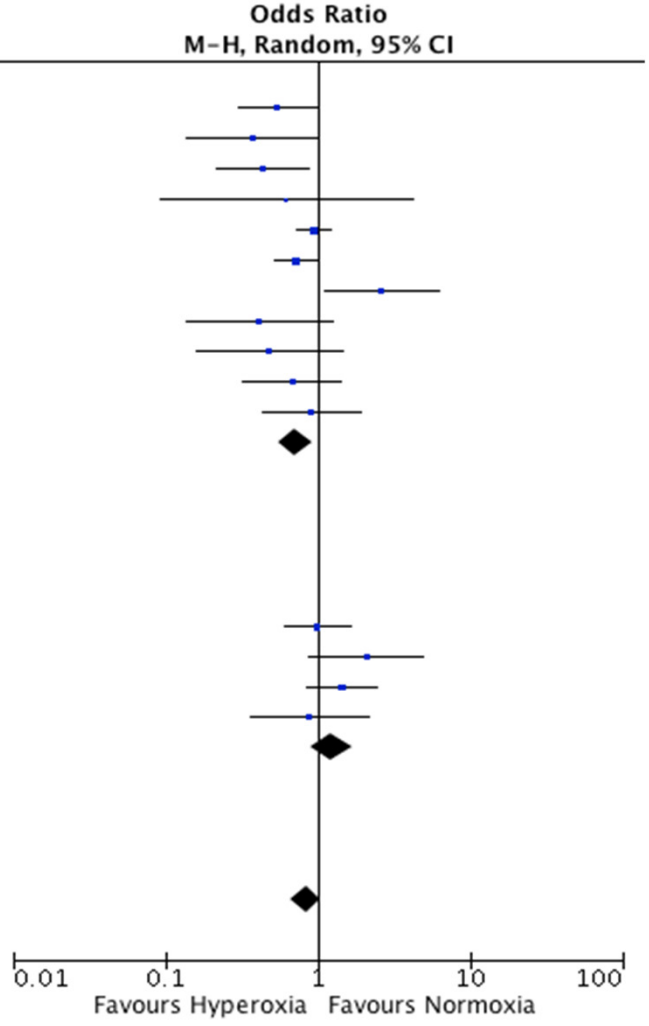


META-REGRESSION: P = 0.05

2014 systematic review & 2016 WHO guidelines

Sub-group analysis

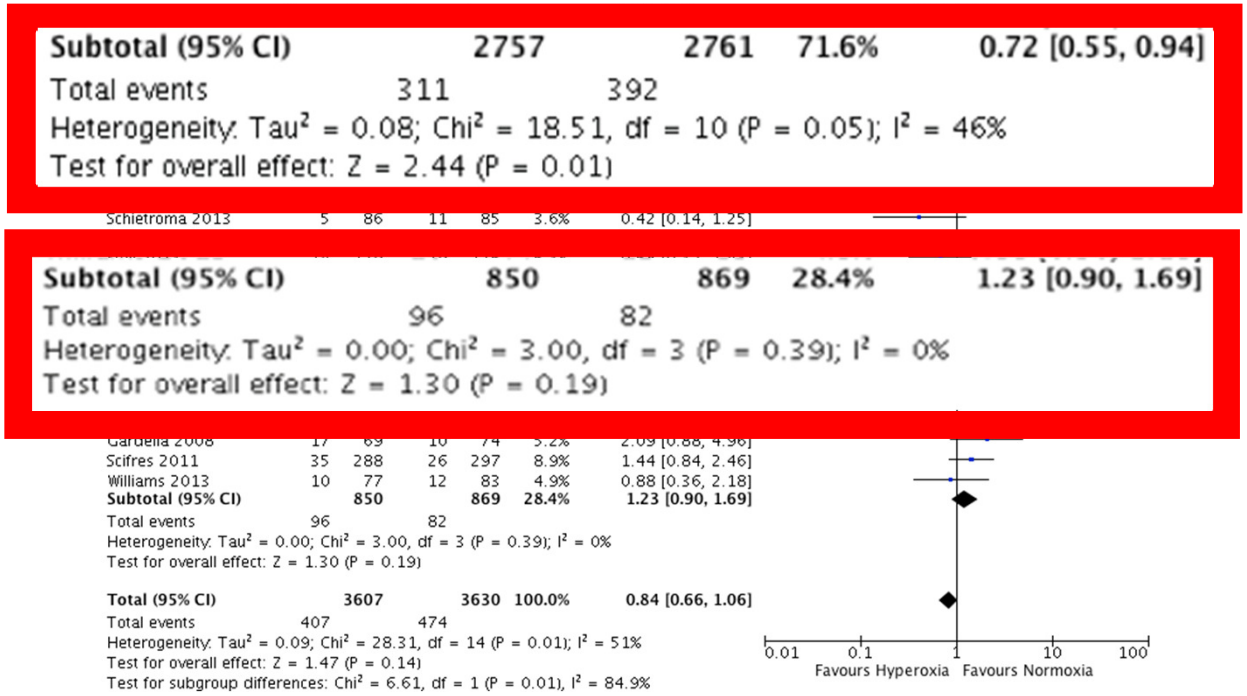
Study or Subgroup	Hyperoxia Events	Hyperoxia Total	Normoxia Events	Normoxia Total	Weight	Odds Ratio M-H, Random, 95% CI
1.2.1 General anesthesia with endotracheal tube						
Belda 2005	22	148	35	143	8.1%	0.54 [0.30, 0.97]
Bickel 2011	6	107	14	103	4.2%	0.38 [0.14, 1.02]
Grief 2000	13	250	28	250	6.9%	0.43 [0.22, 0.86]
Mayzler 2005	2	19	3	19	1.4%	0.63 [0.09, 4.26]
Meyhoff 2009	131	685	141	701	13.4%	0.94 [0.72, 1.22]
Myles 2007	77	997	106	1015	12.6%	0.72 [0.53, 0.98]
Pryor 2004	20	80	9	80	5.2%	2.63 [1.11, 6.20]
Schietroma 2013	5	86	11	85	3.6%	0.42 [0.14, 1.25]
Schietroma 2014	6	40	11	41	3.6%	0.48 [0.16, 1.46]
Stall 2013	14	119	19	116	6.3%	0.68 [0.32, 1.43]
Thibon 2012	15	226	15	208	6.3%	0.91 [0.44, 1.92]
Subtotal (95% CI)		**2757**		**2761**	**71.6%**	**0.72 [0.55, 0.94]**
Total events	311		392			
Heterogeneity: $Tau^2 = 0.08$; $Chi^2 = 18.51$, df = 10 (P = 0.05); $I^2 = 46\%$						
Test for overall effect: Z = 2.44 (P = 0.01)						
1.2.7 Procedure under neuroxia without endotracheal intubation						
Duggal 2013	34	416	34	415	9.5%	1.00 [0.61, 1.64]
Gardella 2008	17	69	10	74	5.2%	2.09 [0.88, 4.96]
Scifres 2011	35	288	26	297	8.9%	1.44 [0.84, 2.46]
Williams 2013	10	77	12	83	4.9%	0.88 [0.36, 2.18]
Subtotal (95% CI)		**850**		**869**	**28.4%**	**1.23 [0.90, 1.69]**
Total events	96		82			
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 3.00$, df = 3 (P = 0.39); $I^2 = 0\%$						
Test for overall effect: Z = 1.30 (P = 0.19)						
Total (95% CI)		**3607**		**3630**	**100.0%**	**0.84 [0.66, 1.06]**
Total events	407		474			
Heterogeneity: $Tau^2 = 0.09$; $Chi^2 = 28.31$, df = 14 (P = 0.01); $I^2 = 51\%$						
Test for overall effect: Z = 1.47 (P = 0.14)						
Test for subgroup differences: $Chi^2 = 6.61$, df = 1 (P = 0.01), $I^2 = 84.9\%$						



2014 systematic review & 2016 WHO guidelines
Sub-group analysis

General anest.
+ endotr. intub.

Neuraxial.
anest. vs
endotr. intub

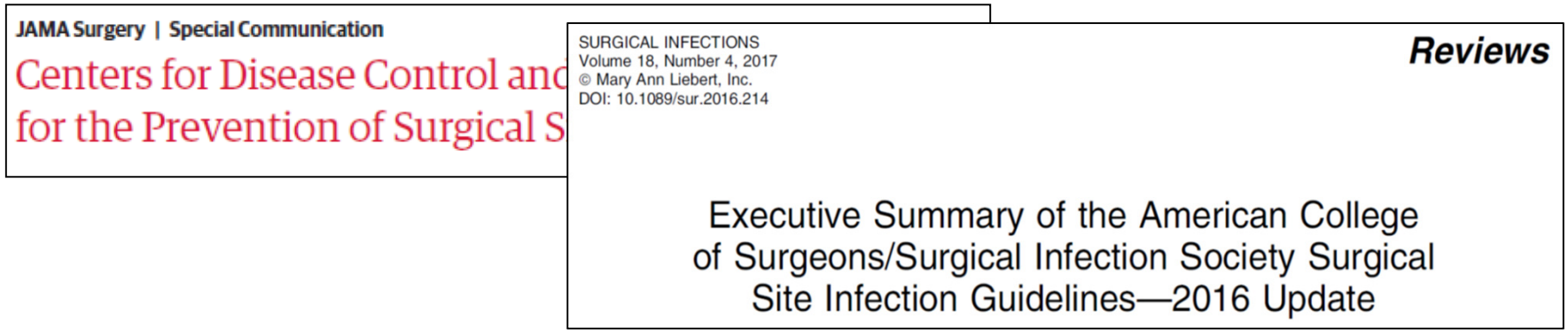


2014 systematic review & 2016 WHO guidelines

<u>WHO recommendation:</u> *"The panel recommends that **adult patients undergoing general anaesthesia with endotracheal intubation** for surgical procedures should receive an **80% fraction of inspired oxygen intraoperatively and, if feasible, in the immediate postoperative period for 2-6 hours** to reduce the risk of SSI."*

Recommendation: Strong

Quality of evidence: Moderate



Concerns raised & GDG consultation 1 (first semester 2017)

*Jannicke Mellin-Olsen,
Robert J McDougall, Davy Cheng
jannicke@mellin.no
World Federation of Societies of

EDITORIAL VIEWS

Who Can Make Sense of t
Surgical Site Infection?

Göran Hedenstierna, M.D., Ph.D., Gaetano Pe

The New World Health Organiz
on Perioperative Administratio
Surgical Site Infections: A Dan
Approach?

Manuel Wenk, MD, PhD, Hugo Van Aken, MD, PhD, and Al

In October 2016, the World Health Organization (WHO)
ing surgical site infections (SSIs). Among those measu
oxygen at an inspired fraction of 80% intra- and postc
been identified as a global health problem, and the WHO should be commended for their efforts. However, this recommendation focuses only on the patient's "wound," ignores other organ systems potentially affected by hyperoxia, and may ultimately worsen patient outcomes.
The WHO advances a "strong recommendation" for the use of a high inspired oxygen fraction even though the quality of evidence is only moderate. However, achieving this goal by disregarding other potentially lethal complications seems inappropriate, particularly in light of the weak evidence underpinning the use of high fractions of oxygen to prevent SSI. Use of such a strategy thus should be intensely discussed by anesthesiologists and perioperative physicians.
Normovolemia, normotension, normoglycemia, normothermia, and normoventilation can clearly

*Christian S Meyhoff, Siv Fonnes,
Jørn Wetterslev, Lars N Jorgensen,
Lars S Rasmussen

Editorial

Anaesthesist
DOI 10.1007/s00101-017-0286-4

CrossMark

T. Volk[1] · J. Peters[2] · D. I. Sessler[3]
[1] Department of Anaesthesiology, Intensive Care and Pain Therapy, Saarland University Medical Center and Saarland University Faculty of Medicine, Homburg, Germany
[2] Klinik für Anästhesiologie und Intensivmedizin, Universität Duisburg-Essen & Universitätsklinikum Essen, Essen, Germany
[3] Department of Outcomes Research, Anesthesiology Institute, Cleveland Clinic, Cleveland, USA

Turk J Anaesthesiol Reanim 2017; 45: 181-92 DOI: 10.5152/TJAR.2017.250701

Forum

WHO Needs High FIO_2?

