



World Health
Organization

IMPLEMENTATION MANUAL

to support the prevention of
surgical site infections at the facility level –
**TURNING RECOMMENDATIONS
INTO PRACTICE**

(INTERIM VERSION)



Build it



Teach it



Check it



Sell it



Live it

WHO/HIS/SDS/2018.18

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FOREWORD

I believe the 2000s will be remembered and commemorated as the 'guidelines era'. The World Health Organization (WHO) led the initiative for the first global surgical site infection prevention guidelines and took a step further by establishing a global guideline that also embraces low- and middle-income country realities. With this innovative implementation manual we, surgeons, can now bring all these surgical site infection prevention improvements to real life with ease and can translate the global guidelines to the bedside.



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President-Elect, Surgical Infection Society-Europe

The infection prevention and control world is largely foreign to the regular surgeon – one in which we as surgeons are often fearful of treading into. However, because surgical practice is an integral part of infection prevention and control practices, the surgeon must boldly walk into this world to look for and to develop appropriate skills for the safety of our patients. Surgical site infections, the development of antimicrobial resistance and the paucity of new antimicrobial agents, are such a threat to the practice of surgery that no surgeon can afford to ignore this threat any longer. The WHO surgical site infection prevention implementation and improvement manual is a very timely tool – coming shortly after the publishing of the WHO global guidelines on surgical site infection prevention. This manual provides an excellent companion for the surgical team seeking to improve patient safety within the surgical ecosystem. It is equally relevant to any resource setting. A must-read for every surgeon and a must-use for every health care institution providing surgical care.



Peter M Nthumba

President, Surgical Society of Kenya
Plastic and reconstructive surgeon,
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Surgical site infection is feared by patients and surgeons alike. While we would like to have zero infections after surgery, the only way to accomplish that would be to have no surgery. What we should accomplish is the lowest possible number of infections and this new manual by WHO, which represents the work of dozens of experts from around the world, now gives us the means and opportunity to achieve the lowest possible number of surgical site infections.



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ABBREVIATIONS AND ACRONYMS

ABHR	alcohol-based handrub
AMR	antimicrobial resistance
CHG	chlorhexidine gluconate
CUSP	Comprehensive Unit-based Safety Program
FiO₂	fraction of inspired oxygen
GDFT	goal-directed fluid therapy
HAI	health care-associated infection
HIC	high-income countries
IPC	infection prevention and control
LMICs	low- and middle-income countries
MBP	mechanical bowel preparation
OR	operating room
pNPWT	prophylactic negative pressure wound therapy
PVP-I	povidone-iodine
SAP	surgical antibiotic prophylaxis
SOP	standard operating protocols
SSI	surgical site infection
SUSP	Surgical Unit-based Safety Program
USA	United States of America
WASH	water, sanitation and hygiene
WHO	World Health Organization

GLOSSARY OF TERMS

Adaptive approaches consider the behavioural, organizational and cultural complexity in health care systems. They aim to improve the local safety climate and motivate local teams to consistently perform best practices by shaping attitudes, beliefs and values of clinicians. This could include engaging leadership, improving collaborations and team work, and facilitating staff ownership of the intervention.

Alcohol-based handrub refers to an alcohol-based preparation designed for application to the hands to inactivate microorganisms and/or temporarily suppress their growth. Such preparations may contain one or more types of alcohol, other active ingredients with excipients and humectants.

Antimicrobial skin sealants refer to sterile, film-forming cyanoacrylate-based sealants that are commonly used as additional antimicrobial skin preparation after antisepsis and prior to skin incision. These sealants are intended to remain in place and block the migration of flora from surrounding skin into the surgical site by dissolving for several days postoperatively.

Cleaning refers to the removal, usually with detergent and water, of adherent visible soil, blood, protein substances, microorganisms and other debris from the surfaces, crevices, serrations, joints and lumens of instruments, devices and equipment by a manual or mechanical process that prepares the items for safe handling and/or further decontamination. Cleaning is essential prior to the use of heat or chemicals.

Decontamination refers to the use of physical or chemical means to remove, inactivate or destroy pathogenic microorganisms

from a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use or disposal. This term is used to cover cleaning, disinfection, or sterilization.

Disinfection refers to either thermal or chemical destruction of pathogenic and other types of microorganisms. Disinfection is less lethal than sterilization because it destroys most recognized pathogenic microorganisms, but not necessarily all microbial forms (for example, bacterial spores). It reduces the number of microorganisms to a level that is not harmful to health or safe to handle.

Health care-associated infection, also referred to as “nosocomial” or “hospital” infection, is an infection occurring in a patient during the process of care in a hospital or other health care facility, which was not present or incubating at the time of admission. Health care-associated infections can also appear after discharge. They represent the most frequent adverse event during care.

Interactive (advanced) wound dressings refer to modern (post-1980) dressing materials that are designed to promote the wound healing process through the creation and maintenance of a local, warm, moist environment underneath the chosen dressing when left in place for a period indicated through a continuous assessment process. Examples are alginates, semipermeable film membranes, foams, hydrocolloids and fibrous hydrocolloids, non-adherent wound contact materials and combinations of those.

High, low- and middle-income countries: WHO Member States are grouped into four

income groups (low, lower-middle, upper middle, and high) based on the World Bank list of analytical income classification of economies for the fiscal year, calculated using the World Bank Atlas method. For the current (2017) fiscal year, low-income economies are defined as those with a gross national income (GNI) per capita of US\$ 995 or less in 2017; lower middle-income economies as those with a GNI per capita between US\$ 996 and US\$ 3895; upper-middle-income economies as those with a GNI per capita of between US\$ 3896 and US\$ 12 005; and high-income economies as those with a GNI per capita of US\$ 12 056 or more.

Mechanical bowel preparation refers to the preoperative administration of substances to induce voiding of the intestinal and colonic contents.

Multimodal strategy: A multimodal strategy comprises several elements or components (three or more; usually five, <http://www.ihl.org/topics/bundles/Pages/default.aspx>) 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 include: (i) system change (availability of the appropriate infrastructure and supplies to enable infection prevention and control good practices); (ii) education and training of health care workers and key players (for example, managers); (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.

Primary closure is defined as closure of the skin level during the original surgery, regardless of the presence of wires, wicks, drains, or other devices or objects extruding through the incision. This category includes surgeries where the skin is closed by some means. Thus, if any portion of the incision is closed at the skin level, by any manner, a designation of primary closure should be assigned to the surgery.

Sterilization refers to the complete destruction of all microorganisms including bacterial spores.

Strength of WHO recommendations

- **Strong** recommendation means that the expert panel was confident that the benefits of the recommended intervention outweighed risks and that most patients would want to receive the recommended intervention and only a small proportion would not. The expert panel considered that the recommendation can be adopted as policy and can be adaptable for implementation in most (if not all) situations and that patients should receive intervention as course of action.
- **Conditional** recommendation means that the expert panel considered that benefits of intervention probably outweighed the risks; a more structured decision-making process should be undertaken locally to evaluate whether to implement the recommendation, based on stakeholder consultation and involvement of patients and health care professionals.

Surgical antibiotic prophylaxis refers to the prevention of infectious complications by administering an effective antimicrobial agent prior to exposure to contamination during surgery.

Surgical hand preparation refers to an antiseptic handwash or antiseptic handrub performed preoperatively by the surgical team to eliminate transient flora and reduce resident skin flora. Such antiseptics often have persistent antimicrobial activity.

Surgical handrub(bing) refers to surgical hand preparation with a waterless alcohol-based handrub.

Surgical handscrub(bing)/presurgical scrub refers to surgical hand preparation with antimicrobial soap and water.

Surgical skin preparation refers to the preoperative treatment of the intact skin of the patient within the OR. Preparation includes not only the immediate site of the intended surgical incision, but also a broader

area of the patient's skin. The aim of this procedure is to reduce the microbial load on the patient's skin as much as possible before incision of the skin barrier.

Surgical procedure refers to an operation where at least one incision (including a laparoscopic approach) is made through the skin or mucous membrane, or reoperation via an incision that was left open during a prior operative procedure AND takes place in an operating room.

Surgical site infection refers to an infection that occurs after surgery in the part of the body where the surgery took place. Surgical site infections can sometimes be superficial infections involving the skin only. Other surgical site infections are more serious and can involve tissues under the skin, organs, or implanted material. (Source: United States Centers for Disease Control and Prevention. <https://www.cdc.gov/HAI/ssi/ssi.html>, accessed 11 July 2016).

Surgical site infection is also defined as an infection that occurs within 30 days after the operation and involves the skin and subcutaneous tissue of the incision (superficial incisional) and/or the deep soft tissue (for example, fascia, muscle) of the incision (deep incisional) and/or any part of the anatomy (for example, organs and spaces) other than the incision that was opened or manipulated during an operation (organ/space). (Source: European Centre for Disease Prevention and Control. http://ecdc.europa.eu/en/publications/Publications/120215_TED_SSI_protocol.pdf, accessed 16 August 2016).

Surgical wound refers to a wound created when an incision is made with a scalpel or other sharp cutting device and then closed in the operating room by suture, staple, adhesive tape, or glue and resulting in close approximation to the skin edges.

INTRODUCTION

Among the range of avoidable harms associated with health care, health care-associated infections (HAI) are a significant burden (1). Surgical site infections (SSIs) are the most frequent HAI in low- and middle-income countries (LMICs) and the second most frequent HAI in higher income settings. In the most challenged settings (2-4), they can affect up to one-third of surgical patients. SSI prevention is a high priority worldwide, but it is particularly complex as the risks include multiple factors determined by the patient's condition, the system and the environment, as well as behaviours and actions associated with the organization and delivery of health care.

BOX 1

SURGICAL SITE INFECTIONS: THE HARD FACTS

- **HAI, including SSI, threaten the lives of hundreds of millions of patients each year.**
- **They contribute to the spread of antibiotic resistance (AMR).**
- **SSI rates range from 0.6 to 9.5 per 100 surgical procedures and remain the second most frequent type of HAI in Europe and the USA (3, 4).**
- **In LMICs, infection is the most frequent complication in surgery (5) and SSIs are the most frequent HAI with an average rate of 5.9 per 100 surgical procedures and 11.2 per 100 surgical patients (WHO. Updated systematic review - unpublished data, 2017).**
- **Up to 20% of women in Africa who have a caesarean section develop a postoperative wound infection, compromising their health and their ability to care for their infants (WHO. Updated systematic review - unpublished data, 2017).**
- **In the USA, SSIs are estimated to contribute to 400 000 additional days in hospital at a cost of US\$ 10 billion per year (6).**
- **SSIs are associated with longer post-operative hospital stays, may necessitate additional surgical procedures and may require intensive care (7).**
- **SSIs result in higher attributable morbidity and mortality (7).**

“With 33 000 deaths each year as a consequence of an infection due to bacteria resistant to antimicrobials and EUR 1 billion in annual health care expenditure, we need to ensure that these medicines are used prudently and that infection prevention and control measures are in place in all health care settings across Europe”.

Andrea Ammon,
ECDC Director
(November 2018).

Infection prevention and control (IPC) promotes health by keeping patients and health care workers safe from avoidable infections and the threat of AMR. IPC plays a critical role in reducing both the spread of antibiotic-resistant organisms and the occurrence of infections; it also promotes the appropriate use of antibiotics.

In the surgical environment, certain key actions are essential for not only infection prevention and surgical safety but also for antibiotic stewardship and AMR containment. These include the optimal timing of surgical antibiotic prophylaxis (SAP), its appropriate discontinuation in the postoperative period, and the avoidance of antibiotic use in surgical wound irrigation and/or due to the presence of postoperative wound drains. Therefore, achieving IPC improvement and SSI prevention will contribute significantly to the implementation of the World Health Assembly resolutions on patient safety (<http://www.who.int/patientsafety/policies/resolutions/en/>) and AMR (http://www.who.int/drugresistance/AMR_DC_Resolutions/en/), as well as the AMR global action plan to ‘reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures’ (8). In this context, implementing the WHO core components for IPC programmes is of the utmost importance, including for SSI prevention (9).

To achieve lasting behavioural and practice change, approaches to improvement should be grounded in social and implementation science theory and supported by an appropriate infrastructure and environment. The most successful improvement projects typically embrace a multipronged approach towards the required changes, which involves a strong understanding of the local context to appropriately apply theory into practice. Importantly and similar to any other HAI, SSIs are largely avoidable and up to one-half can generally be prevented through the successful implementation of clinical practice guidelines using a multimodal improvement strategy (10, 11).

The following questions and answers (Box 2) now help outline the importance of taking steps to prevent SSI, including through use of this implementation manual.

BOX 2

SURGICAL SITE INFECTION AND THE IMPLEMENTATION OF PREVENTIVE MEASURES: KEY QUESTIONS AND ANSWERS FOR USERS

Q. What can be done to support SSI prevention now?

A. Implement the recommendations of the WHO evidence-based global guidelines for the prevention of SSI (12) using an evidence- and team-based approach and a multimodal strategy for achieving sustainable change such as those outlined in the WHO document ‘Preventing surgical site infections: implementation approaches for evidence-based recommendations’ (11).

Q. What is the difference between this manual and the WHO document ‘Preventing surgical site infections: implementation approaches for evidence-based recommendations’ (11)?

A. The purpose of the WHO implementation approaches document is to present an outline of a range of tested implementation strategies for SSI prevention, including the context of a broader surgical safety climate. It is **not** a practical guide to implementation. This manual now builds upon an understanding of the approaches previously outlined, particularly multimodal strategies. It is intended as an ‘operational’ manual for the WHO SSI prevention recommendations.

Q. Who is this manual aimed at and who should be involved in implementation activities to prevent SSI?

A. The manual is aimed at all those concerned by the prevention of SSI. A multidisciplinary team is necessary to successfully implement preventive measures. This should include at least IPC and associated staff, such as those working in epidemiology, decontamination/sterilization, quality improvement and patient safety, hospital administration, and the surgical teams (including surgeons, anaesthesiologists, and perioperative nurses).

Q. How is this implementation manual structured?

A. Part 1 aims to provide a brief outline of the work needed to ensure that the entire facility is ready to undertake the intervention/change required. Part 2 then aims to present practical implementation steps and examples all related to the different interventions in the WHO recommendations, including an approach to improvement.

Q. How should the manual be used?

A. Part 1 should be used to understand how SSI prevention is part of a broader IPC approach to support the fundamental preparation and planning (including embedding in long-term activities) of SSI prevention interventions, as well as the identification of clinical leaders and teams to be involved. Suggestions given for stepwise implementation organization are critical for success and should not be overlooked. Part 2 should be used to understand the key aspects of each SSI prevention recommendation and also based on case scenarios, to undertake a successful multimodal approach to translate them into practice by the surgical and clinical teams. Use of the manual is described in more detail below.

Q. How can the implementation of SSI prevention recommendations be achieved?

A. This manual primarily explains why and how the application of a multimodal improvement strategy embedded within the local context is a strong approach to achieving success for implementation of each WHO SSI prevention recommendation. (See Part 2 for more information on multimodal strategies.)

Q. What is this so-called ‘multimodal strategy’?

A. The multimodal improvement strategy is the most effective way to implement IPC recommendations and improve best practices. It is also a core component of successful IPC programmes at both national and facility level as it is widely accepted that focusing on only one approach to ensure IPC will not achieve or sustain behaviour change (see more explanations below). This is also true of SSI prevention.