Ozan Akca[1], Lorenzo Ball[2], F. Javier Belda[3], Peter Biro[4], Andrea Cortegiani[5], Arieh Eden[6], Carlos Ferrando[3], Luciano Gattinoni[7], Zeev Goldik[6], Cesare Gregoretti[5], Thomas Hachenberg[8], Göran Hedenstierna[9], Harriet W. Hopf[10], Thomas K. Hunt[11], Paolo Pelosi[2], Motaz Qadan[12], Daniel I. Sessler[13], Marina Soro[3], Mert Şentürk[14]

Phase#2: Concerns raised & GDG consultation 1 (first semester 2017)

- Effectiveness of the use of high FiO2
  - Sub-group analysis
  - Update 2015
  - Inclusion criteria
- Harms of the use of high FiO2
  - Atelectasis
  - Animal experiments
  - Other clinical settings (i.e. respiratory distress, critically ill)
- Resource use of the use of high FiO2
  - Priority

World Health Organization

ARTICLE IN PRESS

BJA

British Journal of Anaesthesia, xxx (xxx): xxx (xxxx)

doi: 10.1016/j.bja.2018.11.026
Advance Access Publication Date: xxx
Review Article

REVIEW ARTICLE

Safety of 80% *vs* 30–35% fraction of inspired oxygen in patients undergoing surgery: a systematic review and meta-analysis

Katharina Mattishent[1], Menaka Thavarajah[1], Ashnish Sinha[1], Adam Peel[1], Matthias Egger[2], Joseph Solomkin[3], Stijn de Jonge[4], Asad Latif[5,6], Sean Berenholtz[5,6], Benedetta Allegranzi[7,*] and Yoon Kong Loke[1]

[1]Norwich Medical School, University of East Anglia, Norwich, UK, [2]Institute of Social and Preventive Medicine, University of Bern, Bern, Switzerland, [3]Department of Surgery, University of Cincinnati College of Medicine, Cincinnati, OH, USA, [4]Department of Surgery, Amsterdam Gastroenterology and Metabolism, Amsterdam Infection and Immunity, Amsterdam UMC, Location AMC, University of Amsterdam, the Netherlands, [5]Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA, [6]Armstrong Institute for Patient Safety and Quality, Johns Hopkins Medicine, Baltimore, MD, USA and [7]Infection Prevention and Control Global Unit, Service Delivery and Safety, World Health Organization, Geneva, Switzerland

*Corresponding author. E-mail: allegranzib@who.int

BJA

British Journal of Anaesthesia, xxx (xxx): xxx (xxxx)

doi: 10.1016/j.bja.2018.11.024
Advance Access Publication Date: xxx
Review Article

Effectiveness of 80% *vs* 30–35% fraction of inspired oxygen in patients undergoing surgery: an updated systematic review and meta-analysis

Stijn de Jonge[1], Matthias Egger[2], Asad Latif[3,4], Yoon Kong Loke[5], Sean Berenholtz[3,4], Marja Boermeester[1], Benedetta Allegranzi[6,*,†] and Joseph Solomkin[7,†]

[1]Department of Surgery, Amsterdam Gastroenterology and Metabolism, Amsterdam Infection and Immunity, Amsterdam UMC, Location AMC, University of Amsterdam, Amsterdam, the Netherlands, [2]Institute of Social and Preventive Medicine, University of Bern, Bern, Switzerland, [3]Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA, [4]Armstrong Institute for Patient Safety and Quality, Johns Hopkins Medicine, Baltimore, MD, USA, [5]Norwich Medical School, University of East Anglia, Norwich, UK, [6]Infection Prevention and Control Global Unit, Service Delivery and Safety, World Health Organization, Geneva, Switzerland and [7]Department of Surgery, University of Cincinnati College of Medicine, Cincinnati, OH, USA

*Corresponding author. E-mail: allegranzib@who.int

[†]These authors contributed equally to the manuscript.

de Jonge et al. Br J Anaesth. 2019 Mar;122(3):325-334
Mattishent et al. Br J Anaesth. 2019 Mar;122(3):311-324

Final updated evidence on effectiveness (July 2018)

- Six new trials identified
- Retraction Schietroma trial & serious concerns on other 3 trials validity
  - => Exclude all 4 from primary analysis.

• **Overall analysis:**	**RR: 0.89 (95%CI, 0.73, 1.07)**
• **Meta regression anesthesia**	**P-value: 0.048**
• **Subgroup general anesthesia:**	**RR: 0.80 (95%CI, 0.64, 0.99)**
• **Subgroup neuraxial anesthesia:**	**RR: 1.20 (95%CI, 0.91, 1.58)**

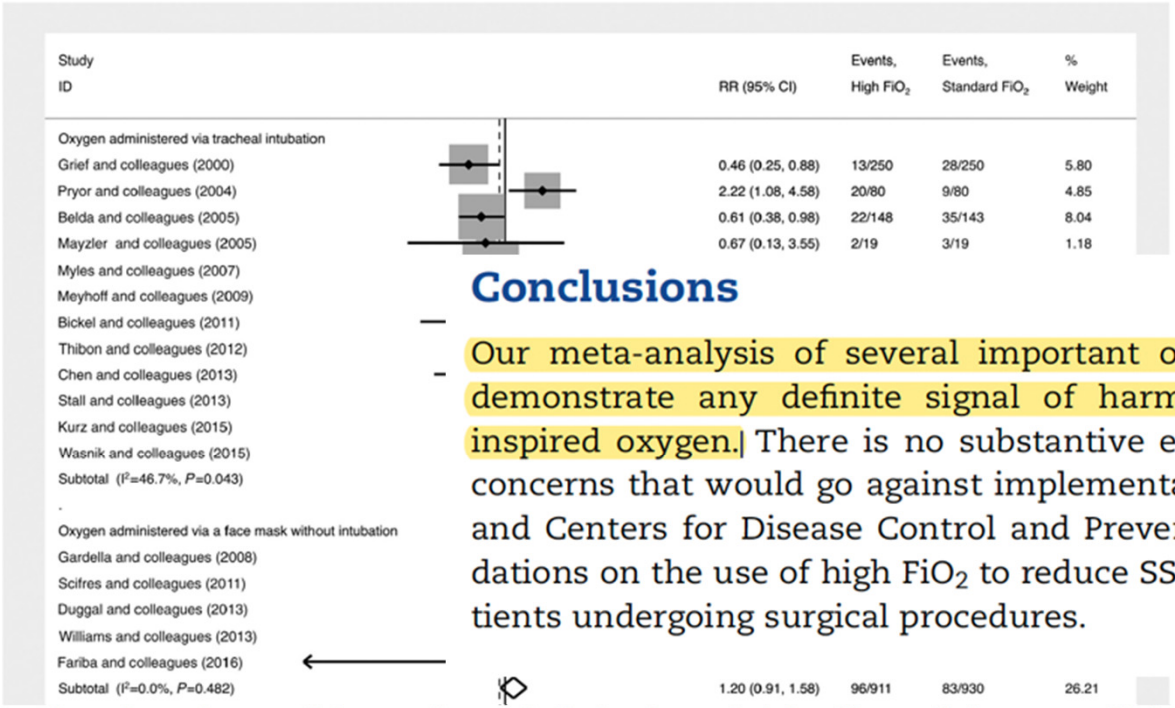
- No further evidence of effect modification
- NB: Sensitivity and meta-regression analyses of Schietroma papers; significant influence effect estimate

Final updated evidence on effectiveness (July 2018)

	2014 SR & Meta analysis	**2018 SR & Meta analysis**
General result	15 RCTs, 7237 participants	17 RCTs, 7817 participants
Schietroma et al.	1 Retracted, 1 Under investigation	All disputed trials excluded
Overall estimate:	OR: 0.84 (95% CI, 0.66, 1.06)	RR: 0.89 (95%CI, 0.73, 1.07)
Heterogeneity:	Chi^2 P value: 0.01 , I2: 51%	Chi2 P value: 0.02 , I2: 46%
Meta regression anesthesia	P value= 0.05	P value = 0.048
Subgroup general anesthesia	OR: 0.72 (95%CI, 0.55, 0.94)	RR: 0.80 (95%CI, 0.64, 0.99)
Subgroup neuraxial anesthesia	OR: 1.23 (95%CI, 0.90, 1.69)	RR: 1.20 (95%CI, 0.91, 1.58)

*Evidence quality (GRADE): moderate quality of evidence

World Health Organization



Conclusions

Our meta-analysis of several important outcomes did not demonstrate any definite signal of harm with 80% FiO_2 inspired oxygen. There is no substantive evidence of safety concerns that would go against implementation of the WHO and Centers for Disease Control and Prevention recommendations on the use of high FiO_2 to reduce SSI in intubated patients undergoing surgical procedures.

Conclusions: The WHO updated analyses did not show definite beneficial effect of the use of high perioperative FiO_2, overall, but there was evidence of effect of reducing the SSI risk in surgical patients under general anaesthesia with tracheal intubation. However, the evidence for this beneficial effect has become weaker and the strength of the recommendation needs to be reconsidered.

de Jonge et al. Br J Anaesth. 2019 Mar;122(3):325-334
Mattishent et al. Br J Anaesth. 2019 Mar;122(3):311-324

Final updated evidence on safety*

	2018 SR & Meta analysis	
General	27 studies: 17 RCTs, 8 post hoc / subgroup analysis, 2 non-randomized studies	
	RCT (good quality, poor AE definition)	**Non-RCT (**Critical – Serious risk of bias)
Atelectasis	RR: 0.91 (95%CI, 0.59 - 1.42), I^2: 85%	NA
Pneumonia	RR: 0.78 (95%CI, 0.50 - 1.09), I^2: 29%	OR: 1.72 (95%CI, 1.30 – 2.28)
Respiratory AE	NA SdJ5	OR: 1.99 (95%CI, 1.72 – 2.31)
ICU admission	RR: 0.93 (95%CI, 0.70 - 1.12), I^2: 03%	OR: 1.64 (95%CI, 1.38 – 1.95)
Cardiovasc AE	RR: 0.90 (95%CI, 0.32 - 2.54), I^2: 58%	OR: 0.90 (95%CI, 0.32 – 2.54)
TE	RR: 0.89 (95%CI, 0.28 – 2.91) I^2: 74%	NA
Short term †▪	RR: 0.49 (95%CI, 0.17 – 1.37) I^2: 50%	OR: 2.09 (95%CI, 0.81 – 5.43)
Long term †	RR: 0.96 (95%CI, 0.65 – 1.42) I^2: 55%	OR: 1.97 (95%CI, 1.30 – 2.99), RR: 1.97 (95%CI, 0.71 – 5.47)

*Evidence quality (GRADE): from very low to moderate; <u>overall</u> low quality of evidence

Diapositive 60

SdJ5 Not pooled due to variation in case definition, but two RCTs with both no evidence of significant harm.
Stijn de Jonge; 10.10.2018

Conclusions

- Exclusion of four studies with disputed credibility and net addition of four new trials.
- Additional information did not strengthen the evidence for effect modification found in the original review and the evidence for a benefit in patients undergoing general anaesthesia with endotracheal intubation that led to the strong recommendation in the WHO guidelines.
- Evidence for a beneficial effect has become weaker despite increased number of patients.
- The benefits of hyperoxygenation would likely be maximized when normothermia and normovolemia are maintained
- Evidence supporting safety has become stronger: no definite signal of harm and no or little evidence to discourage the use of high FiO_2 in this population.
- Further high-quality RCTs are urgently needed.

WHO Guidelines Development Group

The chair of the Guidelines Development Group was Joseph S Solomkin (University of Cincinnati College of Medicine/OASIS Global, USA).

The GRADE methodologist of the WHO Guidelines Development Group was Matthias Egger (University of Bern, Bern, Switzerland).

The following experts served on the Guidelines Development Group:

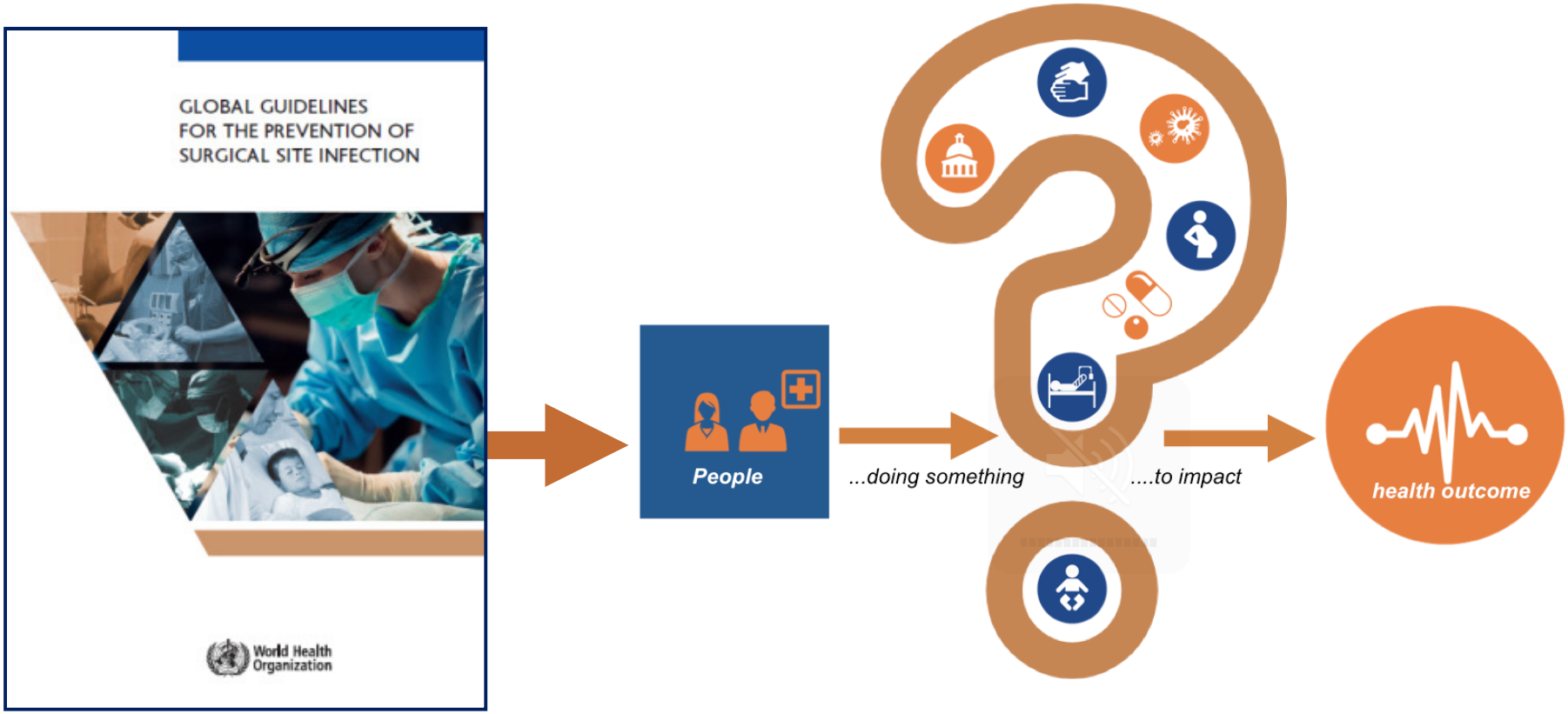
Hanan H Balkhy (King Saud Bin Abdulaziz University for Health Sciences, Kingdom of Saudi Arabia); Javier F Belda (University of Valencia, Spain); Sean Berenholtz (Johns Hopkins Medicine, Baltimore, USA); Marja A Boermeester (University of Amsterdam, the Netherlands); Nizam Damani (Craigavon Area Hospital, UK); E Patchen Dellinger (University of Washington, USA); Mazen S Ferwana (King Saud Bin Abdulaziz University for Health Sciences, Kingdom of Saudi Arabia); Petra Gastmeier (Institute of Hygiene and Environmental Medicine, Charité-University Medicine Berlin, Germany); Robert Greif (Hospital University of Bern, Switzerland); Asad Latif (Johns Hopkins Medicine, Baltimore, USA); Xavier Guirao (Parc Taulí Hospital Universitari, Spain); Nordiah Jalil (University Kebangsaan Malaysia Medical Centre, Malaysia); Robinah Kaitiritimba (Uganda National Health Consumers' Organization, Uganda); Fauzia Khan (Aga Khan University Karachi, Pakistan); Janet Martin (School of Medecine/Dentistry Western University, Ontario, Canada); Regina Kamoga (Community Health and Information Network, Uganda); Claire Kilpatrick (KS Healthcare Consulting (S3 Global, UK); Shaheen Mehtar (Stellenbosch University and Infection Control Africa Network, Republic of South Africa); Jannicke Mellin-Olsen (World Federation of Societies of Anesthesiologists, London, UK); Babacar Ndoye (Infection Control Africa Network Board, Senegal); Peter Nthumba (AIC Kijabe Hospital, Kenya); Bisola Onajin Obembe (University of Port Harcourt,

Nigeria); Akca Ozan (University of Louisville, USA); Leonardo Pagani (Bolzano Central Hospital, Italy); Didier Pittet (University of Geneva Hospitals, Switzerland); Jianan Ren (Nanjing University, People's Republic of China); Joseph S Solomkin (University of Cincinnati, USA); Akeau Unahalekhaka (Chiang Mai University, Thailand); Andreas F Widmer (Basel University, Switzerland).

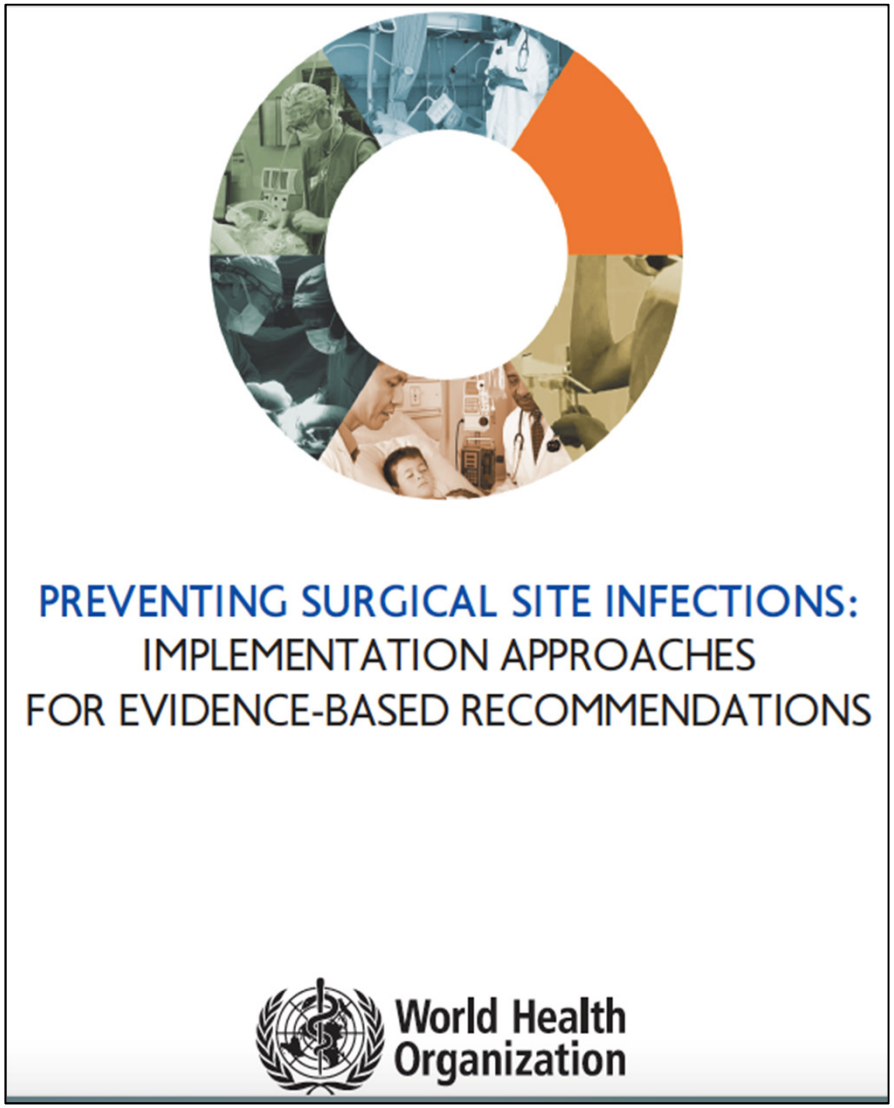
World Health Organization

1	Awareness of the problem
2	Evidence-based recommendations
3	Implementation strategies

Translating guidelines to action



World Health Organization



- Document presenting a range of ***tested approaches to achieve successful SSI prevention*** implementation at the facility level, including in the context of a broader surgical safety climate
  - ➢ *Original section on the **surgical safety checklist** use worldwide*
  - ➢ Results of a comprehensive ***systematic review on SSI prevention strategies***
  - ➢ *Section on WHO pilot testing through the **SUSP study***

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

Ariyo P, et al. ICHE 2019 Feb 21:1-14. doi: 10.1017/ice.2018.355

World Health Organization

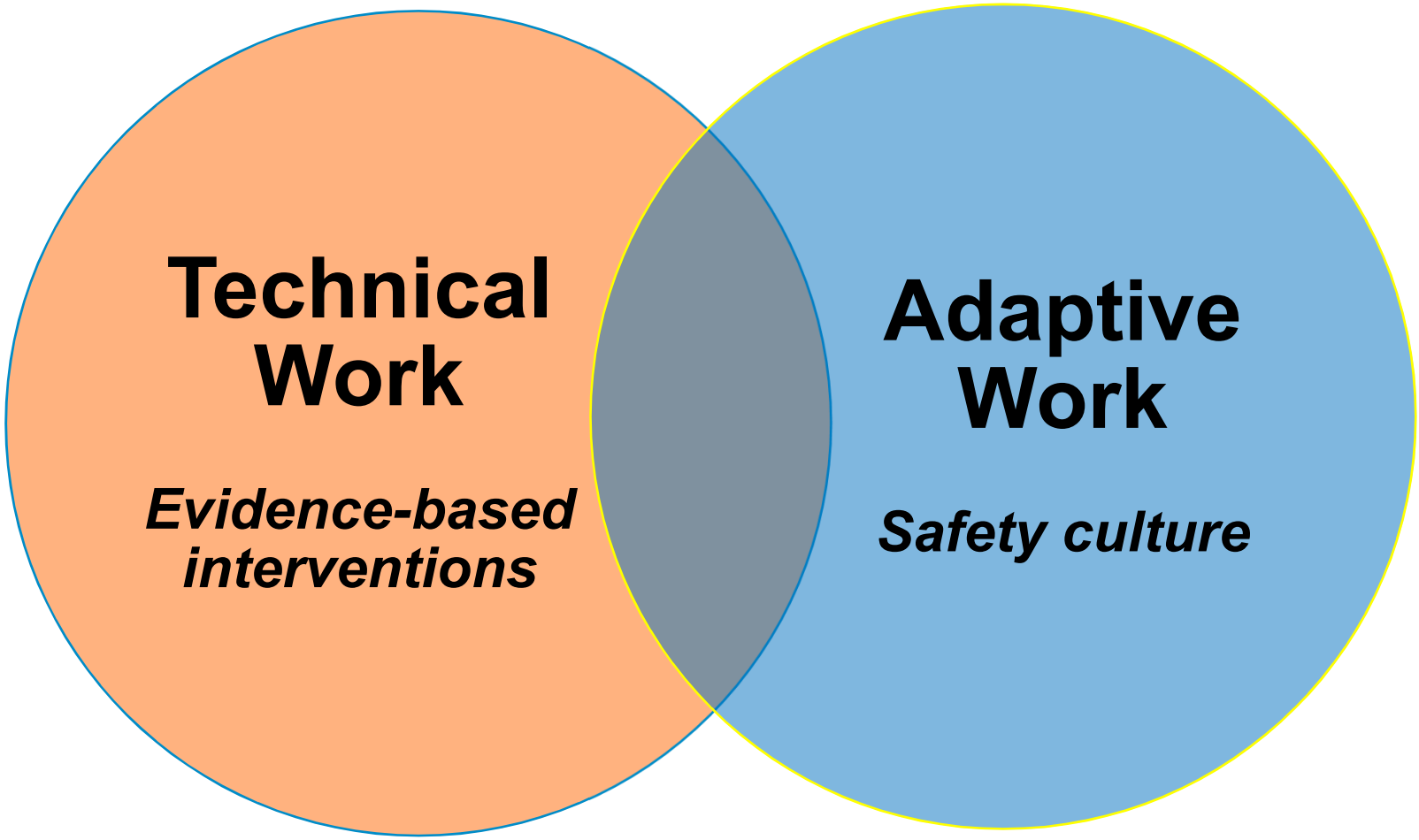
Operational manual for the WHO SSI prevention recommendations.

This implementation manual is designed to be used by all persons concerned by the prevention of SSI in all health care settings, irrespective of the country.

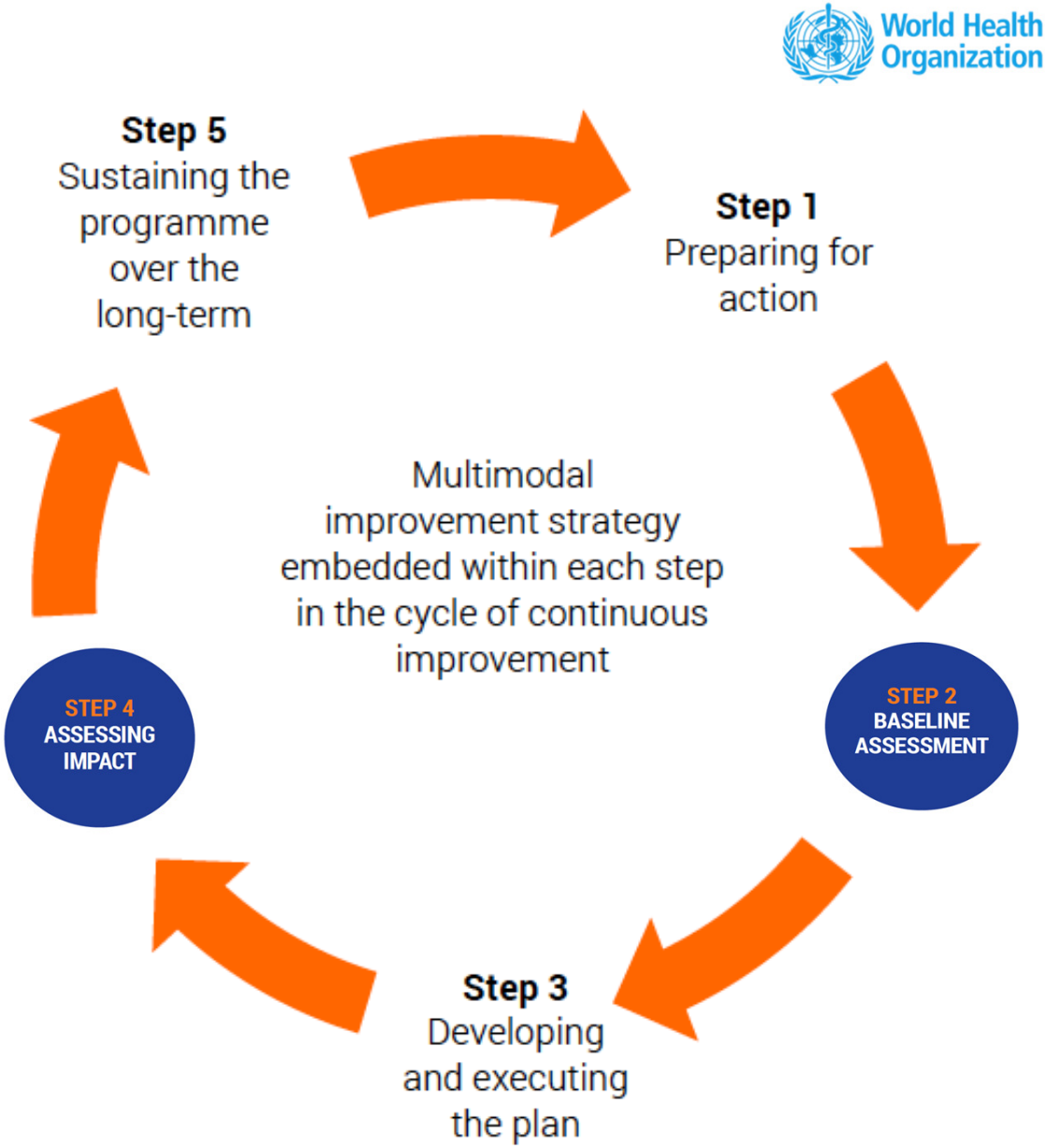
Launched in December 2018

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

World Health Organization



Stepwise approach



Source: http://www.who.int/infection-prevention/tools/core-components/en/

Pilot testing the approach

Articles

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 Berendt

Summary

Background Surgical site infections (SSIs) are the most frequent health-care-associated infections in developing countries. Specific prevention measures are highly effective, but are often poorly implemented. We aimed to establish the effect of a multimodal intervention on SSIs in Africa.

Lancet Infect Dis 2018; 18: 507–15
Published Online March 5, 2018

Methods We did a before–after cohort st
multimodal intervention consisted of th
combined with an adaptive approach ain
outcome was the first occurrence of SSI,
adherence to SSI prevention measures w
within 30 days post surgery was assess
confounders.