Q. What might be achieved through successful implementation of SSI prevention measures?

A. The primary objectives are to achieve improvement of IPC practices and SSI reduction over time. Other important achievements can be improvement of knowledge and awareness about the problem of SSI among the key players (senior managers, surgical team, patients and families), as well as of the culture of safety in surgical services and patients’ safety and satisfaction. Additionally, the objective is to achieve an effective and sustainable impact in practice using proven implementation and improvement strategies.

Q. How should action to prevent SSI be prioritized?

A. All of the WHO recommendations are important for surgical safety. There are strong and conditional recommendations, highlighted in this manual, for consideration within the local context. The WHO guidelines provide more information on the methodology used for developing the recommendations.

The WHO guidelines for the prevention of SSI were launched in 2016 with the dual aim of providing comprehensive guidance on a wide range of issues that influence the risk of SSI and to address inconsistencies in the interpretation of evidence and recommendations in existing national guidelines. Importantly, these guidelines have been developed to be valid for any country and amenable to local adaptation, while fully recognizing also the resource challenges faced especially in LMICs. They take account of the strength of available scientific evidence, cost and resource implications, as well as patient and involved health professionals’ values and preferences.

Fig. 1 provides a summary of the recommendations.

Figure 1.

DO THE RIGHT THING AT THE RIGHT TIME TO STOP SURGICAL SITE INFECTION

Recommendations for safe surgical care





INFECTION PREVENTION AND CONTROL (IPC) TEAM

OPERATIVE TEAM ACTIONS

	ACTION	SUPPORTED BY
	Consider using goal-directed therapy	 SURGICAL TEAM  PROCUREMENT
	Consider irrigating incisional wound with an aqueous povidone iodine solution before closure (in clean and clean-contaminated wounds)	 SURGICAL TEAM  PROCUREMENT
	Do NOT perform antibiotic wound irrigation	 SURGICAL TEAM  PROCUREMENT
	Consider using wound protector devices (in clean-contaminated, contaminated and dirty abdominal procedures)	 SURGICAL TEAM  PROCUREMENT
	Consider prophylactic negative pressure wound therapy (primarily in closed surgical incisions in high-risk wounds)	 SURGICAL TEAM  PROCUREMENT
	Consider using triclosan-coated sutures	 SURGICAL TEAM  PROCUREMENT
	Maintain asepsis and discipline in the operating room	 SURGICAL TEAM  CLINICAL STAFF

POSTOPERATIVE SURGICAL TEAM, CLINICAL STAFF ACTIONS

	ACTION	SUPPORTED BY
	Do NOT prolong surgical antibiotic prophylaxis in the postoperative period	 CLINICAL STAFF  SURGEON  PHARMACY AND POLICY (STOPPING DELIVERY)
	Do NOT continue surgical antibiotic prophylaxis due to the presence of a drain Remove wound drain when clinically indicated	 SURGICAL TEAM AND CLINICAL STAFF  ANTIBIOTIC POLICY IN PLACE
	Administer 80% FIO ₂ for 2–6 hours post-op	 WARD NURSE  DOCTOR PRESCRIPTION (AND PROTOCOLS IN PLACE), ESTATES/MAINTENANCE STAFF
	Evaluate and manage wound appropriately, including cleansing, dressing and care, according to the given wound situation	 CLINICAL STAFF  DOCTOR REVIEW
	Do NOT use advanced dressings of any sort (use standard dressings instead)	 WARD NURSE  PROCUREMENT AND SURGICAL TEAM

The WHO Global guidelines for the prevention of surgical site infection outline **recommendations** for safe surgical care that can significantly reduce the risk of surgical site infection.

Wherever a routine surgical procedure is performed, actions should be taken by patients and health workers **to translate these recommendations into practice**.

Applying all recommendations will improve the **quality of care and patient safety** and **reduce antimicrobial resistance**.

In addition to surgical hand preparation, **hand hygiene** action (the 5 Moments for hand hygiene) apply to pre-, intra- and postoperative periods.

Only the right **human and financial resources**, with senior administrator commitment, can ensure these actions happen every time at the right time.

<http://www.who.int/infection-prevention/en/>

HOW TO USE THIS MANUAL

Part 1 of the manual proposes use of a stepwise approach to implementation and improvement based on the evidence and experience of what has worked in a number of health care settings. The information is designed to be adoptable and adaptable. This is at the core of the information presented in this manual and it is then followed by practical information in Part 2.

In **Part 2** potential solutions are suggested based upon the multimodal improvement strategy, which should direct local actions to prevent SSI. Although there is some special focus on LMICs, the strategy is meant to be useful and stimulating to achieve the improvements required in any setting.

Users may find that other situations, apart from the examples presented in Part 2, arise in their settings. All suggestions for improvement against the WHO recommendations should be considered within the local context. However, the overall concept of how to improve practices against the SSI prevention recommendations can be extrapolated to different local situations, while retaining the evidence-based improvement principles presented.

The manual is based on the implementation concepts described in the document 'Improving infection prevention and control at the health facility: interim practical manual supporting implementation of the WHO

Guidelines on core components of infection prevention and control programmes' (13), with the purpose of improving practices known to prevent or reduce SSI. Thus, consultation of this previous WHO implementation manual could be useful for readers who are not already familiar with these concepts.

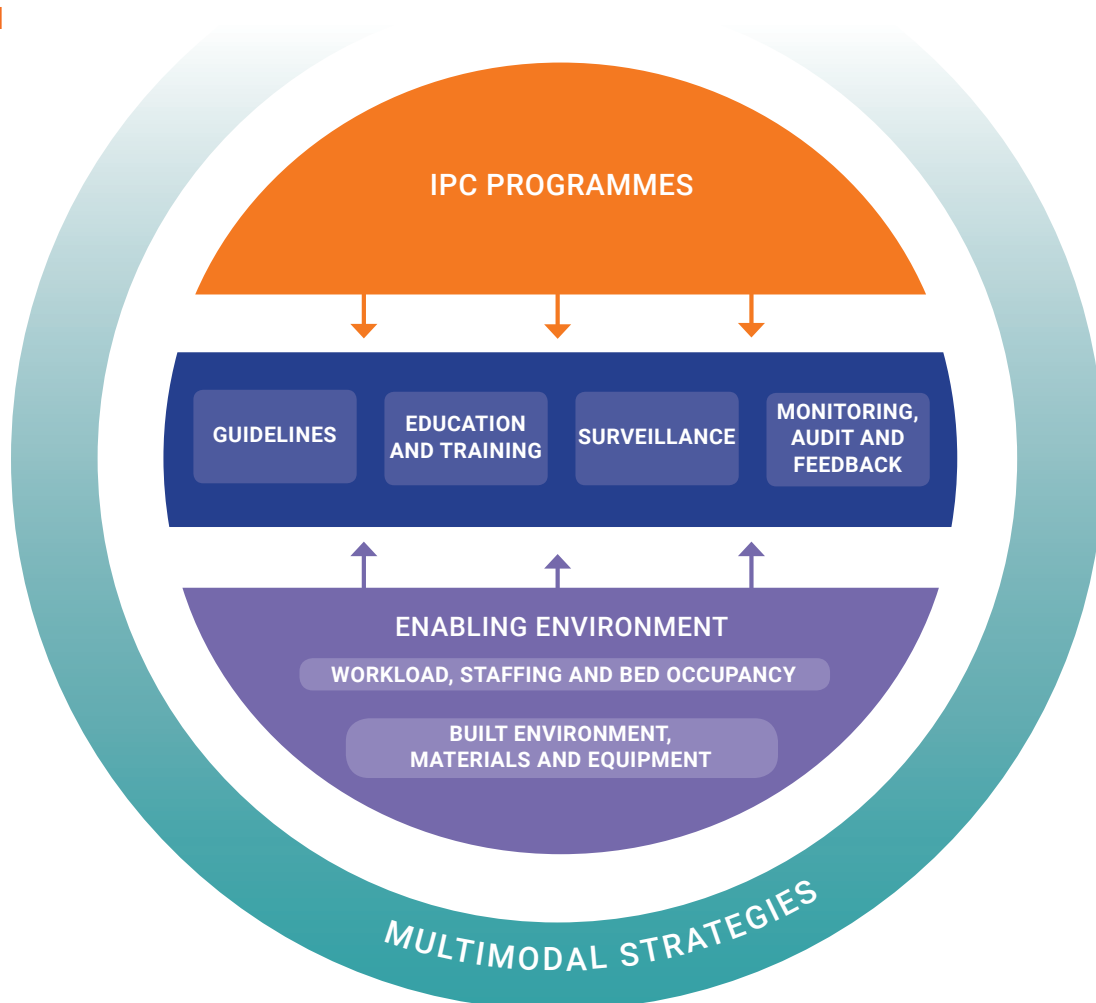
When reviewing the surgical patient journey through the health system and how improved practices to prevent SSI might be achieved, any 'prioritization' of action should be a local decision, additionally informed by all the information presented here and in the WHO guidelines.

HOW SURGICAL SITE INFECTION PREVENTION RELATES TO THE CORE COMPONENTS OF IPC PROGRAMMES: A SUMMARY OF WHY ADDRESSING IPC OVERALL IS IMPORTANT

SSI prevention is considered a key aspect to achieve and impact on patient outcomes in the WHO guidelines on the core components of IPC programmes (9) (Fig. 2).

These guidelines provide a 'roadmap' for health care facilities (and countries) to successfully implement and improve HAI and AMR prevention. The facility-level manual to help promote the implementation of the IPC core components is also available (13).

Figure 2. Visual representation of the core components of infection prevention and control programmes



All IPC core components are important.

- **Core component 1** is particularly crucial as it is related to establishing or strengthening an IPC programme and team that provides in turn the solid, necessary basis for any IPC intervention, including SSI prevention activities.

The following core components were informed by SSI prevention studies and are especially relevant when setting up/improving SSI prevention strategies. This information may help in presenting the specific evidence for SSI as part of a comprehensive IPC programme to colleagues in health care facilities.

- **Core component 2** highlights the overall importance of having evidence-based IPC guidelines to define standards and best practices. This component also emphasizes the importance of conducting training for health care workers when introducing new or updated guidelines (the evidence on implementing IPC training and education, including for target audiences, is further detailed in **core component 3**) and the need for monitoring the implementation and impact of guidelines. All of these aspects fully apply to SSI prevention.
- **Core component 4** concerns HAI surveillance and is critical to inform and guide IPC strategies. This is also true for SSI and conducting SSI surveillance alone has been shown to contribute to substantial reductions in SSI rates. The chapters dedicated to HAI surveillance in the WHO guidelines on the core components of IPC programmes (9) provide valuable information about the background to SSI surveillance presented in the WHO global guidelines for the prevention of SSI (12). WHO has tested (10) and published a protocol and forms for SSI surveillance in settings with limited resources (14-16) and more information on the aspect of monitoring and feedback is presented in this manual within the context of a multimodal improvement strategy.
- **Core component 5** is focused on multimodal improvement strategies. 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. This approach has already been described in Box 2 of this manual and its application is detailed as the main feature of Part 2.
- **Core component 6** concerns the critical importance of performing regular monitoring/audit and timely feedback of health care practices according to standards to prevent and control HAI and AMR at the health care facility level. Monitoring and providing local data feedback on process indicators/practices that influence SSI outcome, such as surgical hand preparation, patient preparation or SAP, is known to influence behaviour and improvement in the long term.



PART 1. INTRODUCING THE WHO STEPWISE APPROACH TO IMPLEMENTATION

WHO proposes a five-step cycle of implementation to support IPC improvement, including for SSI prevention. This approach is featured in the 'Improving infection prevention and control at the health facility level, Interim practical manual supporting implementation of the WHO Guidelines on core components of the infection

prevention and control programmes' (Fig. 3) (13). The work required to ensure that the entire facility is ready to undertake the intervention/change required should not be underestimated. This is critical to achieve success and to demonstrates the facility's commitment to improvement and safe, quality care overall.

Figure 3. The five-step approach to infection prevention and control improvement

STEP 1. Preparing for action: This step ensures that all of the prerequisites that need to be in place for success are addressed, including the necessary resources (human and financial), infrastructures, planning and coordination of activities and the identification of roles and responsibilities (including key opinion leaders and champions). The facility senior managers/leaders play a critical role in this step.

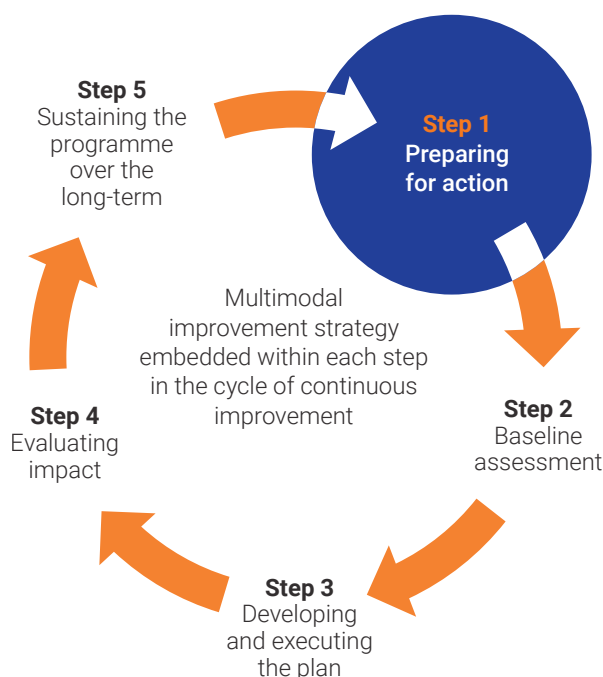
STEP 2. Baseline assessment: Conducting an exploratory baseline assessment of the current situation, including the identification of existing strengths and weaknesses, is critical for developing a tailor-made action plan that addresses the reality of a health care facility. A ready-to-use assessment tool based on the WHO IPC core components is available for step 2 (WHO IPC Assessment Framework [IPCAF]). Ideally, additional IPC assessment tools (for example, the Hand Hygiene Self-assessment Framework [HHSAF] and/or observation-based tools to evaluate IPC practices) could be used.

STEP 3. Developing and executing an action plan: The results of the baseline assessment support the development and execution of an action plan based around a multimodal improvement strategy.

STEP 4. Assessing impact: Conducting a follow-up assessment using the same tools as in step 2 is crucial to determine the effectiveness of the plan. The focus is on impact, acceptability and cost-effectiveness.

STEP 5. Sustaining the programme over the long term: An important step in the cycle of improvement is to develop an ongoing action plan and review schedule to support the long-term impact and benefits of the IPC programme, thus contributing to its overall impact and sustainability.

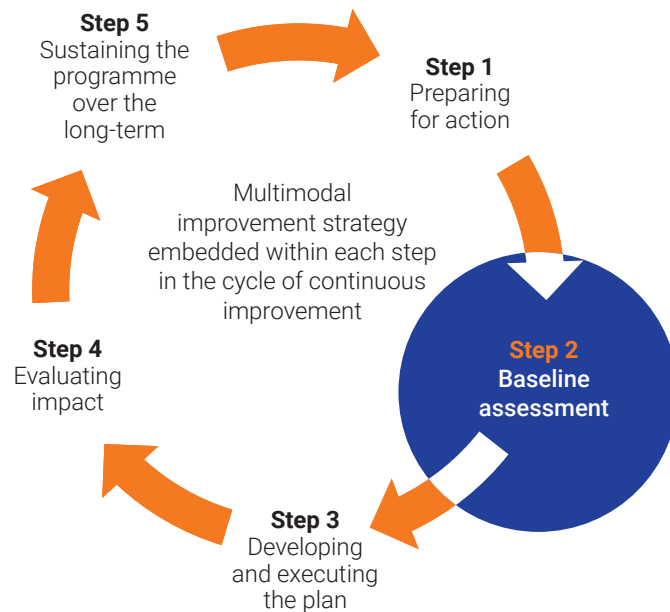
SUMMARY OF ACTIONS IN THE FIVE-STEP CYCLE AS THEY RELATE TO SSI PREVENTION



Step 1.

Getting ready to start a programme of work or strengthen what is already in place to improve SSI prevention in the facility.

- It involves identifying resources and measures needed to support the successful implementation of future actions and starting to put them in place (for example, water supply and quality, other infrastructure improvement, IPC systems and supplies, any training required, including for data management). It also involves engaging senior management, key leaders (including surgeons) and stakeholders in order to gather their formal support to move forward with your plans. Selection of personnel to be in the team to drive forward the plans, and convincing them to be involved will be critical. It implies the establishment of links with other key programmes/services (for example, the microbiology laboratory or the pharmacy or hospital engineers) to support the sustainability of efforts.
- Initial engagement communications and advocacy will need to be addressed as part of this step.
- Note: This step can take months, depending on the facility.
- Unintended consequences should be given consideration. These are actions that might occur, but only as a consequence of the implementation of the intended intervention, not a deliberate act. For example, to fulfill the WHO evidence-based recommendation, a facility may decide to produce locally an alcohol-based solution containing chlorhexidine, if unavailable or too expensive from the market. However, given that such a solution is usually transparent as it does not contain iodine, it is not easily visible on the skin. For this reason, surgeons may find it hard to delimit the surgical incision area and may refuse to change to this new product. This unplanned act could sabotage the whole implementation and improvement plan.

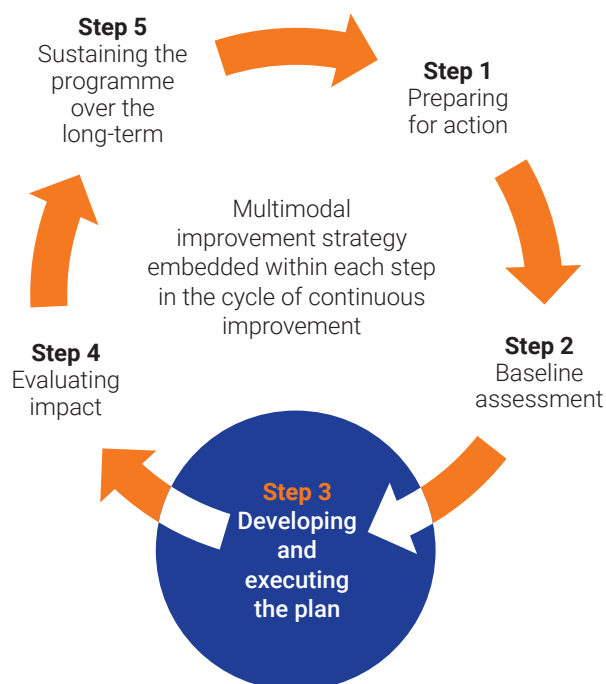


Step 2.

Conducting an exploratory baseline assessment of the current situation concerning SSI and SSI preventive measures in your facility.

This could include:

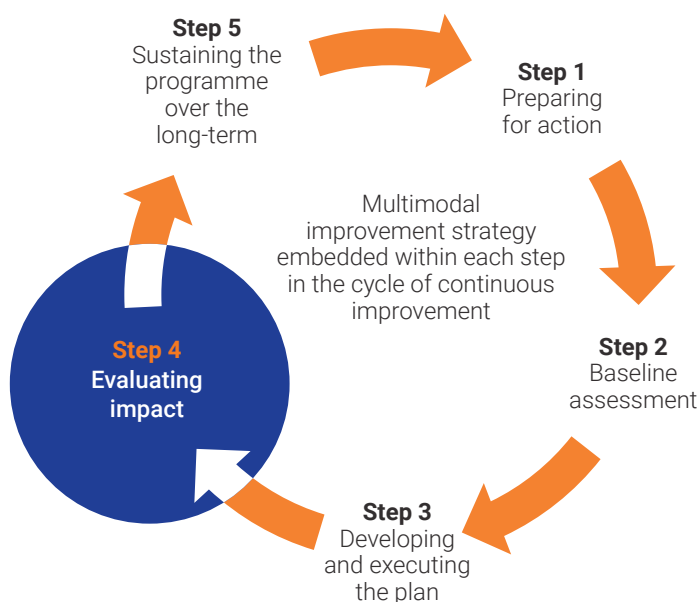
- Using the 'Surgical Unit-based Safety Programme (SUSP) Perioperative Staff Safety Assessment Tool' involving frontline staff and leaders to identify priority measures to be improved (see Part 2 for resource links).
- Reviewing data from SSI surveillance and/or monitoring of SSI preventive measures if already available.
- Conducting SSI surveillance and/or gathering data about current SSI prevention practices/indicators (for example, SAP, skin preparation, etc.) using the WHO SSI surveillance peri- and postoperative data collection forms (15, 16) or protocols from other organizations, for example, the European Centre for Disease Prevention and Control (17) (also see Part 2 for resource links).
- A timeline for baseline assessment and reporting of results should be agreed upon.
- This step will clearly highlight strengths and weaknesses, risks and needs, and may even highlight resource gaps that have not been addressed previously. Highlighting existing strengths and achievements is important to convince decision-makers, surgical teams and other stakeholders that further success and progress is possible.
- This step will also help with engagement communications and advocacy.
- Note: 'Assessment fatigue' is a real risk and ways to embed this work in existing activities/facility goals is important.



Step 3.

Acting on the results of the baseline assessment.

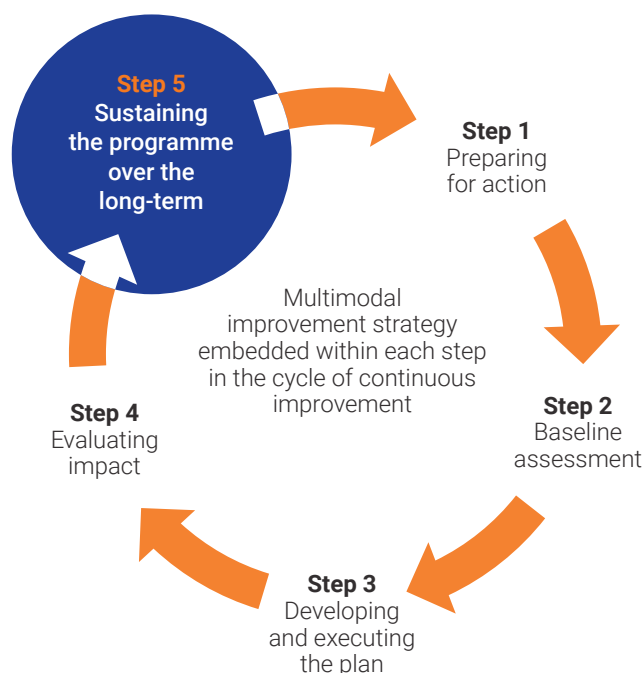
- Develop a plan of action about SSI prevention intervention priorities in your facility and implement it. Further discussion and consensus may be necessary with key leaders and other stakeholders.
- The WHO document 'Preventing surgical site infections: implementation approaches for evidence-based recommendations' (11) and the content of Part 2 will help in the development of your action plan and implementation strategy.
- A realistic, priority-driven action plan based on the local context is key. It is important to focus initially on achieving short-term wins. Some testing of the intervention plans may be useful at this stage. An example of an intervention approach is shown in the Appendix 1.
- It is important to include responsibilities, timelines, budgets and expertise/other resources needed in the action plan, as well as review/reporting dates. Resources needed may be human and/or, for example, a database for data collection, designer services for the creation of new awareness-raising posters (related to the SSI interventions), purchase or production of chlorhexidine-based alcohol products for skin preparation, routine replacement of all necessary surgical devices including those that might be damaged from poor decontamination/chlorine exposure (see Part 2 for more information).
- Always seek approval for your action plan from key leaders and/or senior facility management to ensure buy-in and allocation of budgetary resources.



Step 4.

Collecting evidence to determine what has worked for improvement and the remaining gaps, with the aim to measure the impact and engage critical decision making for the review of action plans within the timeline already defined.

- Your action plan can then be updated including, for example, updated priority activities and revised roles and responsibilities. If possible, an evaluation of cost-effectiveness should be included.
- Follow-up assessment using the same tool used for baseline assessment will allow a comparison with the situation before the intervention/ programme implementation. This review should involve all key leaders, stakeholders, etc. identified in previous steps. A regular schedule of evaluation should be put in place using auditing methodologies for example.



Step 5.

Taking local decisions on how the SSI prevention activities and improvements can be sustained, as well as seriously and realistically addressing gaps hindering SSI prevention.

- Very importantly, it is about conceiving and putting in place feasible strategies for the gradual integration of SSI prevention interventions into routine clinical practice.
- This may require resources.
- This step would also include consideration of new actions required to counteract intervention 'fatigue', for example, launching a campaign on a certain aspect of SSI practices.
- Be sure to build on the momentum of your work until now, celebrate success and maintain engagement!
- It is important to build on experiences or lessons learnt, current understanding of the local situation and organization of the overall IPC programme of work in order to ensure that IPC and SSI prevention is considered a critical part of the regular business of your health facility.
- All key stakeholders will be critical in these discussions.
- Challenges associated with this step include that senior managers may disengage and/or key leaders leave the facility or move on to new projects.
- Remember to revisit all these steps systematically to keep focused on the ongoing improvement plans.

KEY POINTS OF BUILDING A TEAM AND COLLABORATIONS TO UNDERTAKE SSI PREVENTION ACTIVITIES - A REAL LIFE EXAMPLE



- Local multidisciplinary teams (see above) identify the key SSI prevention measures to be prioritized and prepare all the necessary conditions to start monitoring activities and the intervention(s) (step 1).
 - In particular, members of the surgical team supported by the IPC team should co-develop or adapt improvement tools and protocols according to the local situation.
- Use of the 'SUSP Perioperative Staff Safety Assessment Tool' will support team building and ownership as it is designed to help surgical teams to assess the gaps that most frequently cause SSI in the local context (step 2).
- Adopting an adaptive¹ approach specifically aimed at creating or improving the local safety climate motivates local teams to comply with SSI prevention measures (step 3). This includes actions to explore and discuss local beliefs about patient safety, engage local leadership, identify and support local champions, improve communications and promote accountability of frontline staff and teams. The approach should be supported by a range of tools including the use of educational videos, posters and discussion-oriented exercises, including tools to facilitate the engagement of health executives and teams and to identify defects and barriers to improvement, as well as mitigation measures. This approach also aims to support infrastructure development to improve teamwork and help teams to learn from mistakes and assemble a multidisciplinary team to include at least IPC, anaesthesiology, surgery units and senior level executives.
- Collaborative actions to improve perioperative teamwork, communication and the safety culture overall are important.
- Regular team meetings to monitor performance should primarily be led by the local core intervention team, including at least one senior local surgeon (Step 4).
- External experts may need to provide some training and mentorship on implementation approaches, project management and data collection, even at a distance through webinars and monthly telephone calls. Intra- or inter-country meetings can also be held to share experiences and further build positive team cultures.
- Key to success is the gradual integration of SSI prevention measures into routine clinical practice (step 5), as well as the local production (see some examples in Part 2) or procurement of specific products to become part of the regular facility budget.
- Staff in the facility need to be highly motivated to improve their practices and local project leaders need to be influential members of their respective departments.

¹ Adaptive approaches consider the behavioural, organizational and cultural complexity in health care systems. They aim to improve the local safety climate and motivate local teams to consistently perform best practices by shaping attitudes, beliefs and values of clinicians. This could include engaging leadership, improving collaborations and team work, and facilitating staff ownership of the intervention. More information at: <https://www.ahrq.gov/professionals/education/curriculum-tools/cusptoolkit/index.html>, accessed 13 April 2018.

The following scenarios follow on from information on the five-step cycle as it relates to SSI prevention and are intended as some examples to stimulate preparatory thinking and discussions between all relevant people. There are no right or wrong answers and the aim is rather to allow you to consider similar situations within your local context.

Implementation scenario 1 - Challenges with baseline assessment

During a WHO survey, it was established in one country that virtually no IPC monitoring and HAI surveillance existed. However, random SSI surveillance and prevention projects have started in a few facilities based on donor funding and outside experts coming into the country for defined visits. A country lead who works in the Ministry of Health decided to find out if any data collection systems were set up that could be leveraged for the purpose of engaging a range of facilities in coordinated SSI monitoring. One hospital said that they were considering using the WHO Surgical Safety Checklist, by adding some indicators reflecting SSI prevention measures (e.g. appropriate execution of surgical skin preparation). This was meant to achieve some data collection and to avoid a new form given issues with resources. Non-standardized patient flow throughout the hospital was also cited as a factor limiting standardized SSI surveillance, that is, a barrier that needed to be addressed in preparation for full SSI data collection as identified by the WHO SSI guidelines. Therefore, the hospital team agreed that use of the Surgical Safety Checklist would at least provide a baseline assessment about compliance with some SSI prevention measures and allow to build future surveillance plans.

Take a moment to reflect whether you would recommend/take this approach to get SSI surveillance started. What do you consider would be the benefits and limitations? Who would you involve to decide on the key SSI indicators to be embedded in the checklist (internal and external experts)? You can also discuss this scenario and questions with your colleagues. It will stimulate reflections also related to the reality of your local context.

Implementation scenario 2 - The role of key influencers

Alicia is an experienced surgical nurse. She has been asked to be the link champion for infection prevention as the hospital quality department wants to start new projects, which might include activities to reduce infection rates. The surgeon she works closely with thinks this is a great idea and asks her to read up on the latest research on SSI prevention. Alicia is excited and views her role as being able to influence the surgical team, as well as others working in infection prevention and quality improvement in the hospital. She knows most people in the hospital from attending a series of meetings and asking questions and getting to know people. She is allocated one hour per week and considers where she might find the most current information. She wants to prepare her first presentation on what she thinks should be done in the hospital. Alicia asks the surgeon if she can have access to his scientific journals and knows how to enter keywords in a search engine. She remembers that she has heard about a national society that supports infection prevention, so she plans to find out who she can speak to. She also decides to be active on social media and to ask some questions on these fora. She is unclear if there is a problem with SSI in the hospital, but she knows that she can ask her senior colleagues; maybe a short survey would be useful? She also searches the WHO webpages and finds key documents related to the burden of infection and evidence-based recommendations for prevention. However, Alicia is a little worried about being able to do all this in one hour a week while she still has all her full-time nursing duties to perform. As this task will only be for 3 months, she decides that maybe after that there will be an opportunity to officially do more.

Take a moment to reflect about what you would do differently in the hospital or if you were Alicia. What other factors do you think are critical at this stage of a new venture in the hospital to properly address any SSI issues? You can also discuss this scenario and questions with your colleagues. It will stimulate reflections also related to the reality of your local context.

BARRIERS - WHAT MIGHT CONTRIBUTE TO FAILURE?



There are often many barriers that hamper the implementation of improvement plans and activities, including for SSI prevention. The following list has been assembled from a range of real-life examples presented in the document 'Preventing surgical site infections: implementation approaches for evidence-based recommendations' (11). It is important to note that this list encompasses a range of barriers that are common when implementing multimodal improvement strategies. Conversely, barriers and challenges that are specific to the implementation of each SSI prevention recommendation are described in Part 2, as well as the multimodal approach to take to address these issues.