Findings Four hospitals completed the b
quality) data for the sustainability period
891 in the sustainability period). SSI
8·0% (95% CI 6·8–9·5; n=129) to 3·8% (
period (3·9%, 2·8–5·4; n=35). A substant
observed in the follow-up and sustainabi
than pre-intervention (odds ratio [OR] 0
significantly reduced (0·72, 0·42–1·24; p

Interpretation Implementation of our i
across all perioperative prevention practi
heterogeneity between sites. Further lar
improve the sustainability and long-term

Funding US Agency for Healthcare Rese

Copyright © 2018. World Health Organi

Introduction

Health-care-associated infections are on
common adverse events during care
evidence exists on the morbidity, mortali
health-care-associated infections in lo
middle-income countries, but WHO est
that the overall prevalence in these cou
the average reported in high-incom
According to WHO, surgical site infecti
most surveyed and most frequent health
infection in countries of low and middle i
affect up to one-third of surgical
significantly increased risk of SSI in coun
middle income affects all types of proce
clean surgery.[2] SSI is also the second
health-care-associated infection in Europe
Given the increasing recognition of the

www.thelancet.com/neurology Vol 17 May 2018

Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Contents

Table S1: Detailed description of the surgical site infection preventive measures implemented consistently across all sites, available implementation support documents, and process indicators used.

Figure S1: Poster/leaflet designed by the surgical teams to remind staff of the surgical site infection prevention measures implemented during the study intervention period.

Figure S2: Trends of the cumulative incidence of surgical site infection per 100 surgical operations by month in the three study periods for each site.

Figure S3: Results of an interrupted time series analysis assessing the trends of the cumulative incidence of SSI on a monthly basis between the baseline and follow-up periods by site (four sites).

Figure S4: Results of an interrupted time series analysis assessing the trends of cumulative incidence of surgical site infection on a monthly basis between the follow-up and sustainability periods by site (three sites).

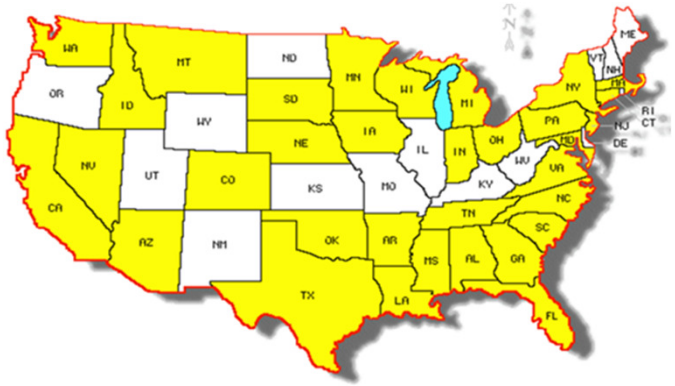
Fact sheet S1: Patient preparation: bathing and hair removal. http://www.who.int/infection-prevention/countries/surgical/en/ (accessed Feb 19, 2018).

Fact sheet S2: Surgical site skin preparation and surgical hand preparation. http://www.who.int/infection-prevention/countries/surgical/en/ (accessed Feb 19, 2018).

Fact sheet S3: Correct and safe surgical antibiotic prophylaxis. http://www.who.int/infection-prevention/countries/surgical/en/ (accessed Feb 19, 2018).

World Health Organization

5 Hospitals



195 Hospitals

JOHNS HOPKINS MEDICINE

Allegranzi B, et al. *Lancet Infect Dis.* 2018 May;18(5):507-515. doi: 10.1016/S1473-3099(18)30107-5

Clack L, et al. *Antimicrob Resist & Infect Control*, submitted


Organizational culture change
Modified WHO checklist
Pre-op Bath
No Hair removal
Surgical hand preparation
Surgical site skin preparation
OR discipline
Antibiotic prophylaxis

Pilot testing the approach

World Health Organization

Articles

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, Alexander Elobu, Josephat Jombwe, Mayaba Maimbo, Joseph Mu

Summary

Background Surgical site infections (SSIs) are the countries. Specific prevention measures are highl establish the effect of a multimodal intervention on

Methods We did a before–after cohort study, betwee multimodal intervention consisted of the implemen combined with an adaptive approach aimed at the i outcome was the first occurrence of SSI, and the sec adherence to SSI prevention measures were prospe within 30 days post surgery was assessed in a mi confounders.

Findings Four hospitals completed the baseline and quality) data for the sustainability period. 4322 opera 891 in the sustainability period). SSI cumulativ 8·0% (95% CI 6·8–9·5; n=129) to 3·8% (3·0–4·8; n period (3·9%, 2·8–5·4; n=35). A substantial improve observed in the follow-up and sustainability periods, than pre-intervention (odds ratio [OR] 0·40, 95% significantly reduced (0·72, 0·42–1·24; p=0·2360).

Interpretation Implementation of our intervention across all perioperative prevention practices. A signi heterogeneity between sites. Further large-scale ex improve the sustainability and long-term effect of s

Funding US Agency for Healthcare Research and Q

Introduction

Health-care-associated infections are one of the r common adverse events during care delivery.[1] L evidence exists on the morbidity, mortality, and effe health-care-associated infections in low-income middle-income countries, but WHO estimates indi that the overall prevalence in these countries is do the average reported in high-income countri According to WHO, surgical site infection (SSI) is most surveyed and most frequent health-care-associ infection in countries of low and middle income, and affect up to one-third of surgical patients. significantly increased risk of SSI in countries of low middle income affects all types of procedure, inclu clean surgery.[2] SSI is also the second most comm health-care-associated infection in Europe and the US Given the increasing recognition of the need for w

	Hospital type	Setting	Intervention implementation activities common to all sites	Additional activities
Kijabe AIC Hospital, Kenya	Private, mission hospital, 360 beds	Rural	Technical SSI preventive measures*: patient preoperative bathing with plain or antiseptic soap; appropriate hair removal (avoidance of or using clippers); optimise patient skin preparation, including local production of alcohol-based and chlorhexidine-based skin disinfection product; optimise surgical hand preparation, including local production of alcohol-based hand rub product and appropriate rubbing technique; appropriate antibiotic prophylaxis based on locally formulated policy, given within 1-h preoperatively and discontinued postoperatively; improved operating theatre discipline, including limitation of the number of individuals and reduction of intraoperative movement.	Provision of antiseptic soap to patients for bathing; addition of food dye to alcohol-based skin preparation to aid visualisation of the application area around the incision site; leaflets explaining the intervention
Mulago Hospital, Uganda	Public sector, tertiary referral, 1500 beds	Urban	Adaptive (team-working and safety) elements†: formation of local SUSP perioperative team; engagement of surgical leads and senior executives; patient safety culture survey; patient safety video played by local surgical leaders; use of CUSP adaptive tools, including Staff safety assessment and Learning from defects; morbidity and mortality meetings; participation in monthly multisite SUSP webinars; conduct of local educational meetings; feedback of data on SSI surveillance and compliance with the SSI preventive measures, including SSI rates.	Better management of students to reduce crowding in operating theatres; work with hospital pharmacy to ensure an antibiotic supply for surgical prophylaxis; patient information card on surveillance in English and local language
Kisiizi Hospital, Uganda	Private, mission hospital, 260 beds	Rural		New locks and lockers in operating theatres to minimise staff movement during operations
Ndola Hospital, Zambia	Public sector, tertiary referral, 851 beds	Urban		Better management of students to reduce crowding in operating theatres

Figure 1: **Characteristics of the four participating hospitals and activities implemented during the intervention**
Due to unforeseen local difficulties, one site (Zimbabwe) was unable to recruit adequate numbers of patients and was not included in the analysis. SSI=surgical site infection. SUSP=Surgical Unit-based Safety Programme. CUSP=Comprehensive Unit-based Safety Programme. *Support materials related to the technical SSI preventive measures are available at http://www.who.int/infection-prevention/countries/surgical/en/ (see appendix). †Materials from the CUSP study used in this project are available at https://www.ahrq.gov/professionals/quality-patient-safety/hais/tools/surgery/index.html.

JOHNS HOPKINS MEDICINE

Allegranzi B, et al. *Lancet Infect Dis.* 2018 May;18(5):507-515. doi: 10.1016/S1473-3099(18)30107-5
Clack L, et al. *Antimicrob Resist & Infect Control*, submitted

Example adaptive tools – addressing the culture

World Health Organization

CUSP for Safe Surgery
Perioperative Staff Safety Assessment

Purpose of this form: The purpose of this form is to tap into your experiences at the frontlines of patient care to find out what risks jeopardize patient safety in your clinical area.

Who should complete this form: All staff members.

How to complete this form: Provide as much detail as possible when answering the 4 questions. Drop off your completed safety assessment form in the location designated by the SUSP team.

When to complete this form: Any staff member can complete this form at any time.

CUSP for Safe Surgery (SUSP)
Safety Issues Worksheet for Senior Executive Partnership

Date of Safety Rounds:

Unit:

Attendees:

1.
2.
3.
4.
5.
6.
7.

(Please use back of form for additional attendees.)

CUSP for Safe Surgery (SUSP)
Executive Safety Rounds Kickoff Template

The Learning From Defects Tool

World Health Organization

JOHNS HOPKINS MEDICINE

Armstrong Institute for Patient Safety and C

World Health Organization

JOHNS HOPKINS MEDICINE

Armstrong Institute for Patient Safety and Quality

Sources: Toolkit to promote safe surgery [website]. Rockville, MD: Agency for Healthcare Research and Quality; 2018 (https://www.ahrq.gov/professionals/quality-patient-safety/hais/tools/surgery/index.html); http://www.who.int/infection-prevention/tools/surgical/en/

Impact on preventive measures

World Health Organization

	Baseline (n=1604)	Follow-up (n=1827)	p value	Sustainability period (n=891)
Preoperative patient bathing (n=4321, 0·02%)	1238 (77·2)	1544 (84·5)	<0·0001	799 (89·7)
Appropriate hair removal (n=4310, 0·3%)	1169 (73·1)	1702 (93·5)	<0·0001	880 (98·8)
Appropriate skin preparation (n=4307, 0·3%)	330 (20·7)	1644 (90·2)	<0·0001	845 (94·8)
Quality of surgical hand preparation (n=4223, 2·3%)	1213 (78·7)	1694 (94·4)	<0·0001	865 (97·4)
Appropriate use of antibiotic prophylaxis (n=4322, 0%)	205 (12·8)	714 (39·1)	<0·0001	635 (71·3)
Theatre discipline				
Theatre door openings per hour of operation time (n=4031, 6·7%)	14·8 (17·8)	14·2 (16·1)	0·3771	19·0 (21·6)
Number of individuals present at the start of the operation (n=4313, 0·2%)	8·3 (3·4)	7·7 (2·5)	<0·0001	7·4 (2·5)
Number of entries during the operation (n=4236, 2·0%)	5·0 (4·1)	4·8 (4·9)	0·1758	4·2 (2·7)

Data are mean (SD). Data per variable and percentage missing data are also given. SSI=surgical site infection.

Table 2: **Process indicators for SSI prevention intervention measures across study periods in four (baseline and follow-up) and three (sustainability period) hospitals**

Impact on SSI

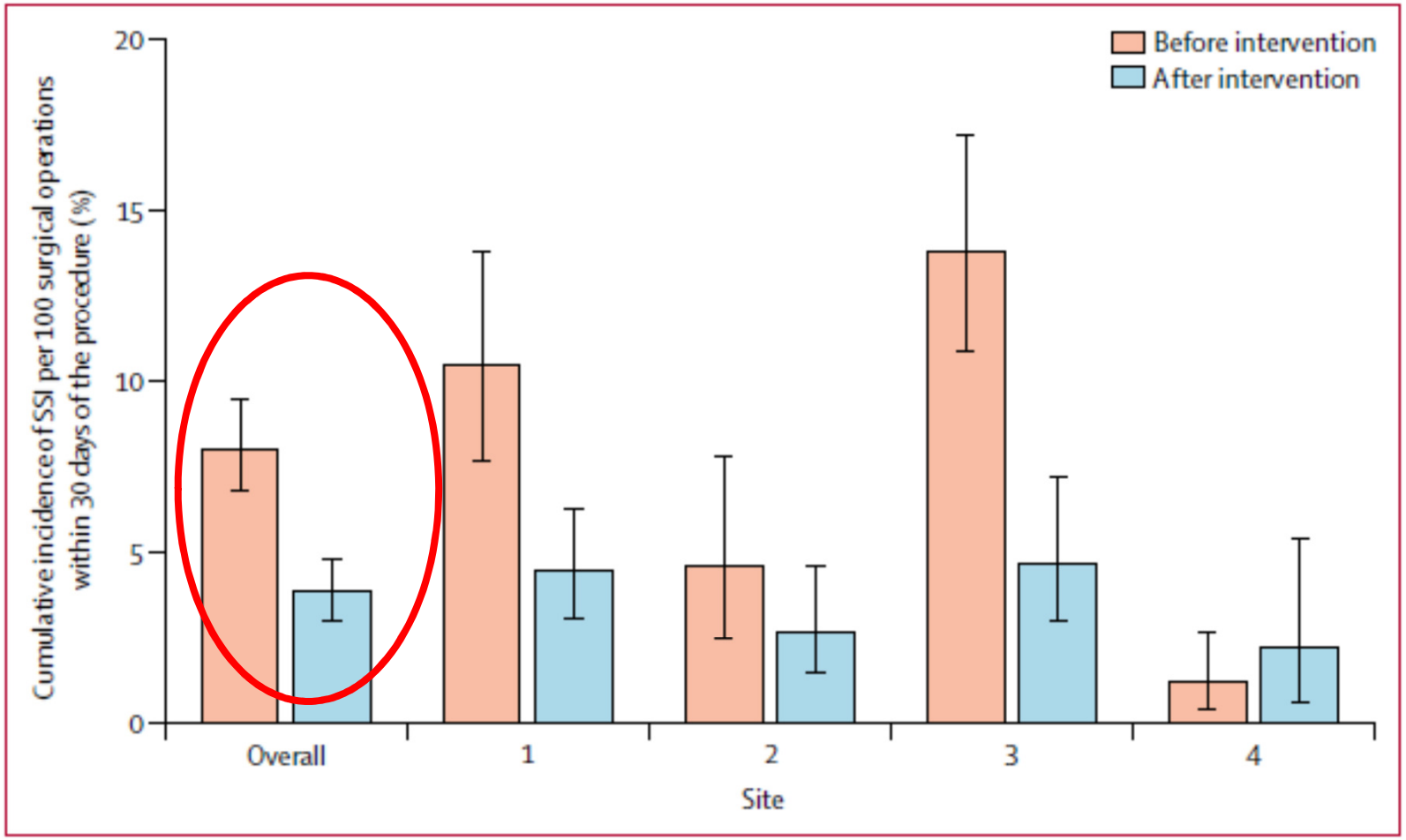


Figure 2: **Unadjusted SSI cumulative incidence overall and by site at baseline and follow-up in four sites**
Error bars show 95% CIs. SSI–surgical site infection.