- Lack of direct leadership involvement (for example, senior managers, heads of clinical services) to facilitate and profile local culture change and to directly support implementation.
- Not involving multiple levels of staff (for example, administration, clinicians, housekeeping) or disciplines (for example, doctors, nurses, specialist consultants).
- Application of one improvement element only, that is, unimodal approaches (for example, training only), instead of a multimodal, integrated approach.
- Lack of dedicated time for implementation of the improvement activities.
- Lack of dedicated time for training and education. In particular, in LMICs, a considerable time investment in training and education delivered in various ways contributed to SSI reduction.
- Associated costs or perceived additional costs.
- Poor access to supplies in support of identified and agreed action.
- Poor communication.
- Lack of awareness of the need to address the problem.
- Previous beliefs of health workers, senior managers and patients, including culture/traditions that may directly contradict the (new) approach to patient care.
- Lack of data to support and track improvement efforts.
- Non-attendance or non-compliance with educational activities.
- Lack of preparedness, planning and evaluation.
- Absence of local standard operating protocols (SOPs) or an implementation manual for SSI prevention.

NATIONAL-LEVEL CONSIDERATIONS – FACTORS THAT MIGHT INFLUENCE FACILITY SUCCESS

There are some key dependencies that present at the national level, which may influence the chances of success or failure at facility level. Applying the WHO ‘Interim practical manual supporting national implementation of the WHO Guidelines on core components of infection prevention and control programmes’ (18) will also allow for the five-step cycle to be adopted at that level in support of SSI improvement, together with facility commitment.

Here are some national-level considerations that might influence facility-level success and could be included in the preparedness step thinking as facilities may not be able to address these. However, such dependencies should not inhibit facility commitment.

- The national IPC programme has proposed a focus on SSI prevention, but has the country already recognized the burden of SSI and SSI prevention as a need and priority? Are there other plans/priorities that could embed aspects related to SSI (for example, AMR, sepsis)?
- Legislation or regulations help enforce the implementation of SSI interventions. Does this already exist, for example, mandatory surveillance?
- National IPC guidelines feature a strong section on SSI prevention (or a stand-alone SSI national guideline). Is it recognized that such a resource is meant to be adopted in all facilities and thus prevent the need for guidelines to be developed at each individual facility?
- Support for SSI prevention through the national coordination of implementation and monitoring. Are there any key players already active, such as national bodies? If not, is there a plan to sensitize and educate them in support of facility-level improvement plans?
- Built and enabling environment. Has it been considered how to ensure adequate built environments, including equipment procurement in all facilities to support SSI prevention plans? Is workload, staffing and bed occupancy addressed to support overall IPC?
- Resources for targeted SSI prevention. Have the costs associated with resources for prevention been accounted for and allocated at national level? Have leaders considered the ‘gold standard’ approach to SSI prevention (for example, a focus on achieving all evidence-based recommendations exactly as they are outlined versus minimum requirements to suit the local setting/need for urgent improvements due to known reliable SSI data)? Is the procurement of supplies for surgical care and SSI prevention already a national activity that influences local resources?

Implementation scenario 3 - Improving SSI surveillance at the national level

A Ministry of Health has begun crafting a national surgical, obstetric and anaesthesia plan to strengthen the delivery of surgical services within the country. Surgical, anaesthesia, obstetric and nursing associations within the country have been engaged, as well as leaders from several of the large university teaching hospitals. They have identified multiple areas that will strengthen the capacity of the health system when improved: governance; infrastructure and supplies; human resources; service delivery; information management; financing; research and innovation; and monitoring and evaluation. Within the monitoring and evaluation framework for this plan, the ministry identified surgical and anaesthesia outcomes as a major challenge; these outcomes include both mortality and morbidities, such as surgical infections. The ministry routinely requests information from hospitals on postoperative mortality and surgical infections, but no definition is applied universally across all centres, data lack a quality assurance mechanism, and incentives for accurate reporting and timely feedback are lacking. For surgical infections, the official definition of the US Centers for Disease Control and Prevention is seen as cumbersome and ministry and hospital staff are not sure following such an approach will produce meaningful data. Thus, the ministry has embarked on a search for easily implementable mechanisms to capture surgical outcomes in an accurate, timely and patient-centred way.

Take a moment to reflect about what the challenges are of using a new mechanism to report outcomes. What types of surveillance strategies currently exist and can they be applied to the local context? How can data collection be incentivized and supported?

You can also discuss this scenario and questions with your colleagues with the aim to identify the approach that you would suggest to the ministry as the most useful for the reality of your local context.

2

PART 2.

2.1 PROPOSING PRACTICAL IMPLEMENTATION APPROACHES FOR EACH RECOMMENDATION

This section focuses on **practical implementation approaches** to turn the WHO recommendations for SSI prevention into actionable interventions and improved practices.

Two key pillars lay the foundations for the implementation approaches presented in this manual and they should always be kept in mind by the user.

1.

The WHO five-step approach to IPC improvement (presented in Part 1).

2.

The WHO multimodal improvement strategy (introduced in Part 1, featured in Figure 4 and presented throughout Part 2 in relation to SSI prevention).

These are also presented in detail in Section III of the WHO document ‘Preventing surgical site infections: implementation approaches for evidence-based recommendations’ (11), which should be read in conjunction with this manual. All practical suggestions given should be considered within the local context. Some are extracted from evidence-based examples of improvement and failure in a range of hospital settings.

The objective is to support targeted SSI prevention improvement steps for each WHO guideline recommendation by providing a scenario to give an example of the approach that might be taken to achieve improvement at the local level. Irrespective of the type and level of progress at the health care facility, the outcome over time of the successful application of this model in the context of the five-step cycle previously described and using additional supporting implementation resources and tools, should be a reduction in SSI supported by practices improvement.

BACKGROUND TO THE WHO MULTIMODAL IMPROVEMENT STRATEGY AND HOW IT SUPPORTS IMPLEMENTATION

Figure 4.
The five elements of the WHO multimodal improvement strategy 'built it', 'teach it', 'check it', 'sell it', 'live it'.

- 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.

- 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 surgical safety checklist (adapted to local conditions).



- 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.

- 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.

- 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.

The implementation approach proposed here is based on the WHO multimodal hand hygiene improvement strategy. This strategy initially proved to be effective in significantly reducing HAI hospital-wide and to be cost effective at Geneva University Hospitals (Geneva, Switzerland) (19-21). Its effectiveness was then proven in many other settings worldwide (22, 23). 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. The strategy can be supported by tools, such as bundles and checklists, developed by multidisciplinary teams that take into account local conditions.

Based on field experience, expert consensus and research (10), WHO adapted the hand hygiene multimodal strategy to any IPC intervention and now proposes it for SSI prevention. The visual representations of the core components (Fig. 2) and the multimodal strategy (Fig. 4), as well as the following explanation illustrates how multimodal strategies are relevant to improvement.

MULTIMODAL THINKING

Scientific evidence and global experience show that effective and sustainable impact in improving patient outcomes and health care practices is achieved by **integrating** the implementation of different elements of the WHO **multimodal strategy** in a **complementary and concurrent** manner.

Indeed, each element of the multimodal improvement strategy is crucial and in general, no component can be considered optional.

However, the implementation strategy itself is designed to be **adaptable** without jeopardizing its fidelity and intended outcome.

Therefore, depending on the local situation and available resources, some elements may be given more emphasis than others or may be **practically implemented** in different ways. For instance, a facility may have already done a lot on training staff but not enough on improving the safety climate or monitoring impact on health care practices that are the object of training. The situation can be assessed by **reviewing progress**, for example for SSI, by appropriately using the WHO surveillance data collection forms, which also include priority SSI prevention indicators (15, 16). **Regular assessment** allows health facilities to direct efforts to all, some or one of the interventions at any given time.

Those persons leading on SSI prevention activities should therefore aim to become **“multimodal thinkers”** and should consider the implementation of each SSI intervention (including the potential challenges and opportunities) through a **multimodal lens**. When considering any aspect of IPC, for example, developing an action plan to improve SSI prevention or addressing an identified gap, multimodal thinking means that teams and their leaders should understand the following concepts, as well as **systematically** consider key questions that will prompt local action.

As you work through this part of the manual, more details will be provided, including in relation to all five elements of the multimodal strategy.

The following five prompts are highlighted again to stimulate multimodal thinking.

BOX 3

FIVE KEY PROMPTS FOR MULTIMODAL THINKING

1. What resources, infrastructures or supplies are required to facilitate practices?

This includes consideration of procurement and accessibility of supplies, water availability and quality and ergonomic factors including workflow. For example, the placement of a central venous catheter set and tray (**system change/“build it”**).

2. Who needs to be trained and/or educated to address the identified gap – how will this happen and who will undertake the training/education?

This involves written information and/or oral instruction and/or e-learning and practical and interactive training sessions, including simulation and/or bedside training. For example, the training of doctors and nurses in charge of the placement and maintenance of central venous catheters on the prevention of bloodstream infection (BSI), including summarizing critical best practices in bundles (**education and training/“teach it”**).

3. How have you become aware that practices need to be improved – how will you know that an improvement has taken place?

This usually involves monitoring compliance with process and practice indicators, as well as monitoring outcome indicators. For example, audits of catheter insertion and maintenance and the provision of timely and direct feedback of results to doctors and nurses (**monitoring and feedback/“check it”**).

4. How will you publicize action on specific measures and promote improvement and best practice in this area?

This may involve the use of reminders, posters or other advocacy/awareness-raising tools and cues-to-action to promote an intervention and methods/initiatives to improve team communication across units and disciplines. For example, discussion of the strategy for the prevention of BSI during clinical meetings and the use of promotional leaflets and posters to reinforce bundles of best practices (**communications and reminders/“sell it”**).

5. How will you make and maintain this as a health care facility priority and engage senior leaders/managers/champions and opinion leaders over time?

This is concerned with ensuring that senior managers/leaders show tangible support and act as champions and role models, including making relevant decisions and promoting an adaptive approach and strengthening a culture that supports IPC, patient safety and quality. In addition, teams and individuals are empowered so that they perceive ownership of the intervention. For example, discussion of BSI rates at the executive level facility meetings (**safety climate and culture of safety/“live it”**).



System change ('build it') refers to ensuring that the health care facility has the necessary infrastructure (including for example procurement procedures and protocols) and resources (including human resources) in place to allow for implementation steps to be taken for SSI prevention. The right infrastructure and available resources can streamline interventions for consistent delivery of care in the pre-, peri- and postoperative periods and make execution easier and safer. This is often considered to be essential when introducing or making changes in the health care setting. As the health care environment is a dynamic complex place, it must be taken into account at all times during improvement activities and not only at the beginning.



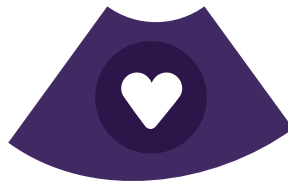
Health worker training ('teach it') is an essential element for effective implementation of evidence-based SSI prevention recommendations. Insufficient knowledge, particularly of SSI recommendations, their evidence base and the reasons why they are important, is a key barrier to change. Alignment to other organizational activities, such as the content of SSI prevention guidelines or protocols and monitoring of SSI prevention interventions, is also critical in making it as easy as possible for all health care staff to do the right thing in practice. The engagement of all staff in achieving alignment is a key element. Effective, practical training and education methods are one important part of achieving improvement. It is important to use a range of training modes deemed appropriate for the local situation, such as short sessions at grand rounds, bedside training, formal, planned training sessions, problem-based learning; hands-on workshops; focus groups; peer-to-peer training; classroom-based simulation. Technical discussions and learning can also be embedded in existing regular meetings of the clinical staff.



Regular monitoring and feedback ('check it') of the following indicators reflecting recommended SSI prevention practices and procedures are vital if improvement is to be achieved: infrastructures and available resources and supplies; health worker knowledge and their perception of the burden of SSI and the importance/benefit of certain recommendations; and SSI outcome data. Producing data reports can be of little use if they are not clearly outlined and interpreted and fed back in a timely manner to the concerned audience. Of note, evaluation and feedback should not be seen as a component separated from implementation or only to be used for scientific purposes. It should be seen rather as an essential step in identifying areas deserving major efforts, as well as positive results that can reward and encourage teams to further improve, and to feed crucial information into the local action plan and refine it. It is also critical to ascertain whether the interventions have been effective and to convince providers that changes do not cause harm.



Reminders and communications for awareness-raising in the workplace ('sell it') are key to prompting and reminding health care workers about the importance and relevance of practices to prevent SSI and are particularly important at the point of care, whether in the pre-, peri- or postoperative areas. They can also be a means of informing patients and visitors of the standard of care that they should expect to receive from their health workers, as well as informing senior leaders and decision-makers on the standards that they should assure. There are many types of reminders and means of communication and they should be selected according to the local habits, culture and available resources. Some examples are posters, leaflets, videos, eye cues, stickers, social media and telephone messages, screensavers, memos, newsletters, etc. In the context of multimodal strategies and for a greater impact on the targeted audience, these resources should be developed in collaboration with staff - ideally, communications and design professionals.



Institutional safety climate and culture change ('live it') refers to creating an environment and the perceptions that facilitate commitment to SSI prevention at all levels in the facility. At the institutional level, this component represents the foundation for implementing and sustaining improvement, which must be embedded in a climate that understands and prioritizes surgical safety issues, including through team spirit and cohesion. At the individual level, this component is important with respect to accountability/ownership, advocacy, championing and the self-capacity to make change happen by all health workers and, at times, patients/visitors. Through the creation of an institutional safety climate and the 'right' culture for the local context, both the institution and each health worker become aware of their capacity to make a change and catalyse improvement across all SSI prevention recommendations.

In summary, system change is needed to enable evidence-based SSI practices, including infrastructure, equipment, supplies and other resources; the right training and education is needed to consistently improve health worker (and others) knowledge and create local expertise; monitoring and feedback of various indicators is needed to assess the problem, drive appropriate change and document practice improvement; reminders and communications are needed to promote the desired actions at the right time; and finally, a culture of safety is essential to facilitate an organizational climate that values the intervention, with a particular focus on the involvement of senior managers/leaders and champions/role models.

The following sections present:

- a list of generic WHO SSI prevention resources with web links, including resources from other organizations;
- a summary of each guideline recommendation;
- a summary of a scenario and problem that has arisen in relation to the recommendation and a short case study outlining a range of actions that might (or might not) lead to implementation or improvement;
- most frequent challenges that can be encountered when implementing each recommendation;
- the *what, why, when and who* of each recommendation, that is, an at-a-glance outline of its focus and practical implications, why it is important, who should be involved and when action should occur;
- a table of key considerations for action in the context of the WHO multimodal improvement strategy and multimodal thinking to achieve the desired change (the *how* of improving adherence with the intervention and thus SSI prevention);
- specific WHO supporting tools already available.

WHO SSI prevention resources and web links

Global guidelines for the prevention of surgical site infection. 2016

<http://apps.who.int/iris/bitstream/handle/10665/250680/9789241549882-eng.pdf?sequence=1>

Preventing surgical site infections: implementation approaches for evidence-based recommendations. 2018.

<http://apps.who.int/iris/bitstream/handle/10665/273154/9789241514385-eng.pdf?ua=1>

Protocol for surgical site infection surveillance with a focus on settings with limited resources. 2018.

<http://www.who.int/infection-prevention/tools/surgical/SSI-surveillance-protocol.pdf?ua=1>

Surgical site infection surveillance perioperative data collection form

<http://www.who.int/infection-prevention/tools/surgical/SSS-pre-op-form.pdf?ua=1>

Surgical site infection surveillance postoperative data collection form. 2018.

<http://www.who.int/infection-prevention/tools/surgical/SSI-post-op-form.pdf?ua=1>

Do the right thing at the right time to prevent surgical site infection. 2018.

<http://www.who.int/infection-prevention/tools/surgical/key-recommendations.jpg?ua=1>

Stop infections after surgery – what is the problem, what is the solution? 2018.

<http://www.who.int/gpsc/ssi-infographic.pdf?ua=1>

IPC training – prevention of surgical site infection. 2018.

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

See your hands poster. 2016. http://www.who.int/gpsc/5may/A4_hh-poster-visual-EN.pdf?ua=1

Decontamination and reprocessing of medical devices in health care facilities. 2016.

<http://apps.who.int/iris/bitstream/handle/10665/250232/9789241549851-eng.pdf?sequence=1>

WHO Surgical Safety Checklist. 2009. <https://www.who.int/patientsafety/topics/safe-surgery/checklist/en/>

Other key IPC and improvement resources and web links

Improving infection prevention and control at the facility. Interim practical manual supporting implementation of the WHO Guidelines on the core components of infection prevention and control programmes. 2018.

<http://www.who.int/infection-prevention/tools/core-components/facility-manual.pdf?ua=1>

Perioperative Staff Safety Assessment

<https://www.ahrq.gov/professionals/quality-patient-safety/hais/tools/surgery/guide-appcusp.html>

Learn From Defects Tool – Perioperative Setting

<https://www.ahrq.gov/professionals/quality-patient-safety/hais/tools/surgery/guide-appcusp.html>

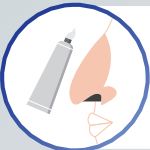
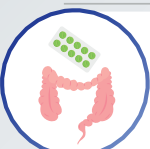
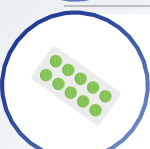
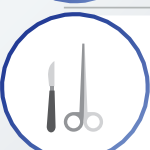
Survey on Patient Safety

<https://www.ahrq.gov/sops/quality-patient-safety/patientsafetyculture/hospital/index.html>

The CUSP Method

<https://www.ahrq.gov/professionals/education/curriculum-tools/cusptoolkit/index.html>

2.2 PREOPERATIVE MEASURES

	ACTION	SUPPORTED BY
 Patient bathes or showers prior to surgery with either plain or antimicrobial soap	 PATIENT	 SURGICAL TEAM AT PREOPERATIVE CONSULTATION
 Use 2% mupirocin decolonization in known nasal carriers of <i>Staphylococcus aureus</i> in cardiac and orthopaedic surgery <i>(consider for other surgeries)</i>	 WARD NURSE	 DOCTOR PHARMACY
 Do NOT remove patient hair, or if absolutely necessary, remove with a clipper, do not shave	 SURGICAL TEAM	 PATIENT INFORMATION AND EDUCATION
 Administer surgical antibiotic prophylaxis in the 120 minutes preceding surgical incision <i>(depending on the type of operation and the half life of the antibiotic)</i>	 ANAESTHETIST (OR OTHER IN SURGICAL TEAM)	 IPC TEAM/PHARMACY
 Prepare hands for surgery by scrubbing, using the correct technique with a suitable antimicrobial soap and water OR an alcohol-based handrub <i>(before donning sterile gloves)</i>	 SURGEON	 PHARMACY/ PROCUREMENT
 Carry out mechanical bowel preparation always combined with administering preoperative oral antibiotics in adult patients undergoing elective colorectal surgery	 SURGICAL TEAM	 PHARMACY/ PROCUREMENT
 Consider administering oral or enteral multiple nutrient-enhanced formulas in underweight patients <i>(undergoing major surgical operations)</i>	 SURGICAL TEAM	 PHARMACY/PROCUREMENT AND CLINICAL STAFF
 Do NOT discontinue immunosuppressive medication	 SURGICAL AND WARD TEAM	 PHARMACY AND CLINICAL STAFF
 Clean and sterilize/decontaminate surgical instruments and other equipment	 SURGICAL TEAM	 PROCUREMENT/ STERILIZATION UNIT
 Clean and prepare operating room environment	 CLEANING STAFF	 SURGICAL TEAM

2.2.1. PREOPERATIVE BATHING



WHO recommendation (conditional):
It is good clinical practice for patients to bathe or shower prior to surgery. Either a plain or antimicrobial soap may be used for this purpose.

Scenario

Surgical staff would like to establish a standard preoperative bathing regimen for all patients undergoing surgery.

Problem

No standard protocol, procedures or guidance for preoperative bathing exist.

Case study

The surgical team receives a call from a nurse on a surgical ward saying that a patient had been admitted and was asking questions about preoperative bathing. The nurse said that she was not clear how to answer these questions. The surgeon told the nurse that all patients should bathe prior to surgery and he had assumed that this was a standard procedure with clear instructions available. When informed that this was not the case, the surgeon meets with colleagues to discuss a protocol for preoperative bathing for both inpatients and outpatients. They also meet with the IPC team to understand the challenges for implementation of the improvement and ask questions. The IPC team informs them that plain soap would be sufficient for preoperative bathing, but the surgical team:

- notes that soap is not routinely available and represents an additional cost for the facility or the patient (scenario more likely in a LMIC);
- is not convinced that plain soap will be effective (scenario more likely in a high-income country [HIC]);
- observes also that patients are not counselled on perioperative bathing when presenting for surgery as an outpatient.

The IPC team provides evidence from the WHO guidelines recommending preoperative bathing and emphasizes that in settings where personal and environmental hygiene is usually poor, this might be particularly important. The team also shows that there is no difference between plain and antimicrobial soap and suggests that outpatients should be counselled to bathe and all inpatients should be routinely bathed the night before surgery.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- Good clinical practice recommends that patients should bathe or shower with either plain or medicated soap prior to surgery.
- Effective local strategies and standard operating procedures (SOP) should be implemented and monitored, including a focus on patient engagement/training.
- Provision of soap by health care facilities, preferably supported by procurement plans, may be required or desirable. The aspect of water availability (and quality) may also be a consideration in some countries.

WHY

- A preoperative shower or bath ensures that the skin is as clean as possible and reduces the skin bacterial load, especially bacterial colony counts at the site of surgical incision.
- Scientific evidence shows that preoperative bathing with antimicrobial soap containing chlorhexidine gluconate (CHG) has no additional benefit in reducing the SSI rate compared to plain soap (24).

WHEN

- It is useful to perform patient bathing or showering on the day of the operation or the day or night before so that patients are prepared before entering the intraoperative area/period.

WHO SHOULD BE INVOLVED

- Directly: surgical teams including outpatient clinic staff involved in preoperative patient information and preparation, and surgical and nursing ward staff.
- Patients, patient representatives/care givers, primary care health workers.
- To support: procurement services, senior management and IPC and patient safety teams.



Most frequent challenges encountered in implementing this recommendation

- No instructions available to patients and families.
- Lack of consideration of the importance of bathing by surgical teams.
- Incorrect timing for bathing (for example, done too early before admission).
- Lack of soap and/or out-of-pocket cost for patients.
- Low quality and/or lack of water.
- Waste of resources if CHG impregnated cloths and antimicrobial soap are used, especially in settings with limited resources.

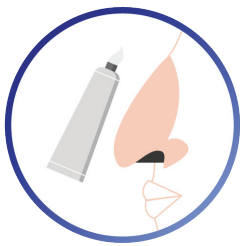
The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	- Put in place/improve a sustainable system to reliably procure and deliver soap for the preoperative bathing of patients, including a dedicated budget. - In settings where water access/quality and baths/showers are not readily available, develop a plan for improving water access and quality and increasing the number of showers and basins.
TRAINING AND EDUCATION ('teach it') 	- Put in place a reliable mechanism for producing/using updated education resources and information for staff and patients to support preoperative bathing. - Train key staff on the need for preoperative patient bathing and how to advise patients on this measure. - Provide patients and families with leaflets/ educational materials in a timely manner to educate on preoperative bathing.
MONITORING AND FEEDBACK ('check it') 	- Put in place/improve a monitoring, reporting and feedback mechanism (including roles and responsibilities) regarding: - reliable availability of soap for preoperative patient bathing and appropriate placement in a location suitable for the timing of bathing (this might be in clinical areas supporting the preoperative patient assessment in the hospital or primary care setting); - staff knowledge and perception on preoperative bathing to help assess training needs and identify lack of awareness and/or implementation barriers; - adherence to preoperative patient bathing SOPs; - patient feedback on the approach/tools used to educate them on preoperative bathing; - SSI rates. - Integrate patient bathing into the preoperative checklist or patient preparation form.
COMMUNICATIONS AND REMINDERS ('sell it') 	- In collaboration with staff, develop/adapt: - prompts to be used to champion the need for preoperative patient bathing (including in conjunction with patient representatives/clinics/primary care health workers) and to be placed/replenished in suitable areas; - other communications to highlight a plan of changes that will happen (standardized approach to preoperative bathing) where this is necessary and the reasons why adherence to preoperative bathing will be monitored and fed back to all staff; - videos on bathing as part of patient preoperative preparation to be used in outpatient areas. - Integrate preoperative bathing into the preoperative checklist.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Engage surgeons, nurses (including from the wards and outpatient clinics/primary care), patients and their families to ensure maximum awareness and compliance. - Organize meetings and focus group discussions with all the right people to discuss the problem (for example, lack of knowledge and awareness). - Promote the importance of a facility culture that supports staff to be given the time to be updated/trained on preoperative bathing. - Gather support from community leaders known to be influential and who could issue messages on preoperative bathing, for example, in the form of a billboard or radio message, as well as social media messages (particularly in settings where resources are limited). - Obtain senior management budget allocation, as necessary.

Specific WHO supporting tools already available at:
<http://www.who.int/infection-prevention/tools/surgical/en/>

- Key facts on patient bathing

2.2.2 DECOLONIZATION WITH MUPIROCIN OINTMENT WITH OR WITHOUT CHLORHEXIDINE GLUCONATE BODY WASH FOR THE PREVENTION OF *STAPHYLOCOCCUS AUREUS* INFECTION IN NASAL CARRIERS UNDERGOING SURGERY



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

WHO recommendation (conditional): Consider to treat also 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.

Scenario

A health facility has just established a routine screening protocol for *S. aureus*.

Problem

Surgical staff are not aware of the actions to be taken if a patient tests positive for *S. aureus* preoperatively.



Case study

The IPC team has launched a programme for the nasal decolonization of *S. aureus* using a routine screening protocol for all cardiothoracic and orthopaedic patients. The senior surgeons are told about the protocol, which involves ward nurses taking a swab from all appropriate patients for the organism and subsequently applying mupirocin ointment and organizing a CHG bath prior to surgery. The surgeons express concern about the practicalities of executing the protocol. In particular, there has not been any education dispensed to nursing staff, materials have not been made available in all the appropriate surgical areas to achieve decolonization (including procurement of mupirocin ointment), and the timing of nasal decontamination does not work for the inpatient setting. The IPC nurse outlines a plan for training to ensure that everyone knows about their roles in executing the protocol and the IPC team leave with a list of actions regarding supplies still to be secured, including further discussions with procurement personnel on swabbing and decontamination needs. All team members agree that the programme is best introduced in the outpatient clinics before attempting to accomplish this in the hospital. The orthopaedic and cardiac surgeons are interested in help from IPC teams to implement this process and protocol.

Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendations?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- A protocol and systematic approach for identification of the nasal carriage of *S. aureus* among patients undergoing cardiothoracic and orthopaedic surgery and eventual treatment with perioperative intranasal mupirocin 2% ointment with or without a combination of CHG body wash should be developed, implemented and monitored at the facility level.
- A decision-making process should be undertaken in the facility to consider also applying this recommendation to patients with known nasal carriage of *S. aureus* undergoing other types of surgery. This is not applicable for paediatric patients due to a lack of evidence in this population.
- Potential allergic reactions to mupirocin and CHG should be investigated and recorded.
- The implementation of this recommendation has financial implications, but it has been shown to be cost-effective. However, it requires good quality microbiological laboratory support.

WHY

- *S. aureus* infections impose a high burden on the patient and the health system and are a known cause of postoperative wound infections, which can be very serious.
- 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 HAI due to *S. aureus* originates from the patients' own flora.
- Treatment with mupirocin 2% ointment with or without a combination of CHG body wash in surgical patients with *S. aureus* nasal carriage has significant benefit in reducing the *S. aureus* SSI rate, as well as the overall *S. aureus* HAI rate. The evidence is most solid for the cardiothoracic and orthopaedic patient population (25).
- AMR can represent a possible harm associated with the use of mupirocin, although there is no evidence showing an increase with short-term use in surgical patients. However, treating all patients instead of carriers only increases the likelihood of resistance to mupirocin.

WHEN

- Nasal application of mupirocin 2% ointment: two times daily for five-seven days before the operation plus once in the immediate preoperative period on the day of surgery.
- A CHG 2-4% soap body wash can be used in combination with mupirocin nasal application.

WHO SHOULD BE INVOLVED

- Surgical teams and ward staff, outpatient clinic staff, procurement services, pharmacy senior management, IPC teams, microbiology laboratory staff, as well as patients and family members.



Most frequent challenges encountered in implementing these recommendations

- Lack of quality laboratory support to undertake screening and identify carriers.
- Lack of resources to prioritize screening and/or provision of 2% mupirocin ointment.
- Difficulties to procure 2% mupirocin ointment.
- Absence of protocols to timely conduct screening and treatment in the preoperative period, including in outpatient facilities.
- Patient fear of stigma to be identified as a carrier.
- Concerns about antimicrobial resistance as an important possible harm associated with the use of mupirocin.
- Concerns about possible harm associated with the use of CHG-containing solutions, (possible skin irritation, delayed reactions such as contact dermatitis and photosensitivity, and hypersensitivity reactions such as anaphylactic shock in very rare cases).

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	- Put in place/improve a sustainable system to reliably procure and make available swabs, reagents for identifying <i>S. aureus</i>, mupirocin 2% ointment and CHG 2% or 4% soap in a location suitable to local clinical workflow, including a dedicated budget. - Develop/adapt a protocol/SOP with instructions for collecting samples to identify <i>S. aureus</i> nasal carriers and for administering the decolonization treatment, including roles and responsibilities. - Plan for reliable and timely clinical laboratory support for <i>S. aureus</i> identification including a dedicated budget.
TRAINING AND EDUCATION ('teach it') 	- Put in place/improve a reliable mechanism for producing/using updated training resources and information for staff and patients to support the identification and decolonization of carriers, including scientific evidence. - Train key staff (as identified) on the methods for swabbing and decolonization and instruct patients to use mupirocin ointment and CHG soap. - Provide patients and families with leaflets/ educational materials explaining the importance of identifying and decolonizing carriers, as well as instructions how to use mupirocin ointment and CHG soap.
MONITORING AND FEEDBACK ('check it') 	- Put in place/improve a monitoring, reporting and feedback mechanism (including roles and responsibilities) regarding: - health care workers' knowledge on the rationale of this intervention and the protocol content; - the reliable availability and consumption of mupirocin ointment and CHG soap; - adherence to the protocol; - the local epidemiology of mupirocin resistance among <i>S. aureus</i>; - SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	- In collaboration with staff, develop/adapt: - prompts to be used to champion the need for appropriate decolonization, (including in conjunction with patient representatives/clinics/primary care health workers) and to be placed/replenished in suitable areas; - other communications to highlight a plan of implementation of the protocol and the reasons why adherence will be monitored and fed back to all staff; - videos on how to use mupirocin ointment as part of patient preoperative preparation to be used in outpatient areas. - Include electronic reminders/alerts about the need for decolonization in <i>S. aureus</i> carriers connected to electronic patient records, if existing.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Engage surgeons, nurses (including from the wards and outpatient clinics/primary care), patients and their families to ensure a maximum adherence to the protocol for decolonization. - Obtain the formal commitment of microbiology laboratory staff to perform <i>S. aureus</i> identification reliably and timely, supported by hospital management.