Summary of success factors for SSI prevention implementation

World Health Organization

- **Use of multimodal strategies**
- Having a **dedicated multidisciplinary team and a step-wise action plan**
- Mapping recommendations according to the surgical patient journey
- Empowering teams involving front-line staff and letting teams take the lead on adaptation
- Engaging leadership
- Catalysing collective and individual ownership
- **Using data to create awareness**
- Awarding teams and work demonstrating a safety culture spirit

Allegranzi B, et al. *Lancet Infect Dis.* 2018 May;18(5):507-515. doi: 10.1016/S1473-3099(18)30107-5
Clack L, et al. *Antimicrob Resist & Infect Control*, submitted

IPC improvement strategy: multimodal thinking

World Health Organization

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

1. Build it
(system change)

What infrastructures, equipment, supplies and other resources (including human) are required to implement the intervention?

Does the physical environment influence health worker behaviour? How can ergonomics and human factors approaches facilitate adoption of the intervention?

Are certain types of health workers needed to implement the intervention?

Practical example: when implementing hand hygiene interventions, ease of access to handrubs at the point of care and the availability of WASH infrastructures (including water and soap) are important considerations. Are these available, affordable and easily accessible in the workplace? If not, action is needed.

2. Teach it
(training & education)

Who needs to be trained? What type of training should be used to ensure that the intervention will be implemented in line with evidence-based policies and how frequently?

Does the facility have trainers, training aids, and the necessary equipment?

Practical example: when implementing injection safety interventions, timely training of those responsible for administering safe injections, including carers and community workers, are important considerations, as well as adequate disposal methods.

3. Check it
(monitoring & feedback)

How can you identify the gaps in IPC practices or other indicators in your setting to allow you to prioritize your intervention?

How can you be sure that the intervention is being implemented correctly and safely, including at the bedside? For example, are there methods in place to observe or track practices?

How and when will feedback be given to the target audience and managers? How can patients also be informed?

Practical example: when implementing surgical site infection interventions, the use of key tools are important considerations, such as surveillance data collection forms and the WHO checklist (adapted to local conditions).

4. Sell it
(reminders & communications)

How are you promoting an intervention to ensure that there are cues to action at the point of care and messages are reinforced to health workers and patients?

Do you have capacity/funding to develop promotional messages and materials?

Practical example: when implementing interventions to reduce catheter-associated bloodstream infection, the use of visual cues to action, promotional/reinforcing messages, and planning for periodic campaigns are important considerations.

5. Live it
(culture change)

Is there demonstrable support for the intervention at every level of the health system? For example, do senior managers provide funding for equipment and other resources? Are they willing to be champions and role models for IPC improvement?

Are teams involved in co-developing or adapting the intervention? Are they empowered and do they feel ownership and the need for accountability?

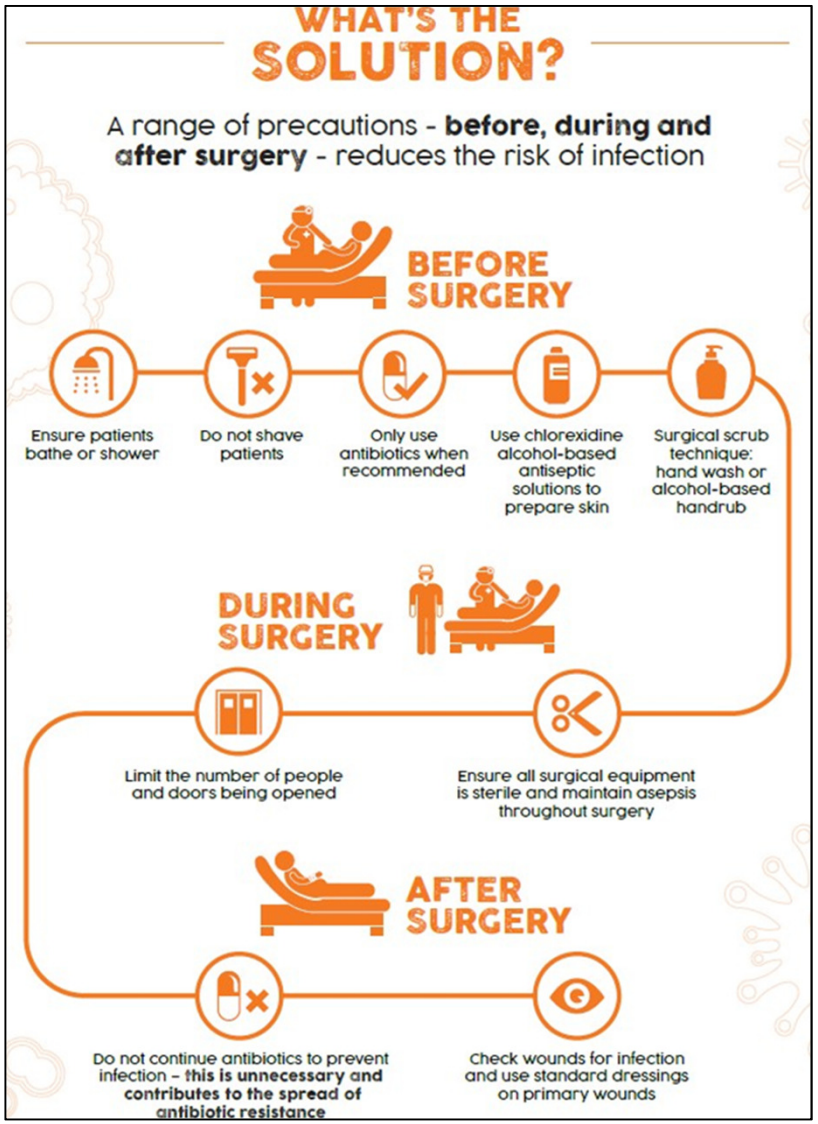
Practical example: when implementing hand hygiene interventions, the way that a health facility approaches this as part of safety and quality improvement and the value placed on hand hygiene improvement as part of the clinical workflow are important considerations.

Multidisciplinary team

Source: http://www.who.int/infection-prevention/tools/core-components/cc-implementation-guideline.pdf?ua=1

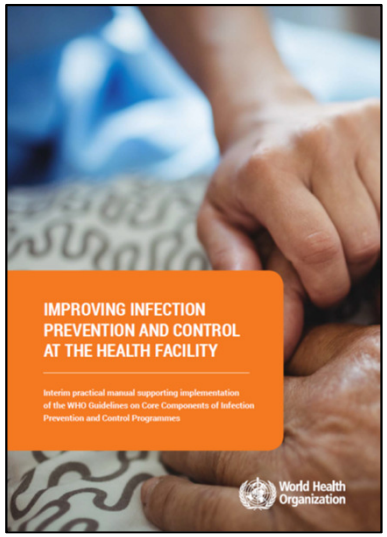
Integration of hand hygiene in the flow of patient care

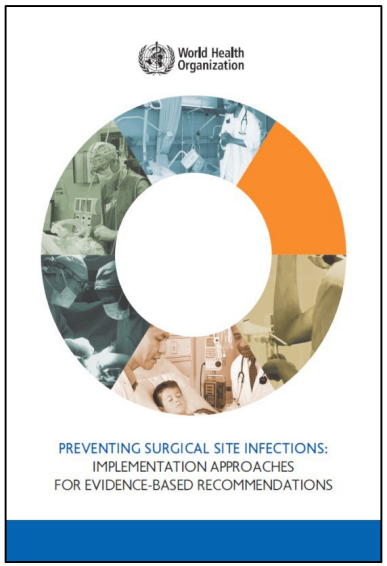
World Health Organization



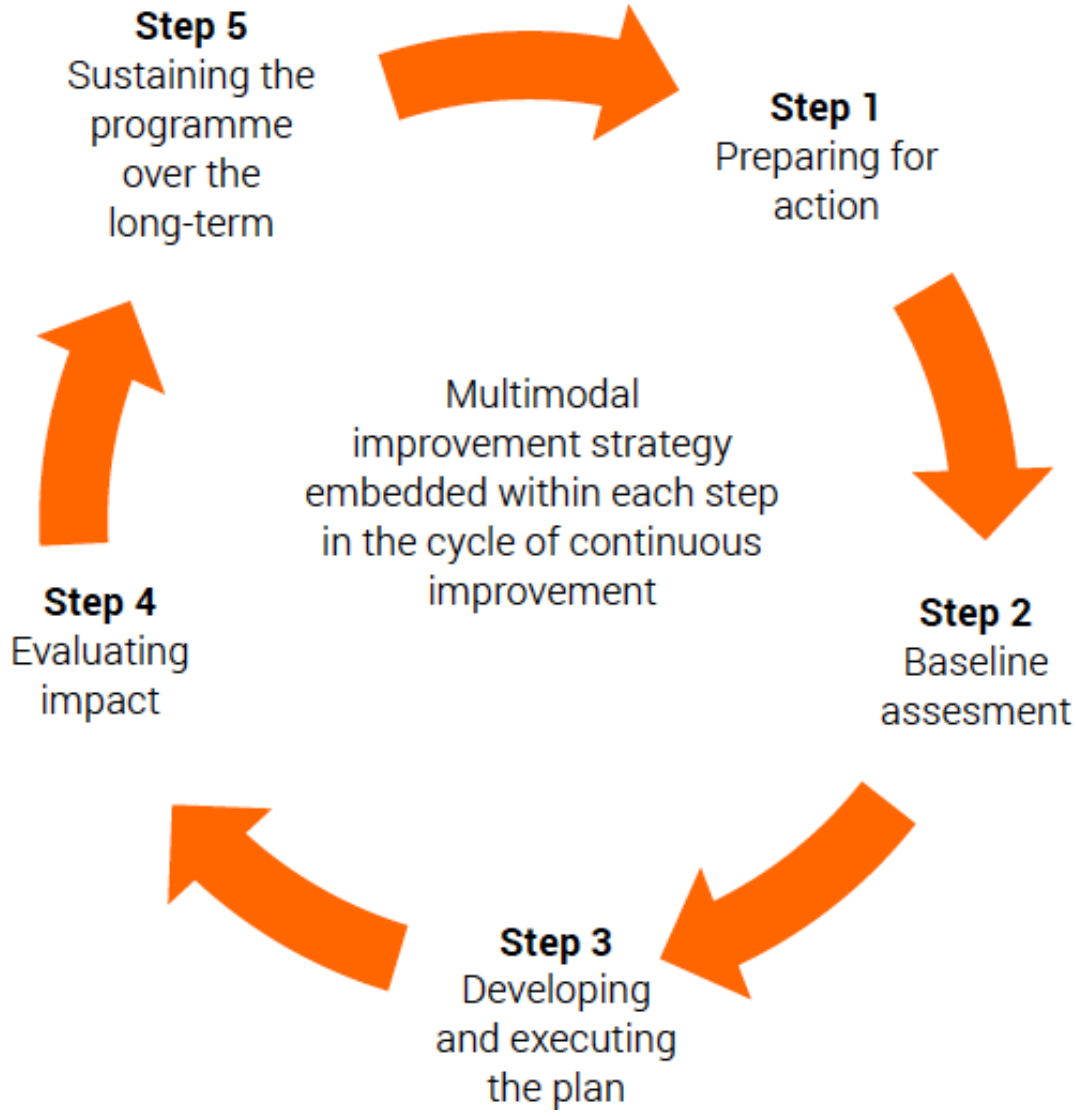
Source: http://www.who.int/infection-prevention/tools/surgical/reminders-advocacy/en/

A WHO implementation framework





Stepwise approach



Sources: http://www.who.int/infection-prevention/tools/core-components/en
Preventing surgical site infections: implementation approaches for evidence-based recommendations. Geneva: World Health Organization; 2018 (http://www.who.int/infection-prevention/tools/surgical/en/).

World Health Organization

Operational manual for the WHO SSI prevention recommendations.

This implementation manual is designed to be used by all persons concerned by the prevention of SSI in all health care settings, irrespective of the country.