WHO supporting tools already available at:**<http://www.who.int/infection-prevention/tools/surgical/en/>**

- Key facts on the decolonization of nasal carriers of *S. aureus*
- IPC training – prevention of surgical site infection – slides 54-57

2.2.3 HAIR REMOVAL



WHO recommendation (strong): For patients undergoing any surgical procedure, hair should either not be removed or, if absolutely necessary, it should be removed only with a clipper. Shaving is strongly discouraged at all times, whether preoperatively or in the operating room.

Scenario

A member of the surgical team notes the importance of avoiding hair removal before surgical procedures or using clippers rather than shaving.

Problem

Surgical staff disagree over whether to remove patient hair before surgical procedures or not and how to do it.

Case study

A newly appointed surgeon presents information on reducing surgical infections to the surgical group, including the observation that avoiding hair removal, or its appropriate removal, is an important component of infection prevention. Other staff maintain that hair removal is cleaner as hair may be a potential source of infection. In addition, when antisepsis agents are used for skin preparation, they require extended dry times (up to one hour) when hair is still present. Although the group agrees to try clipping rather than shaving, the surgeon notes after a few weeks that razors are still present and clippers are not always available and rarely used. The surgeon takes steps to remove razors from the surgical wards and the operating room and procures clippers for each operating room. Each surgeon is then coached on how to use the clippers for hair removal.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- Hair removal in patients undergoing any surgical procedure should be avoided or, if absolutely necessary, hair should only be removed with a clipper.
- Shaving is strongly discouraged at all times, both preoperatively and in the operating room. A protocol/SOP regarding the avoidance of hair removal should be developed, implemented and monitored to standardize practices and with the aim to undertake a thorough assessment of hair removal practices if deemed necessary, including the use of clippers.

WHY

- Scientific evidence shows that either no hair removal or clipping is associated with a significantly lower risk of SSI when compared to shaving (26).
- The risk of SSI is higher when hair removal is performed by a razor than by a clipper as shaving causes small abrasions to the skin.
- Evidence shows that the use of a depilatory cream has neither benefit nor harm when compared to shaving for the prevention of SSI. Additional drawbacks are the necessity to leave them in place for approximately 15-20 minutes for the hair to be dissolved and the potential for allergic reactions.

WHEN

- Hair should not be removed. Hair removal, if absolutely necessary, should be done shortly before the operation.

WHO SHOULD BE INVOLVED

- Directly: surgical teams, including outpatient clinic staff involved in preoperative patient information and preparation, surgical ward staff, patients, patient representatives and primary care health workers.
- To support: procurement services, senior management and IPC and quality improvement teams.



Most frequent challenges encountered in implementing this recommendation

- No instructions available to patients and families prior to admission about avoiding hair removal.
- No protocol/SOPs about hair removal available to surgical teams.
- Cultural issues (especially in women) about avoiding hair removal.
- Surgeons' reluctance to avoid hair removal.
- Habits and cultural resistance to dismiss shaving.
- Incorrect timing for hair removal, when deemed necessary (for example, done the day before surgery instead shortly before skin preparation).
- Financial and procurement constraints to make single-use clippers continuously available.
- Lack of/or defective process for the decontamination of clippers if they are reused.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE "HOW OF IMPROVEMENT"	
SYSTEM CHANGE ('built it') 	- Put in place/improve: - a sustainable procurement system to reliably procure single-use clippers, including a dedicated budget; - a system which can ensure the safe and correct disposal of clippers; - a safe and reliable system for the cleaning and decontamination of clipper heads* and handle if single-use clippers are not affordable; - a system for the appropriate location of clippers for essential hair removal; - a system for the identification of razors for regular facial hair removal only in order to ensure that surgical site skin hair is not removed preoperatively (or only if absolutely necessary with clippers). - Review and update as necessary all hospital policies and procedures on appropriate preoperative hair removal.
TRAINING AND EDUCATION ('teach it') 	- Put in place/improve a reliable mechanism for producing/using updated training resources and information for staff and patients about avoiding hair removal or performing it with clippers when necessary, including scientific evidence. - Conduct training for key staff and educational sessions for patients.
MONITORING AND FEEDBACK ('check it') 	- Put in place a monitoring, reporting and feedback system (including roles and responsibilities) regarding: - reliable availability of single-use clippers; - staff knowledge and perception on avoiding hair removal to help assess training needs and identify lack of awareness and/or implementation barriers; - adherence to hair removal SOPs; - patient feedback regarding the approach/tools used to educate them; - SSI rates. - Integrate avoiding hair removal or using clippers into the preoperative checklist or patient preparation form.
COMMUNICATIONS AND REMINDERS ('sell it') 	- Develop/adapt: - awareness-raising messages (for example, posters) and place them appropriately to remind staff not to remove hair at the surgical skin site (unless absolutely necessary and never with a razor); - patient information leaflets, including for specific target audiences (for example, pregnant mothers undergoing a caesarean section).
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Convince management to provide a budget for the purchase of clippers. - Engage surgeons, nurses, patients and their families to ensure maximum awareness and compliance. - Organize meetings and focus group discussions with all the right people to discuss the problem (for example, lack of knowledge and awareness). - Consider one- to-one meetings with senior management to address opinions by surgeons who continue to want to remove hair preoperatively. - Use messages from leading surgeons telling all surgical staff not to remove hair at the surgical skin site (unless absolutely necessary and never with a razor), for example, video messages, on grand rounds, at surgical meetings. - Engage community leaders when messages to the public are needed to prevent hair removal at home or in the hospital.

* Proposed expert consensus-based decontamination process: cleaning and decontamination after use before use on another patient. This is performed by carefully disassembling the blades using protective equipment, cleaning with soap and water, drying and then wiping them with alcohol or another suitable disinfectant according to manufacturer's instructions.

WHO supporting tools already available at:**<http://www.who.int/infection-prevention/tools/surgical/en/>**

- Key facts on hair removal
- IPC training – prevention of surgical site infection – slides 60-61
- Surgical site infection surveillance perioperative data collection form

2.2.4 OPTIMAL TIMING FOR PREOPERATIVE SURGICAL ANTIBIOTIC PROPHYLAXIS



WHO recommendations (strong): Administer surgical antibiotic prophylaxis (SAP) prior to the surgical incision when indicated (depending on the type of operation) within 120 minutes before incision, while considering the half-life of the antibiotic.

Scenario

The surgical team suspects that prophylactic antibiotics are being given too far in advance of surgery as they are typically administered on the wards prior to a patient being brought to the operating room.

Problem

Patients are not receiving appropriately timed SAP and are therefore at risk of SSI.

Case study

The surgical team is interested in improving and tightening the control of SAP so that it is administered within 120 minutes prior to incision. Since they have little control of the timing of SAP outside of the operating room, they decide that the best course would be for antibiotics to be administered in the operating room just before induction of anaesthesia. They observed that the current practice is for antibiotics to be delivered to the ward the morning of surgery by the pharmacists and a surgical house officer or staff nurse administers the antibiotic on their rounds as soon as possible after its delivery, regardless of the timing of surgery. They note that the majority of staff do not know that SAP should be administered within 120 minutes before incision. The surgeons work with the ward nurses, pharmacists and anaesthesiologists to design a new protocol and approach for administering SAP that involves the antibiotic being delivered to the operating room and administered by the anaesthetist prior to induction of anaesthesia.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- SAP should be administered intravenously when indicated (depending on the type of operation) within 120 minutes before the surgical incision.
- For exact timing, the half-life of the antibiotic should be considered. Thus, antibiotics with a short half-life should be administered closer to incision time.
- A standardized protocol for SAP should be developed (ideally adapted from national/international ones), implemented and monitored, including instructions on timing, indications, antibiotic regimens of first and alternative choice, doses, need for re-dosing in specific situations, etc., while taking into consideration antibiotic pharmacokinetics and pharmacodynamics and local AMR patterns, if available.

WHY

- Correct preoperative SAP administration timing, dose and intraoperative re-dosing (when necessary) achieve adequate concentrations of the drug at the site of incision at the beginning of the operation (highest risk of surgical site contamination) and throughout the operation duration.
- Incorrect (before 120 minutes or after incision) timing can lead to an increased risk of SSI (27, 28);
- Use of the correct antibiotic type according to the procedure and patient history aims to eliminate the risk of bacterial contamination most frequently found at the operation site and maintain patient safety.
- Correct use of SAP is important not only to prevent SSI, but also to avoid the emergence of antimicrobial-resistant pathogens that can cause more serious disease to the patient.

WHEN

- Within 120 minutes before surgical incision (and intraoperative re-dosing, when necessary),

WHO SHOULD BE INVOLVED

- Directly: anaesthetists or others tasked to administer SAP in the surgical team.
- To support: procurement services, pharmacy senior management and antimicrobial stewardship and IPC teams, especially experts in antimicrobial therapy and infectious diseases.



Most frequent challenges encountered in implementing this recommendation

- Absence of protocols for appropriate SAP, including correct time of administration.
- Unclear roles and responsibilities about who is in charge of ensuring correct SAP.
- Lack of knowledge of the evidence supporting the need for administering SAP intravenously within 120 minutes before incision.
- Incorrect location of antibiotic stockage, thus preventing prompt availability when SAP needs to be administered.
- Lack of resources to ensure appropriate SAP.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE "HOW OF IMPROVEMENT"	
SYSTEM CHANGE ('built it') 	• Develop a locally- adapted detailed SAP protocol. Up-to-date SAP protocol should be readily available to all concerned staff. • Put in place/improve: – a reliable system for the continuous supply of adequate antibiotics for SAP, including a dedicated budget; – a reliable delivery system of SAP, including electronic orders and/or an appropriate location in the operating room area with provision of new lockers with locks to ensure appropriate timing.
TRAINING AND EDUCATION ('teach it') 	• Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff on the SAP protocol (including timing), including scientific evidence and information on how antibiotics can be promptly accessed in the flow of care (including the hospital system/ policy on the placement of SAP). • Plan formal training sessions as well as one-to-one training/coaching sessions during clinical practice, also involving pharmacy staff when appropriate.
MONITORING AND FEEDBACK ('check it') 	• Put in place/improve a monitoring, reporting and feedback system (including roles and responsibilities) regarding: – staff knowledge and perception on SAP; – continuous procurement of SAP antibiotics; – appropriate administration of SAP (including timing); – antibiotic consumption for SAP; – SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	• Develop and make clear communications to key players about the local SAP protocol in a range of formats, as well as highlighting the changes to happen where necessary. • Make the local SAP protocol easily available in electronic and/or printed copy to all involved staff and display the protocol at the point of use. • Develop pocket booklets or leaflets for staff. • Develop posters, in conjunction with staff, highlighting the location of antibiotics for SAP and the key principles of the SAP protocol. • Put in place electronic reminders/alerts about the need for SAP connected to electronic patient records, if existing.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	• Involve procurement, pharmacy and surgical and antimicrobial stewardship teams for the SAP protocol development. • Convince management to provide budget for purchasing the right antibiotics for SAP. • Engage leaders and champions among surgical and anaesthesiology staff to drive change and ensure maximum compliance with the protocol. • Organize meetings and focus group discussions with all the right people to discuss the new SAP protocol. • Issue leadership messages on a regular basis in a range of formats to remind staff of the SAP location and protocol. • Introduce/support a culture that supports reliable SAP delivery, including visible messages from senior management.

WHO supporting tools already available at:**<http://www.who.int/infection-prevention/tools/surgical/en/>**

- Surgical site infection surveillance perioperative data collection form
- IPC training – prevention of surgical site infection – slides 62-64
- Infographic: Handle antibiotics with care in surgery

2.2.5 SURGICAL HAND PREPARATION



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

See Appendix 2 for more details on WHO recommendations for surgical hand preparation.

Scenario

A surgeon reports that antimicrobial soap and ABHR have sometimes run out in the scrub area.

Problem

Surgeons cannot reliably comply with the recommendation for surgical hand preparation if these materials are missing as hands are not cleaned to the standard expected to help prevent SSI.

Case study

The surgeons request a meeting with procurement and hospital administration to improve the availability of antimicrobial soap and ABHR for surgical hand preparation as it has been running out in the scrub area. During the meeting, the problem is identified to be with the supplier as products are only delivered every two weeks. They agree to source a new supplier and test their reliability and to put in place a new system for checking delivery of supplies to the operating room based on the volumes used. A new process for the timely delivery and feedback from operating room staff regarding the availability of products is also brainstormed and agreed upon. As this discussion was initiated by a procurement issue, the IPC team notes that it would also be useful to assess the appropriate use of these products. The team lead agrees to provide increased monitoring and feedback on surgical hand preparation performance. The procurement lead also agrees to present this issue and the proposed solution at the next senior management meeting chaired by the chief executive officer and invites the surgeons to join the meeting in order to demonstrate clinical commitment to this important safety issue.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- Surgical hand preparation, including the use of the right products and technique, should be performed following the WHO hand hygiene recommendations (Appendix 2).
- Either a suitable antimicrobial soap, water and sterile single-use towels or a suitable ABHR can be used for surgical scrubbing. Products are suitable when they comply with the European Norm EN 12791 or the ASTM E-1115 standard.
- Appropriate product availability, placement and quality of supplies (including water) are critical for optimal compliance and adequate efficacy.
- Adequate supplies should be supported by procurement plans and budget. Market options as well as local production should be evaluated.

WHY

- To maintain the lowest possible contamination of the surgical field (gloves punctures can occur even when sterile gloves are worn). Hand preparation should reduce the release of skin bacteria from the hands to the open wound, particularly in the case of an unnoticed puncture of the surgical glove.
- Surgical hand preparation should eliminate transient flora and reduce resident flora.
- Some evidence shows no difference between the use of ABHR and antimicrobial soap and water for surgical hand preparation in reducing SSI (29).
- Some evidence indicates a primary surgeon preference for ABHRs, due mainly to the reduced time required for surgical hand preparation and fewer skin reactions.

WHEN

- The hands of the surgical team should be clean upon entering the operating room by washing with a non-medicated soap.
- Once in the operating area, handrubbing or scrubbing should be done immediately prior to donning sterile gloves and gowns; repeating this action before switching to the next procedure is required without an additional prior handwash.

WHO SHOULD BE INVOLVED

- Directly: surgical teams.
- To support: procurement staff, senior health facility leaders/managers, IPC, quality improvement and patient safety teams. In some areas, it might also be useful to include water and sanitation teams when necessary.



Most frequent challenges encountered in implementing this recommendation

- Lack of resources to prioritize procurement of ABHR and/or antimicrobial soap.
- Difficulties to procure ABHR.
- Absence of SOPs for the appropriate performance of surgical hand preparation.
- Lack of knowledge about the efficacy of ABHRs for surgical hand preparation causing surgeons' reluctance to use them.
- Concerns about possible harm associated with the use of ABHR (skin tolerance, other occupational health concerns, religious concerns, fire risks).