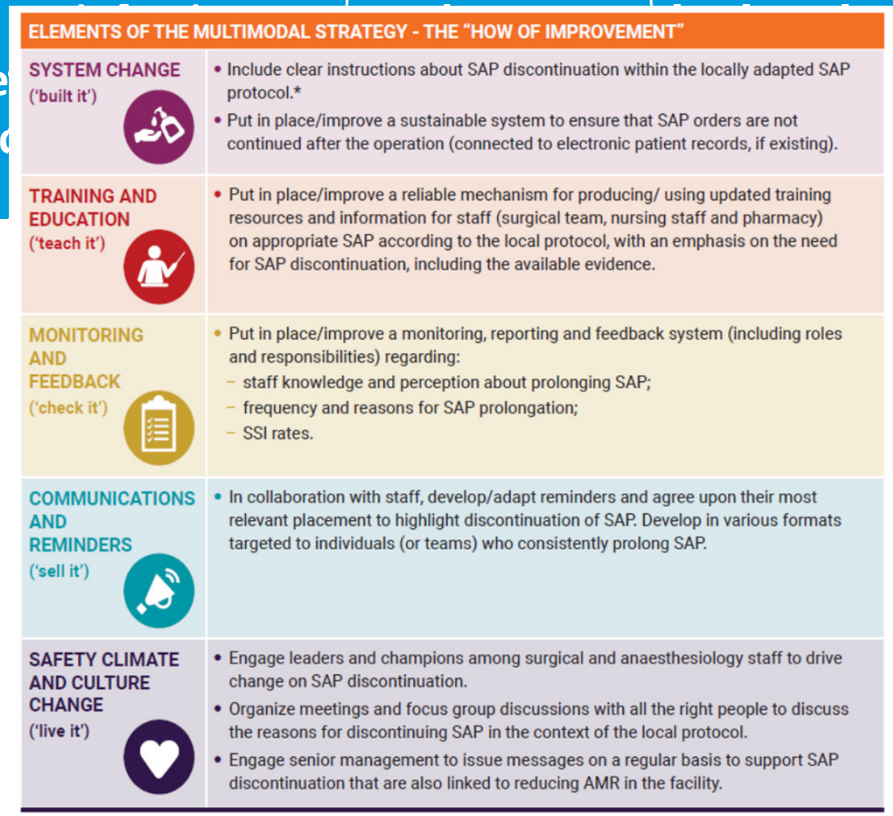
Launched in December 2018

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

Bringing improvement to life

- **Example Scenario**
- **Problem**
- **Case study**

What has to be addressed to make the improvement required?	Why?	When?	Who should	How should you make the improvement?



ELEMENTS OF THE MULTIMODAL STRATEGY - THE "HOW OF IMPROVEMENT"

SYSTEM CHANGE ('built it')	• Include clear instructions about SAP discontinuation within the locally adapted SAP protocol.* • Put in place/improve a sustainable system to ensure that SAP orders are not continued after the operation (connected to electronic patient records, if existing).
TRAINING AND EDUCATION ('teach it')	• Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff (surgical team, nursing staff and pharmacy) on appropriate SAP according to the local protocol, with an emphasis on the need for SAP discontinuation, including the available evidence.
MONITORING AND FEEDBACK ('check it')	• Put in place/improve a monitoring, reporting and feedback system (including roles and responsibilities) regarding: – staff knowledge and perception about prolonging SAP; – frequency and reasons for SAP prolongation; – SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it')	• In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement to highlight discontinuation of SAP. Develop in various formats targeted to individuals (or teams) who consistently prolong SAP.
SAFETY CLIMATE AND CULTURE CHANGE ('live it')	• Engage leaders and champions among surgical and anaesthesiology staff to drive change on SAP discontinuation. • Organize meetings and focus group discussions with all the right people to discuss the reasons for discontinuing SAP in the context of the local protocol. • Engage senior management to issue messages on a regular basis to support SAP discontinuation that are also linked to reducing AMR in the facility.

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

New WHO implementation package for SSI prevention

World Health Organization

Infection prevention and control

- Home page
- About us
- Campaigns
- Implementation tools and resources
- Evidence, guidelines and publications
- Work in countries
- News and events

Surgical site infections tools and resources

A range of tools exist for you to adopt and adapt to support local improvement. They are proven to achieve change if used as part of a multi-modal strategy as represented in the 5 components listed here.

- **System change**
- **Communications for awareness raising**
- **Training and education**
- **Institutional safety climate and culture**
- **Evaluation and feedback**

Link to Global guidelines on the prevention of surgical site infection publications page

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

WHO core component 5 for effective IPC
Strong recommendation: multimodal strategies

- **National level:** national IPC programmes should coordinate and facilitate the implementation of IPC activities through multimodal strategies on a nationwide or subnational level.
- **Facility level:** IPC activities using multimodal strategies should be implemented to improve practices and reduce HAI and AMR.

- A **multimodal strategy** comprises **several elements or components** (three or more; usually five) implemented in an **integrated way** with the **aim of improving an outcome and changing behaviour**. It includes tools, such as bundles and checklists, developed by multidisciplinary teams that take into account local conditions.
- The five most common components are: (i) **system change** (availability of the appropriate infrastructure and supplies to enable IPC recommendations implementation); (ii) **education and training** of health care workers and key players; (iii) **monitoring** infrastructures, practices, processes, outcomes and providing data **feedback**; (iv) **reminders** in the workplace/**communications**; and (v) **culture change** within the establishment or the strengthening of a safety climate.

Source: Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level. Geneva: World Health Organization; 2016 (http://www.who.int/infection-prevention/publications/ipc-core-components/en/).

Understanding the multimodal strategy for SSI prevention (1)

System change

"Build it"

- *Ensuring that the health care facility has the **necessary infrastructure and resources in place** to allow for steps to be taken to prevent SSI based on the known modifiable risk factors*
- The right infrastructure and available resources can streamline interventions for consistent delivery of care and make execution easier and safer.

Source: Preventing surgical site infections: implementation approaches for evidence-based recommendations. Geneva: World Health Organization; 2018 (http://www.who.int/infection-prevention/tools/surgical/en/).

System change - *"Build it" (cont')*
Necessary infrastructure and resources

World Health Organization

- Allocated budget
- Standard operating procedures, protocols, local policies and tools/mechanisms for training
- An IT system (or paper) for monitoring and feedback on infrastructure and resources and other improvement steps
- Laboratory services
- Surgical services/human resources including a dedicated, competent team for ensuring SSI prevention activities working to an action plan
- Supplies for surgical hand preparation* - ABHR, antimicrobial soap

* Procurement vs local production

- Sterile drapes and gowns
- The correct antibiotics for SAP (and if need to be given with MBP) - easily accessible
- Clippers (if hair removal essential)
- Chlorhexidine- alcohol-based (skin prep) solution*
- Mupirocin 2% ointment
- Oxygen
- Standard postoperative wound dressings

To consider:

- Antimicrobial-coated sutures
- Negative pressure wound therapy devices
- Nutritional formulas
- Warming devices
- Fluid therapy
- Aqueous povidone iodine solution (irrigation)

Understanding the multimodal strategy for SSI prevention (2)

Training and education – *"Teach it"*

- *Practical **training and education** methods aligned with the recommendations for SSI prevention*

- Onsite hospital courses
- Bolus (single relatively large) sessions
- Simulation sessions for skills training
- Use of locally made or online videos
- Online e.learning courses and webinars
- Focus groups and workshops
- Bedside training
- In-person sessions, e.g. during ward or grand rounds, town hall meetings, coaching visits
- Pre and post knowledge and perception tests
- Training support materials (handouts, e-learning, etc.)

Understanding the multimodal strategy for SSI prevention (3)

Evaluation and feedback

"Check it"

*Regular **monitoring** and timely **feedback** of:*

- *risk factors for SSI;*
- *compliance with recommended procedures and practices;*
- *infrastructures and available resources and supplies;*
- *knowledge and perception of the problem;*
- *SSI rates.*

It should not be seen as a component separate from implementation or only to be used for scientific purposes. Targeted tools and use of observations are inherent.

This is an essential step in:

- identifying areas deserving major efforts and feeding crucial information into development of local local action plan;
- measuring the changes induced by improvement efforts and ascertaining whether interventions have been effective;
- engaging staff in deciding upon different formats for providing feedback (real time and personalised feedback have proven beneficial).

Understanding the multimodal strategy for SSI prevention (4)

Reminders and communications

"Sell it"

- ***Reminding and prompting*** *health care workers about the importance of practices to prevent SSI when they are working at the point of care*
- ***Informing*** *patients and their visitors of the standard of care that they should expect to receive*
- ***Communications*** *to inform senior leaders and decision-makers regarding the standards that they should assure*

- Posters
- Leaflets
- Banners
- Stickers
- Flowcharts
- Infographics
- Letter templates
- Advocacy messages suitable to the local setting, e.g. memos
- Manuals
- Electronic reminders (built in to hospital IT system)
- Telephone call (including for patient reminders)

Understanding the multimodal strategy for SSI prevention (5)

Institutional safety climate and culture

"Live it"

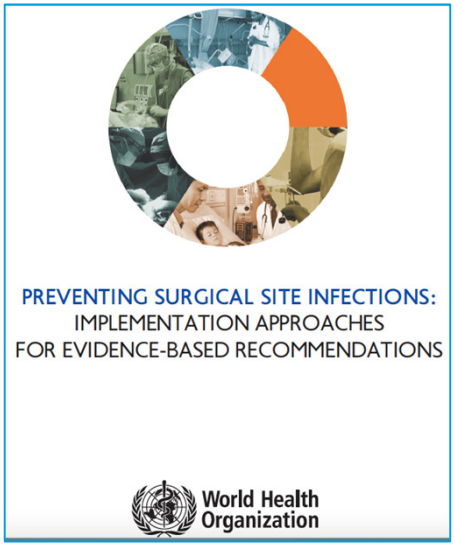
*Creating an **environment and the perceptions** that facilitate awareness-raising about SSI prevention at all levels:*

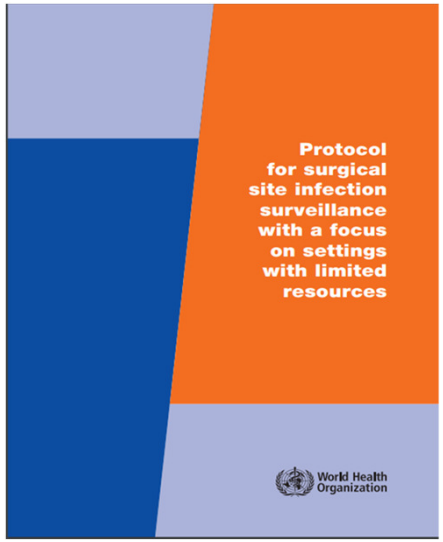
- *a climate that understands and prioritizes surgical safety issues;*
- *team spirit and cohesion;*
- *awareness of self-capacity to make a change, ownership of the intervention.*

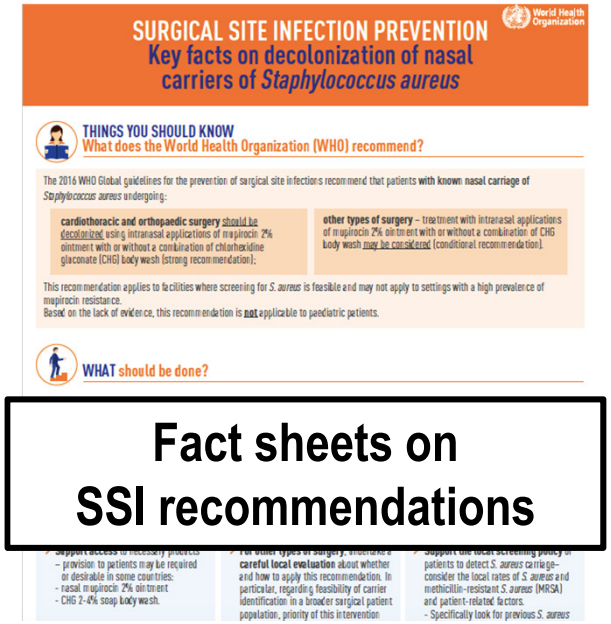
- Motivated, multidisciplinary well functioning teams
- Champions
- Role models
- Visible leadership including on ward/grand rounds, through photographs and signatures
- Morbidity and mortality meetings including senior hospital staff – to learn from defects and facilitate sharing for improvement
- Advocacy messages from leaders (delivered in a timely manner)

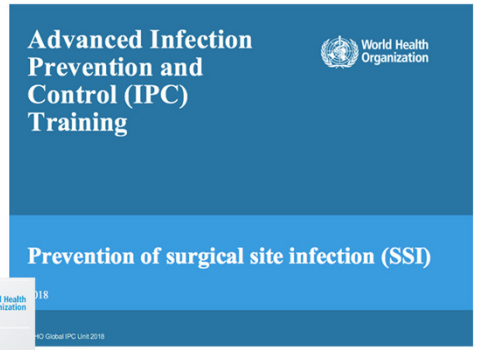
Recently launched WHO SSI Prevention Implementation Package