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	- Put in place/improve: - a sustainable procurement system to reliably procure and deliver adequate surgical hand preparation supplies (including antimicrobial soap, single-use sterile towels, good quality water, and ABHR), including a dedicated budget; - a service/unit to produce ABHR locally according to the WHO formulation (see WHO tools below) if unavailable or unaffordable from the market. - Define and agree on roles and responsibilities for those who will ensure continuous availability and placement of supplies in a position suitable to clinical workflow and agreed with surgeons.
TRAINING AND EDUCATION ('teach it') 	- Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff on appropriate surgical hand preparation technique, including evidence to support the use of ABHR and all related issues covered by the WHO recommendation (for example, avoiding nail brushes). - Engage staff in interactive sessions, simulation and practical training using standardized tools such as the WHO poster and training video.
MONITORING AND FEEDBACK ('check it') 	- Put in place a monitoring and feedback system (including roles and responsibilities) regarding: - staff knowledge about surgical hand preparation; - continuous procurement of ABHR and antimicrobial soap; - ABHR and antimicrobial soap consumption; - tolerance and acceptability of surgical hand preparation solutions; - appropriate surgical hand preparation; - SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	- Use/adapt the WHO surgical hand preparation technique posters (available from WHO) and place them in the most suitable areas after consultation with surgical staff. - Develop prompts to be used to champion the need for and the use of surgical hand preparation products at the right time.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Put in place visible signage showing surgeon and other key leader commitment to reliable surgical hand preparation, for example, a memo issued to all relevant hospital staff, a photo with a statement and signature placed around the surgical units, a video message to be played on computers/TVs. - Discuss about appropriate surgical hand preparation and SSI risk during staff meetings, etc.

WHO tools already available at:

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

- Surgical hand preparation poster
- Surgical hand preparation video
- Guide to local production: WHO-recommended handrub formulations*
- Surgical site infection surveillance perioperative data collection form
- IPC training – prevention of surgical site infection – slides 65-66

Additionally,

- Chapters 10 and 13, and recommendations chapter of the WHO Guidelines on hand hygiene in health care
http://apps.who.int/iris/bitstream/handle/10665/44102/9789241597906_eng.pdf;jsessionid=803DB5323EB7F01528EDB590DC2F3E51?sequence=1
- Hand hygiene acceptability and tolerability surveys
http://www.who.int/infection-prevention/tools/hand-hygiene/system_change/en/

* For the WHO formulations for surgical hand preparation, use these modified formulas:

Formulation I

- Final concentrations: ethanol 80% w/w, glycerol 0.725% v/v, hydrogen peroxide 0.125% v/v.

Ingredients:

1. Ethanol (absolute), **800 g.**
2. Hydrogen peroxide (3%), **4.17 ml.**
3. Glycerol (98%), **7.25 ml** (or $7.25 \times 1.26 = 9.135$ g).
4. Top up to 1000 g with distilled or boiled water.

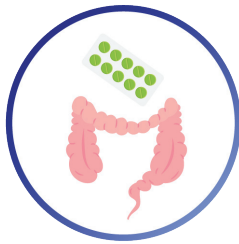
Formulation II

- Final concentrations: isopropanol 75% w/w, glycerol 0.725% v/v, hydrogen peroxide 0.125% v/v.

Ingredients:

1. Isopropanol (absolute), **750 g.**
2. Hydrogen peroxide (3%), **4.17 ml.**
3. Glycerol (98%), **7.25 ml** (or $7.25 \times 1.26 = 9.135$ g).
4. Top up to **1000 g** with distilled water.

2.2.6 MECHANICAL BOWEL PREPARATION AND THE USE OF ORAL ANTIBIOTICS



WHO recommendation (strong): Mechanical bowel preparation (MBP) alone (without administration of oral antibiotics) should not be used for the purpose of reducing SSI in adult patients undergoing elective colorectal surgery.

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

Scenario

A general surgeon suspects that a combination of MBP and oral antibiotics is not being used routinely by patients prior to colorectal surgery.

Problem

Low patient compliance and barriers to the use of MBP with oral antibiotics lead to poorer outcomes in colorectal surgery.

Case study

A general surgeon at a teaching hospital observes that patients undergoing colorectal surgery do not seem to have undergone an adequate bowel preparation. Following discussions with patients, she notes that they are either not taking the preparation at all or are only taking the mechanical preparation and not using the oral antibiotic. On further questioning, out-of-pocket cost seems to be an issue and patients do not understand why they need to take both medications. She works with the procurement office to identify a supplier that will provide both the bowel preparation product and the oral antibiotic at a reasonable cost. The hospital management agrees to include the cost of the preparation in the fee scheme. She works with the staff nurses at both her private clinic and on the ward of the teaching hospital to develop a new system to distribute both the preparation and the oral antibiotic directly to the patient with instructions for their use.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendations?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- MBP alone (without administration of oral antibiotics) should not be used for the purpose of reducing SSI in adult patients undergoing elective colorectal surgery. A local process for ensuring that this practice is abandoned should be instituted.
- Preoperative oral antibiotics combined with MBP can be used to reduce the risk of SSI in adult patients undergoing elective colorectal surgery. A decision-making process should be undertaken in the facility to consider the use of this intervention.
- Most frequently-used products for MBP are polyethyleneglycol and/or sodium phosphate, while aminoglycosides associated with metronidazole or erythromycin are usually the oral antibiotics used in combination. The impact of this recommendation is dependent on relevant resources and the considered local benefits.
- Availability and affordability of product/s may represent a barrier for the patient/health facility.
- This intervention is not applicable to paediatric patients due to a lack of evidence in this population.

WHY

- MBP combined with oral antibiotics should minimize faecal contamination during colorectal resection.
- MBP and oral antibiotics combined have been shown to reduce SSI in colorectal surgery, compared to MBP alone (30).

WHEN

- MBP and antibiotics should be administered the evening before surgery (protocols differ between timing of application, fasting and dosage).

WHO SHOULD BE INVOLVED

- Directly: surgical teams, including clinic and/or ward staff attending to patients preparing for colorectal surgery.
- To support: procurement and pharmacy staff, senior health facility leaders/managers, microbiology, surveillance and quality improvement teams.



Most frequent challenges encountered in implementing these recommendations

- Lack of knowledge about the ineffectiveness of MBP alone.
- No instructions available to patients and families.
- Difficulties to procure products to be used for MBP.
- Absence of protocols or SOPs for appropriate MBP in combination with oral antibiotics.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	- Put in place/improve a sustainable system to reliably procure and deliver materials required for MBP combined with oral antibiotics, including a dedicated budget. - Develop/adapt a protocol/SOP with practical instructions for the administration of MBP combined with antibiotics approved by all relevant staff, including a dedicated budget and, where appropriate, costs outlined for patient payment.
TRAINING AND EDUCATION ('teach it') 	- Put in place/improve a reliable mechanism for producing/using updated training resources and information for staff and patients to support the use of MBP combined with oral antibiotics. - Train key staff (as identified) on the SOP and to instruct patients to perform MBP combined with oral antibiotics. - Provide patients and families with leaflets/educational materials in face-to-face consultations, explaining the rationale for MBP and instructions for performing MBP in combination with oral antibiotics.
MONITORING AND FEEDBACK ('check it') 	- Put in place/improve a monitoring, reporting and feedback system (including roles and responsibilities) regarding: - adherence to the protocol and recommended regimen; - ongoing barriers to administering MBP and oral antibiotics; - patient feedback on MBP combined with oral antibiotics and any adverse events; - SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	- In collaboration with staff, develop/adapt: - prompts to be used to champion the need for appropriate MBP in combination with oral antibiotics (including in conjunction with patient representatives); - videos and leaflets for use in outpatient areas on how to perform MBP in combination with oral antibiotics as part of the patient preoperative preparation; - a range of communication reminders for staff delivering or administering MBP with oral antibiotics. - Include electronic reminders/alerts about the need for MBP in combination with oral antibiotics connected to electronic patient records (if available).
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Engage surgical teams (including from the wards and outpatient clinics/primary care), patients and their families to ensure maximum adherence to the protocol. - Engage senior management to use the opportunity to explain that the facility is supportive of the right patient preparation to prevent SSI through a range of communications, including the media.

WHO tools already available at:

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

- IPC training – prevention of surgical site infection – slides 58-59

2.2.7 ENHANCED NUTRITIONAL SUPPORT



WHO recommendation (conditional): 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.

Scenario

The surgical team in a tertiary academic hospital identifies the need to enhance the nutritional status of some categories of preoperative patients.

Problem

No nutritional support programme exists to target all relevant preoperative patients, thus certain patient groups have poorer outcomes postoperatively.



Case study

The clinical team at a tertiary academic hospital that performs many of the oncology resections for a large catchment area wants to start a nutritional support programme to optimize patient preparation for surgery. Many of the patients have advanced disease and also frequently arrive with simultaneous infections (skin and soft tissue, urinary, parasitic, etc.). The lead of the clinical team presents a review of a number of “prehabilitation” programmes that help enhance nutrition before major operations.

- The team also visits a local fistula centre where women are admitted several weeks prior to surgery to provide supplemental nutrition and treat concomitant infections (LMIC scenario).
- The team launches a nutritional programme that includes recipes and instructions for family members in the community, as well as patients admitted prior to surgery.
- The team also identifies commercial nutritional supplementation options, such as protein shakes, and plans an organized assessment of nutritional status for patients presenting for major cancer surgery (middle-income and HIC scenario).

Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- A decision-making process should be undertaken in the facility to consider instituting a process for the administration of enteral multiple nutrient-enhanced nutritional formulas in underweight* patients who undergo major surgical operations.
- It will be necessary for health care facilities to provide nutritional advice/materials and multiple nutrient-enhanced nutritional formulas, supported by procurement and business planning (cost effectiveness in the local settings versus need for a budget allocated to other activities).
- This recommendation is not applicable for paediatric patients due to a lack of evidence in this population.

WHY

- Nutritional support can help reduce the risk of SSI in underweight patients who undergo major surgery (particularly oncology and cardiovascular procedures) (31).

WHEN

- There is little evidence as to whether the timing of administration of multiple nutrient-enhanced nutritional formulas modifies the effect related to the prevention of SSI. Therefore, an optimal timing and duration of the administration of these formulas cannot be dictated. On a practical basis, it should be instituted at least two weeks in advance of surgery.

WHO SHOULD BE INVOLVED

- Directly: clinic and/or ward staff attending to patients preoperatively, dieticians where present, and surgical teams (if necessary).
- To support: procurement and pharmacy staff, senior health facility leaders/managers and quality improvement teams.

* "underweight" is a term describing a person whose body weight is considered too low to be healthy. The definition usually refers to people with a body mass index of under 18.5 or a weight 15-20% below the norm for their age and height group.



Most frequent challenges encountered in implementing this recommendation

- Lack of understanding of the importance of malnutrition and its effect on surgical outcomes.
- Lack of commitment to preoperative enhancement of nutrition.
- Lack of financial and human resources to procure and/or prepare enteral multiple nutrient-enhanced nutritional formulas or other nutritional supplements.
- Perceived powerlessness to make interventions in malnourished patients (particularly those with cancer).
- Lack of laboratory support to undertake screening to identify malnutrition.
- Lack of resources or knowledge to conduct body mass index assessments or benchmark deviations.
- Absence of and difficulties to develop nutritional supplementation protocols for both inpatients and outpatients.
- Unfamiliarity with general nutritional guidelines and needs.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”

SYSTEM CHANGE ('built it') 	• Develop/adapt: – A screening tool (or similar) based on a validated scale to identify specific patients in need of supplemental nutrition; – A protocol/ SOP to ensure implementation of the nutritional programme, including roles and responsibilities. • Put in place/improve a sustainable procurement system to reliably procure and deliver adequate supplies of enteral multiple nutrient-enhanced nutritional formulas or other nutritional supplements where necessary, including a dedicated budget.
TRAINING AND EDUCATION ('teach it') 	• Put in place/improve a reliable mechanism for producing/ using updated training resources and information: – to educate clinic and nursing managers on how to screen for underweight patients; – for dietitians and pharmacists on the appropriate preparation (including IPC measures) and use of the formulas; – on a dedicated education programme for patients and families on the need for supplemental nutrition, based on the local situation and culture; ideally to include contextually relevant recipes.
MONITORING AND FEEDBACK ('check it') 	• Put in place/improve a monitoring, reporting and feedback system (including roles and responsibilities) to: – identify the number of patients who are underweight in the target groups and determine the potential markers available to assess nutritional status and improvement; – ensure that the delivery of nutritional supplements to identified patients works efficiently; – gather patient feedback on supplements (for example, what they actually used, palatability, adverse events, improvement); – SSI rates. • Use data to set metrics for the patients who should be targeted for a nutritional intervention in relation to SSI prevention.
COMMUNICATIONS AND REMINDERS ('sell it') 	• Develop/adapt: – reminders for staff regarding when to screen and provide nutritional supplements (for example, flowchart) and agree upon their most relevant placement; – instructions for patients and families (leaflets, pictorials), including recipes for preparing nutritional formulas/supplements in collaboration with nutritionists and including patient input.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	• Facilitate meetings and discussions with all relevant staff on how working on nutritional status can enhance patient outcomes and how the nutritional support service can be integrated into the workflow. • Engage senior management to support the facility in addressing nutrition goals using a range of communications including the media.

2.2.8 PERIOPERATIVE DISCONTINUATION OF IMMUNOSUPPRESSIVE AGENTS



WHO recommendation (conditional): Do not discontinue immunosuppressive medication prior to surgery for the purpose of preventing SSI.

Scenario

The senior nurse educates patients to stop certain medications preoperatively.

Problem

Patients are inappropriately counselled to stop their immunosuppressive medication, which can affect their overall health condition and does not contribute to preventing SSI.

Case study

Surgical staff at a clinic routinely advises patients to stop most oral medication prior to surgery, including immunosuppressive agents that are commonly prescribed to prevent rejection of transplanted organs or for the treatment of inflammatory disease, such as rheumatoid arthritis or inflammatory bowel disease. Some colleagues mention that they have heard that the immunosuppressive effect of the drugs could lead to impaired wound healing and increased risk of infection in patients treated with these agents. However, others fear that discontinuation of immunosuppressive treatment could induce flares of disease activity and long-term interruptions of therapy might induce the formation of anti-drug antibodies and subsequently decrease the effect of the medication as mentioned in the recent WHO recommendation. Some patients also express their anxiety about discontinuing their medications. A meeting with the clinic staff, doctors and surgeons in the facility is organized to review the evidence and recommendation of WHO with the aim to update their guidance on the discontinuation of immunosuppressive agents in the preoperative period.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- It is not necessary to discontinue immunosuppressive medications prior to surgery for the purpose of preventing SSI. Health facilities should consider whether this problem is relevant in their situation and put in place a strategy to align with this recommendation, if necessary.

WHY

- There is a lack of (or very limited) evidence (for anti-tumour necrosis factor inhibitors) to support a discontinuation of immunosuppressive treatment, and even potential harm (for methotrexate). Moreover, there is risk of flare-up or progression of the patient's underlying disease with discontinuation (32).

WHEN

- Preoperatively, during any discussions about patient medications.

WHO SHOULD BE INVOLVED

- General practitioners, doctors treating the patient's underlying disease, clinic and/or ward staff attending to patients preoperatively, as well as surgical teams, pharmacy staff, senior health facility leaders/managers and quality improvement teams.