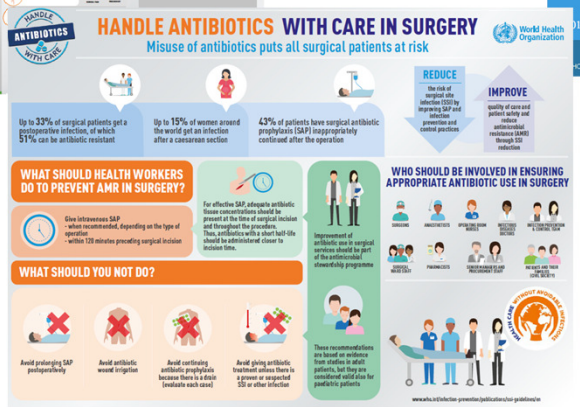
World Health Organization





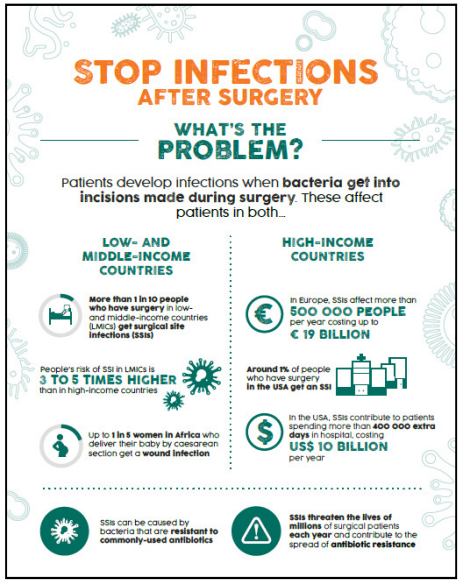


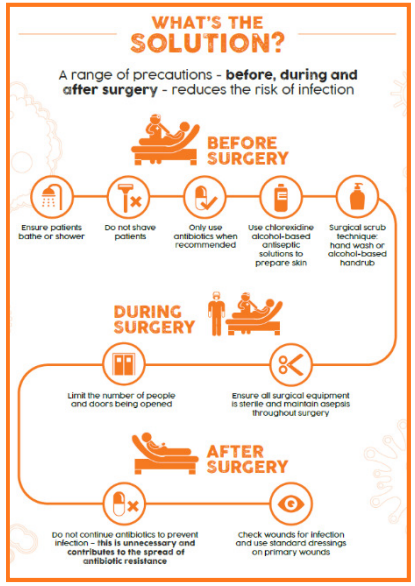


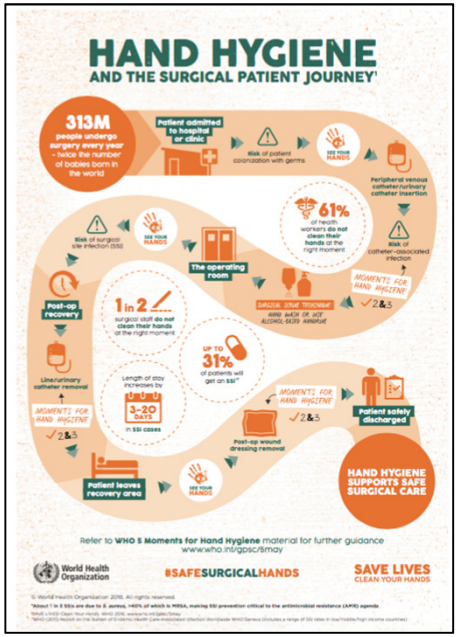


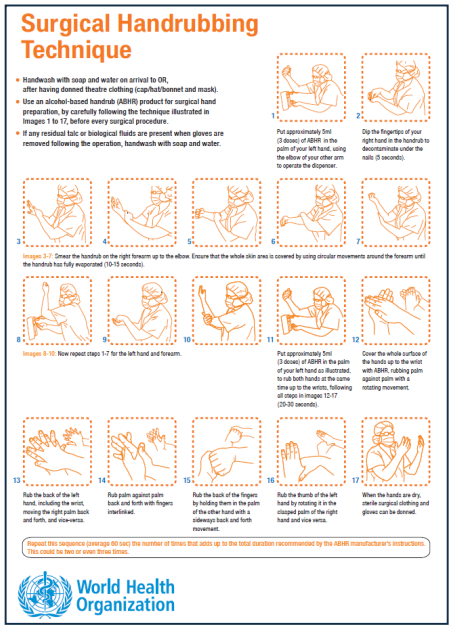
Fact sheets on SSI recommendations

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





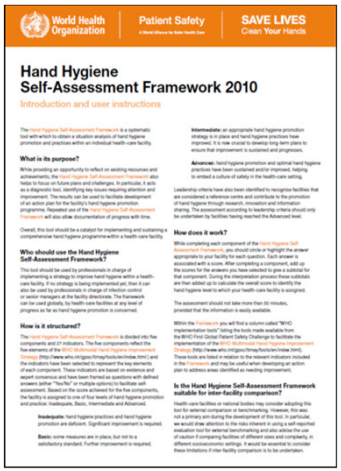




http://www.who.int/infection-prevention/tools/surgical/en/

WHO 2019 Global Survey on Infection Prevention and Control and Hand Hygiene

Facility-level assessments in a spirit of improvement



16 January – 16 July

All health care facilities and countries are invited to participate!

Find instructions here https://www.who.int/infection-prevention/campaigns/ipc-global-survey-2019/en/

System change: modified WHO formulations for surgical hand preparation

World Health Organization

Formulation I

Final concentrations: ethanol 80% wt/wt, glycerol 0.725% vol/vol, hydrogen peroxide 0.125% vol/vol.

Ingredients:

1. ethanol (absolute), **800 g**
2. H_2O_2 (3%), 4.17 ml
3. glycerol (98%), **7.25 ml** (or 7.25 x 1.26 = 9.135 g)
4. top up to **1000 g** with distilled or boiled water

Formulation II

Final concentrations: isopropanol 75% wt/wt, glycerol 0.725% vol/vol, hydrogen peroxide 0.125% vol/vol.

Ingredients:

1. isopropanol (absolute), **750 g**
2. H_2O_2 (30%), **4.17 ml**
3. glycerol (98%), **7.25 ml** (or 7.25 x 1.26 = 9.135 g)
4. top up to **1000 g** with distilled water

Sources:

- Suchomel M KM, Kundi M, Pittet D, Rotter ML. Modified World Health Organization hand rub formulations comply with European efficacy requirements for preoperative surgical hand preparations. Infect Control Hosp Epidemiol. 2013; 34(3):245–250.
- Allegranzi B, Aiken AM, Zeynep Kubilay N, Nthumba P, Barasa J, Okumu G et al. A multimodal infection control and patient safety intervention to reduce surgical site infections in Africa: a multicentre, before–after, cohort study. Lancet Infect Dis. 2018; 18(5):507–515.

Key resource

Education and training example: improving surgical hand preparation

1. **Local production of modified WHO formulation for ABHR**

2. Surgical hand preparation
   - **Antimicrobial soap + water** = 2–5 minutes
   - **Alcohol-based** = 1.5–3 minutes
   - The right technique is crucial
   - Nailbrushes are <u>not</u> recommended.

Education and training example

World Health Organization

YouTube AT Search

Video https://www.youtube.com/watch?v=h16JPBcOIGs

Key resource

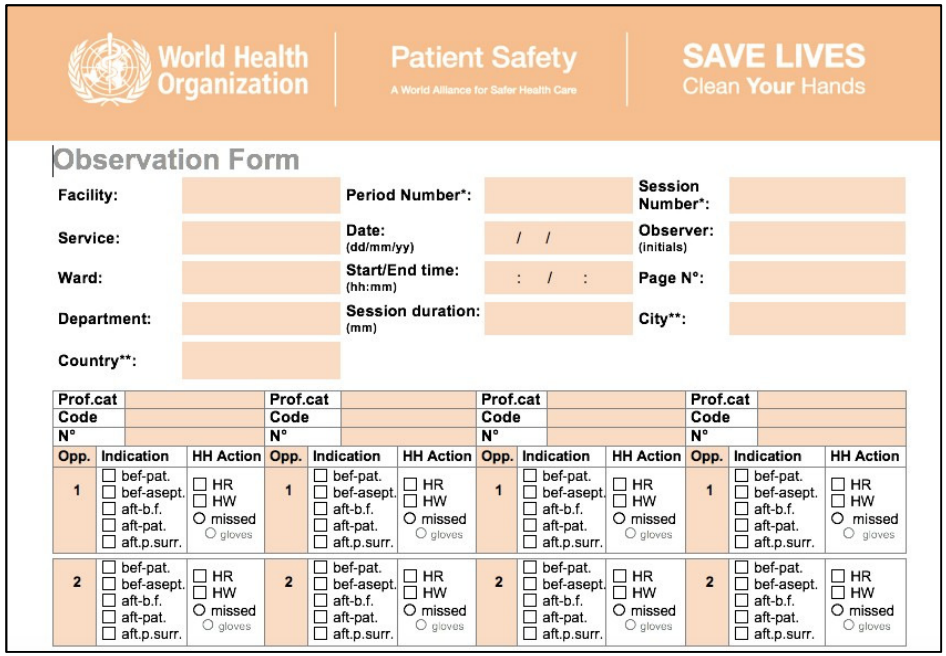
HUG Hôpitaux Universitaires Genève

University of Geneva Hospitals and Faculty of Medicine, Geneva, Switzerland

WHO Collaborating Centre on Patient Safety Infection Control & Improving Practices

Monitoring example – observation tools

World Health Organization



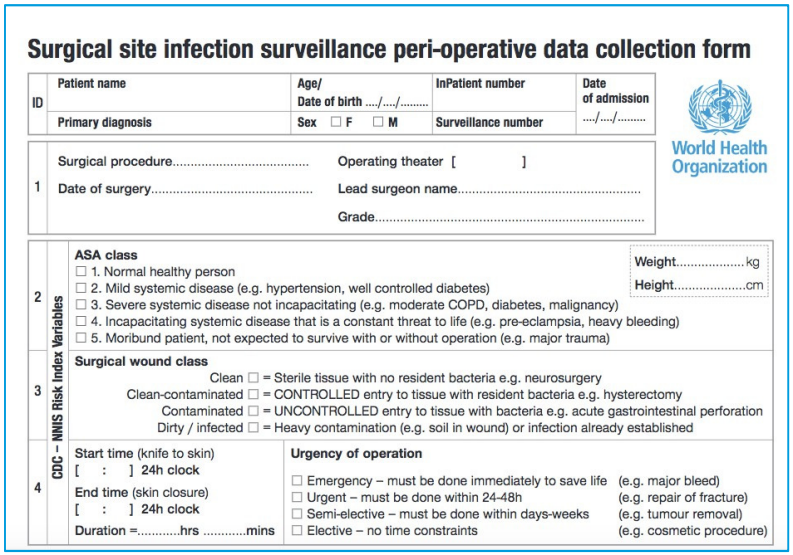
World Health Organization | Patient Safety — A World Alliance for Safer Health Care | SAVE LIVES Clean Your Hands

Observation Form

Facility:		Period Number*:		Session Number*:	
Service:		Date: (dd/mm/yy)	/ /	Observer: (initials)	
Ward:		Start/End time: (hh:mm)	: / :	Page N°:	
Department:		Session duration: (mm)		City**:	
Country**:					

Prof.cat		Prof.cat		Prof.cat		Prof.cat	
Code		Code		Code		Code	
N°		N°		N°		N°	

Opp.	Indication	HH Action	Opp.	Indication	HH Action	Opp.	Indication	HH Action	Opp.	Indication	HH Action
1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves
2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○ missed ○ gloves



Surgical site infection surveillance peri-operative data collection form

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

World Health Organization

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

CDC – NNIS Risk Index Variables

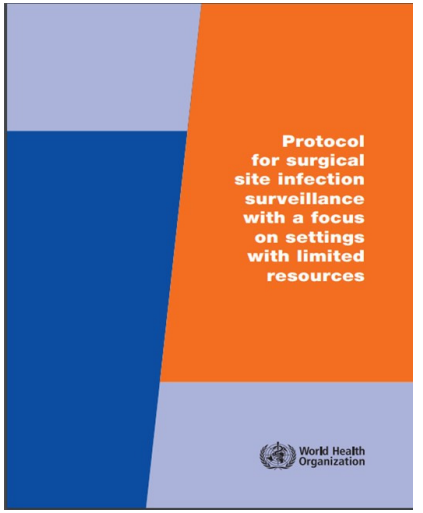
2 — **ASA class**
☐ 1. Normal healthy person
☐ 2. Mild systemic disease (e.g. hypertension, well controlled diabetes)
☐ 3. Severe systemic disease not incapacitating (e.g. moderate COPD, diabetes, malignancy)
☐ 4. Incapacitating systemic disease that is a constant threat to life (e.g. pre-eclampsia, heavy bleeding)
☐ 5. Moribund patient, not expected to survive with or without operation (e.g. major trauma)

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

3 — **Surgical wound class**
Clean ☐ = Sterile tissue with no resident bacteria e.g. neurosurgery
Clean-contaminated ☐ = CONTROLLED entry to tissue with resident bacteria e.g. hysterectomy
Contaminated ☐ = UNCONTROLLED entry to tissue with bacteria e.g. acute gastrointestinal perforation
Dirty / infected ☐ = Heavy contamination (e.g. soil in wound) or infection already established

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

Urgency of operation
☐ Emergency – must be done immediately to save life (e.g. major bleed)
☐ Urgent – must be done within 24-48h (e.g. repair of fracture)
☐ Semi-elective – must be done within days-weeks (e.g. tumour removal)
☐ Elective – no time constraints (e.g. cosmetic procedure)

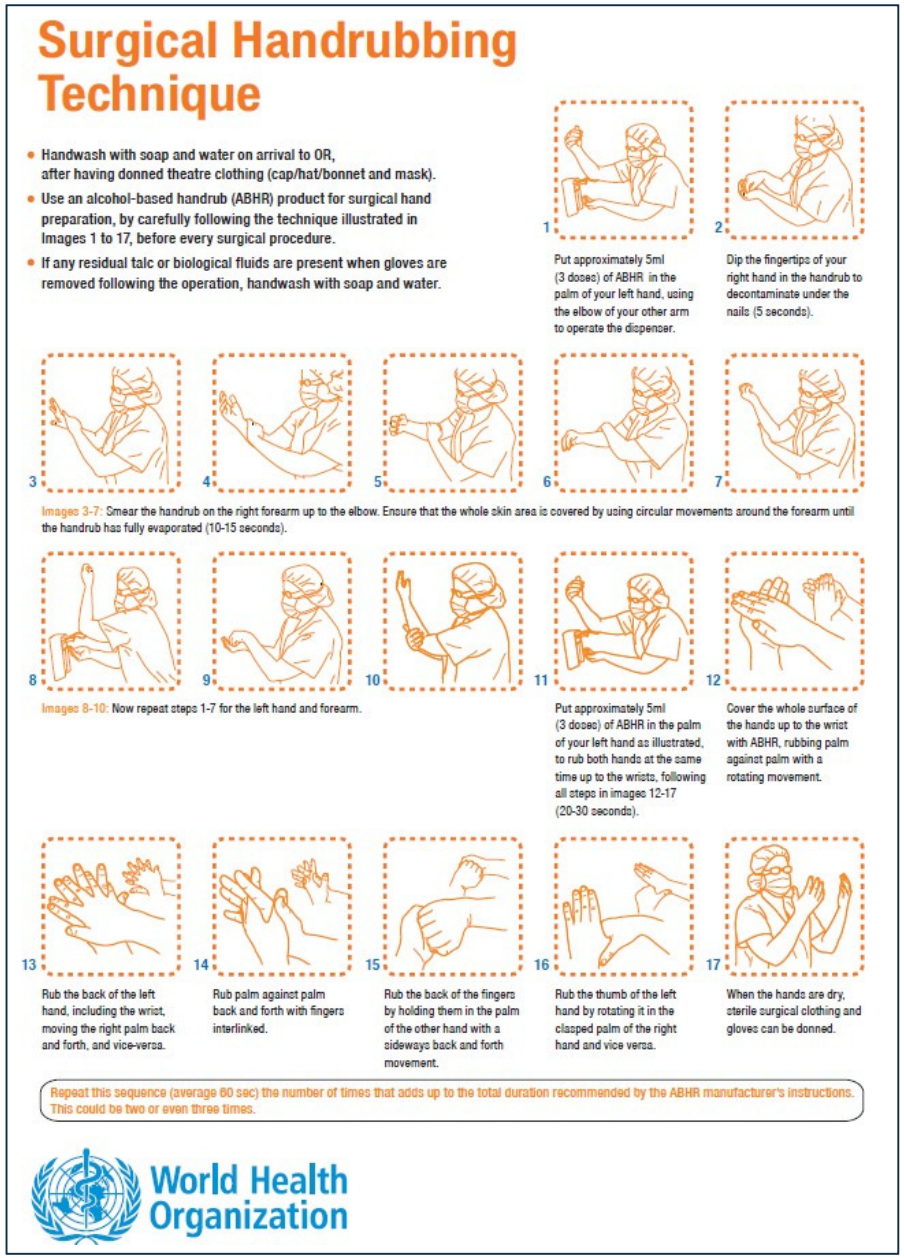


Key resource

Sources:

- http://www.who.int/infection-prevention/tools/hand-hygiene/evaluation_feedback/en/
- Protocol for surgical site infection surveillance with a focus on settings with limited resources. Geneva: World Health Organization; 2018 (http://www.who.int/infection-prevention/tools/surgical/evaluation_feedback/en/).

Reminders



World Health Organization

Source: http://www.who.int/infection-prevention/tools/surgical/reminders-advocacy/en/

Key resource

Reminders and communications: campaigning poster

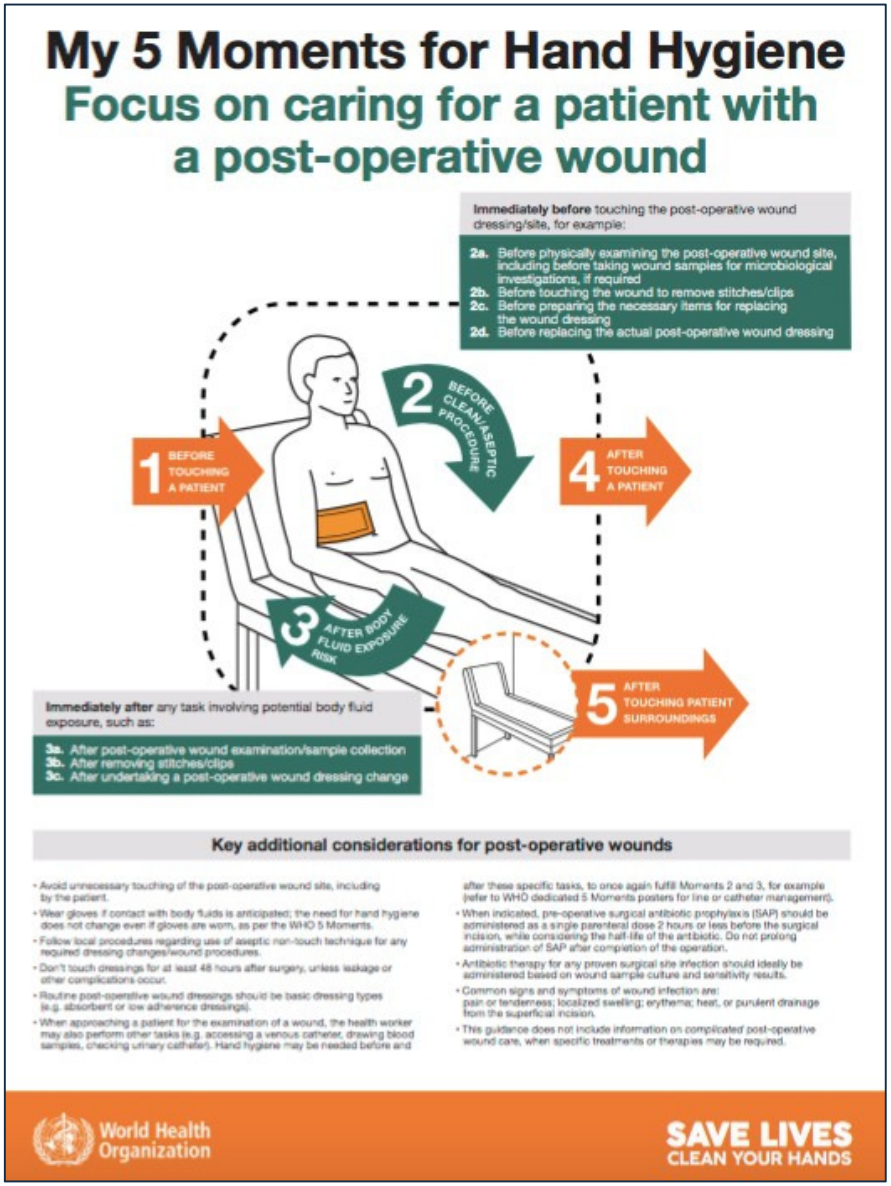
World Health Organization

Source: http://www.who.int/gpsc/5may/A4_hh-poster-visual-EN.pdf?ua=1

Key resource

Reminders: embedding hand hygiene in the surgical patient's journey

World Health Organization



Source: http://www.who.int/infection-prevention/tools/surgical/reminders-advocacy/en/

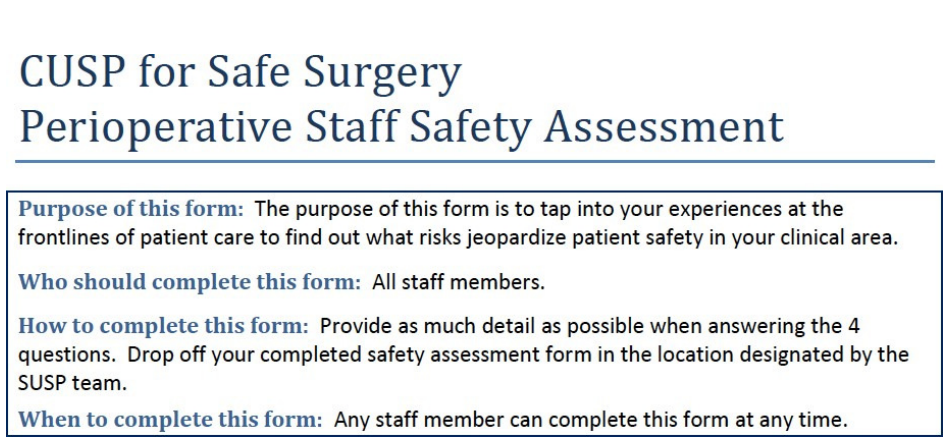
Key resource

Tools to address the culture

World Health Organization

Core CUSP toolkit

Created for clinicians by clinicians, the CUSP toolkit is modular and modifiable to meet individual unit needs. Each module includes teaching tools and resources to support change at the unit level, presented through facilitator notes that take you step-by-step through the module, presentation slides, tools, videos.



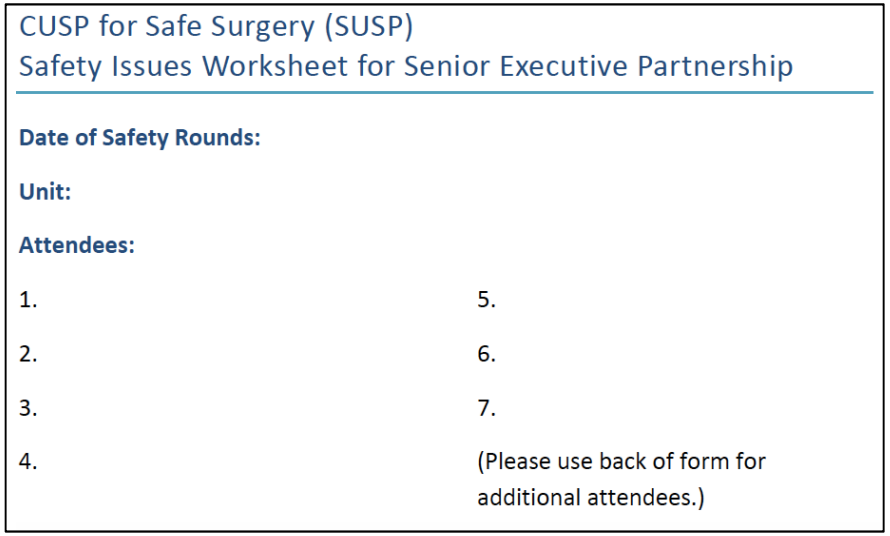
CUSP for Safe Surgery
Perioperative Staff Safety Assessment

Purpose of this form: The purpose of this form is to tap into your experiences at the frontlines of patient care to find out what risks jeopardize patient safety in your clinical area.

Who should complete this form: All staff members.

How to complete this form: Provide as much detail as possible when answering the 4 questions. Drop off your completed safety assessment form in the location designated by the SUSP team.

When to complete this form: Any staff member can complete this form at any time.



CUSP for Safe Surgery (SUSP)
Safety Issues Worksheet for Senior Executive Partnership

Date of Safety Rounds:

Unit:

Attendees:

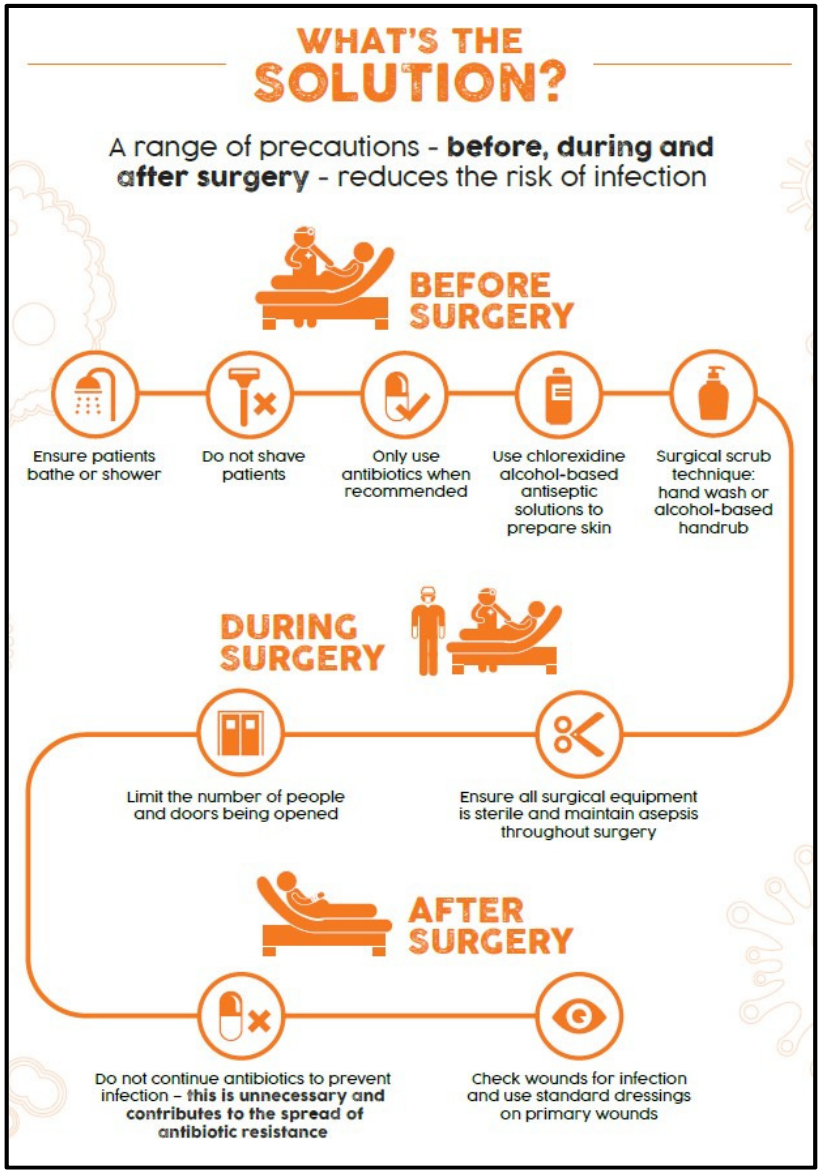
1.
2.
3.
4.
5.
6.
7.

(Please use back of form for additional attendees.)

Sources: Core CUSP Toolkit [website]. Rockville, MD: Agency for Healthcare Research and Quality; 2018 (https://www.ahrq.gov/professionals/education/curriculum-tools/cusptoolkit/modules/index.html); Supplemental Tools [website]. Rockville, MD: Agency for Healthcare Research and Quality; 2018 (https://www.ahrq.gov/professionals/quality-patient-safety/hais/tools/surgery/guide-appcusp.html).

SSI prevention throughout the patient journey – IPC in action

World Health Organization



Source: http://www.who.int/gpsc/ssi-infographic.pdf

Key resource

Acknowledgements

- Benedetta Allegranzi (Department of Service Delivery and Safety, WHO) coordinated the development of this module and contributed to its writing.
- Claire Kilpatrick (Department of Service Delivery and Safety, WHO) led the writing of the module.
- Anthony Twyman and Nizam Dimani (Department of Service Delivery and Safety, WHO) contributed to the writing of the module.

THANK YOU

WHO Infection Prevention and Control Global Unit

Learn more at: http://www.who.int/infection-prevention/en/

World Health Organization