Most frequent challenges encountered in implementing this recommendation

- Lack of knowledge about the available evidence on the effect of continuing immunosuppressive medications perioperatively, in particular on SSI risk.
- Lack of standardized protocols/SOPs explaining that it is not necessary to discontinue immunosuppressive medications for the purpose of preventing SSI.
- Lack of communications and alignment between clinical staff involved in patient treatment management pre- and perioperatively.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing a plan to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	• Develop/adapt a protocol/SOP to outline <u>not</u> to discontinue immunosuppressive agents, including the process for monitoring drug prescribing preoperatively. • Put in place a system to support the supply of immunosuppressant agents to be continued for identified surgical patients, including through orders embedded in electronic health records/system where available, as well as a dedicated budget if not already in place.
TRAINING AND EDUCATION ('teach it') 	• Assess local training needs on this topic. • Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff on this topic/practice, including pharmacy and clinical staff. • Develop information/educational resources for patients and hold sessions to explain why it is safe to continue immunosuppressive agents preoperatively.
MONITORING AND FEEDBACK ('check it') 	• Put in place/improve monitoring, reporting and feedback mechanisms (including roles and responsibilities): – for identifying patients treated with immunosuppressive agents; – delivery of immunosuppressive agents to identified patients; – patient feedback on continuation of their drugs; – SSI rates. • Use any available data/feedback to set metrics for reporting the intervention in relation to SSI prevention.
COMMUNICATIONS AND REMINDERS ('sell it') 	• In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement to ensure that immunosuppressive agents are not discontinued. • Create information resources to alert patients, in collaboration with clinical, pharmacy staff and patient representatives.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	• Facilitate discussions and consensus on avoiding the discontinuation of immunosuppressive medications among various levels of clinical staff involved in patient treatment management pre- and perioperatively. • Identify pharmacy and surgical champions to talk to other staff and advocate for not stopping immunosuppressive agents. • Engage senior managers and leaders to explain that the facility is supportive of the right patient preoperative preparation and patient and medication safety using a range of communications including the media as relevant.

2.2.9 IMPORTANCE OF A CLEAN ENVIRONMENT IN THE OPERATING ROOM AND DECONTAMINATION OF MEDICAL DEVICES AND SURGICAL INSTRUMENTS



Best practices recommended in WHO guidance: clean and prepare the operating room environment for each surgical procedure; clean and sterilize/decontaminate surgical instruments and other equipment; maintain asepsis in the operating room.

While not part of the official evidence-based recommendations informed by systematic reviews in the WHO SSI prevention guidelines, appropriate environmental cleaning in the operating room including maintaining asepsis and the decontamination of medical devices and surgical instruments, are crucial for the prevention of SSI. A chapter on the importance of a clean environment in the operating room and the decontamination of surgical instruments is included in the WHO SSI prevention guidelines and a separate WHO manual on decontamination exists.

Scenario 1

Staff in an operating room has observed that when laying out the sterile surgical instruments on the operating trolley for the start of a procedure, some instrument packs are wet.

Problem 1

Wet instrument packs can mean that the sterile instruments are contaminated or that the process of sterilization is not being corrected performed.

Case study 1

The surgical team requests a meeting with staff from the sterile services department and IPC team. In the meeting, the sterile services staff state that they have not noticed that packs are wet when distributing them to the operating room. The IPC team agree to work with the sterile services department and surgical team to conduct an audit of the whole process in order to understand the root of the problem. However, due to work overload, the team will only be able to feedback the results in approximately one month. The lead surgeon says that this timeline is unacceptable and that unless resolved immediately it is too much of a risk to perform surgery. He states that he will speak to the chief medical officer and chief executive officer immediately.



Scenario 2

A staff member who cleans one of the operating room has highlighted that while cleaning of the OR is undertaken at the end of each day, cleaning between patients is done quickly and not always effectively.

Problem 2

Different approaches to cleaning the OR could mean that it is not being done effectively.



Case study 2

A scrub nurse in the OR has spoken with a cleaner and is worried about cleaning standards. She suggests to the surgeons that a discussion is held on cleaning of the operating room during the routine surgical staff monthly meeting to find out what others have observed and what concerns there might be. The surgical team agrees that this is a matter of concern and it would be important to discuss with the IPC team about any recent document on cleaning standards/approaches for the operating room and the need for reviewing and enforcing the operating room cleaning SOPs. During the meeting there is much discussion and also disagreement on how cleaning should be done between patients and at the end of the day. The surgeons agree to set up a project to investigate the best approach to be taken according to the latest available literature and to audit current cleaning practices. They also ask for more regular updates from the IPC team on SSI rates generated by the current data collection system. The scrub nurse agrees to make a plan and outline a schedule for training on operating room cleaning once all the information has been collated, noting that she may need to source or create training materials.

Suggestions for making improvements at local level – how do I change the situation to meet the best practices recommendations?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- Clear protocols/SOPs should be developed or improved as needed on appropriate environmental cleaning in the operating room, including maintaining asepsis and the decontamination of medical devices and surgical instruments, and effective multimodal implementation strategies should be put in place and monitored accordingly.

Cleaning

- The environment should be thoroughly cleaned and general principles of good practice should be taken into consideration (see Figure 5) (12).
- Cleaning is an essential first step prior to any disinfection process to remove dirt, debris and other materials.
- Appropriate detergent/disinfection solutions should be used and must be discarded after each use.
- **At the beginning of each day**, all flat surfaces should be wiped with a clean, lint-free moist cloth to remove dust and lint.
- **Between surgical procedures**, hand-touch surfaces and surfaces that may have come in contact with patients' blood or body fluids (see Figure 6) should be wiped clean first by using a detergent solution and then disinfected according to hospital policy and allowed to dry. The operating table should be cleaned and wiped with a detergent solution, including the mattress and the surface. All surfaces that have come in contact with a patient or a patient's body fluids must be cleaned and disinfected using an appropriate disinfectant solution according to local SOPs.
- **At the end of every day**, a total cleaning procedure must be performed. All areas of the surgical suite, including scrub sinks, scrub or utility areas, hallways and equipment should be thoroughly cleaned, regardless of whether they were used or not during the last 24 hours.
- Soiled linen should be removed in closed leak-proof containers. All contaminated waste containers should be removed and replaced with clean containers. Sharps' containers should be closed and removed when they are three-quarters full. All surfaces should be cleaned from top to bottom using a detergent, followed by a disinfectant if necessary, and then allowed to dry.
- To reduce the microbial contamination of environmental surfaces, such as walls, ceilings and floors, they should be thoroughly cleaned from top to bottom with a detergent and allowed to dry. The routine use of a disinfectant or fumigation of the operating room is *not* necessary, even after contaminated surgery.

Decontamination of medical devices and surgical instruments

- Decontamination is a complex and highly specialized subject.
- The availability of a separate demarcated department or a designated decontamination area with clear demarcated areas for workflow is critical.
- According to the Spaulding classification, which is based on the degree of risk of infection transmission, surgical instruments are categorized as 'critical' (at high risk) and require sterilization.
- All medical devices that are reprocessed, such as surgical instruments, must undergo **rigorous cleaning prior to decontamination and sterilization** procedures. Soaking contaminated medical devices prior to cleaning in disinfectants of any kind is not sufficient or recommended.
- At the end of every surgical procedure, all instruments should be returned to the sterile services department (after rinsing as per the SOP and securely contained in a leak-proof container before transportation).
- The cycle of decontamination is an important part of this (see Figure 7). More details can be found in the WHO guidelines for SSI prevention in the section on 'Importance of a clean environment in the operating room and decontamination of medical devices and surgical instruments'.

WHY

- A contaminated health care environment plays a significant role in the transmission of microorganisms.
- If the operating room is not thoroughly cleaned and sterile services/instruments are not available or appropriately used, these are known to be contributing factors for the acquisition of HAI (or what can be described as surgery-associated infection).

WHEN

- **Environmental cleaning of the operating room** with appropriate procedures (see above): at the beginning and at the end of each day, between procedures.
- **Cleaning and sterilization of surgical instruments:** at the end of every surgical procedure.

WHO SHOULD BE INVOLVED

- Directly: cleaning staff, sterile services staff and surgical teams.
- To support: procurement services, senior management and IPC and quality improvement teams.

Figure 5. General principles for environmental cleaning

- Cleaning is an essential first step prior to any disinfection process to remove dirt, debris and other materials.
- The use of a neutral detergent solution is essential for effective cleaning. It removes dirt while improving the quality of cleaning by preventing the build-up of biofilms and thus increasing the effectiveness of chemical disinfectants.
- If disinfectants are used, they must be prepared and diluted according to the manufacturer's instructions. Too high and/or too low concentrations reduce the effectiveness of disinfectants. In addition, high concentrations of disinfectant may damage surfaces.
- Cleaning should always start from the least soiled areas (cleanest) first to the most soiled areas (dirtiest) last and from higher levels to lower levels so that debris may fall on the floor and is cleaned last (4).
- Detergent and/or disinfectant solutions must be discarded after each use.
- Avoid cleaning methods that produce mists or aerosols or disperse dust, for example dry sweeping (brooms, etc.), dry mopping, spraying or dusting.
- Routine bacteriological monitoring to assess the effectiveness of environmental cleaning is not required, but may be useful to establish the potential source of an outbreak and/or for educational purposes (5).

Figure 6. Example of cleaning frequencies in preoperative care areas

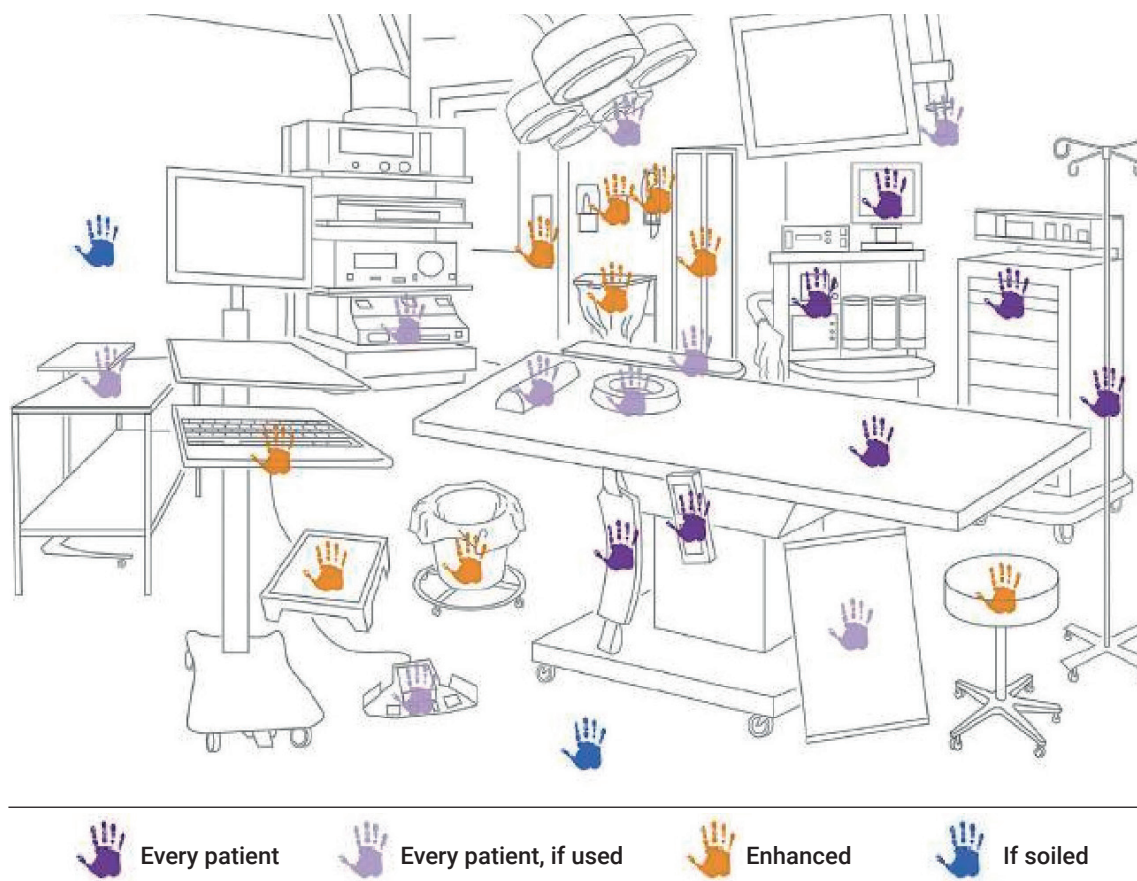
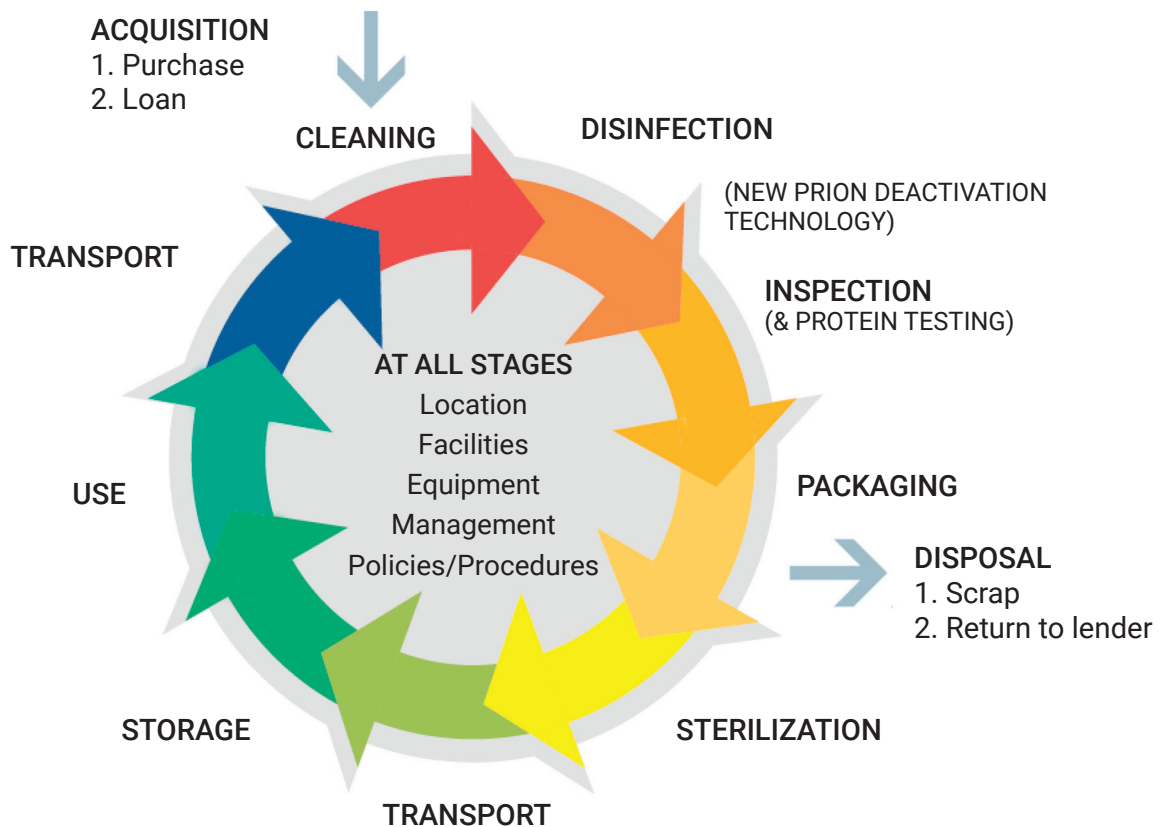


Figure 7. The cycle of decontamination of a reusable surgical instrument



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Most frequent challenges encountered in implementing cleaning and decontamination

- Lack of consideration of the importance of cleaning and decontamination/sterilization by surgical teams.
- Lack of cleaning and disinfectant solutions.
- Incorrect methods and timings for cleaning and decontamination/sterilization (including inappropriate disinfectants for the task/equipment).
- Lack of or malfunctioning sterile services department.
- Lack of SOPs in line with established guidelines and standards.
- Lack of trained and dedicated staff.
- Low quality and/or lack of water.
- Low quality of cleaning performance.
- Cleaning activities contracted to an external company (for example, difficulties to reach consensus on standardized protocols/SOPs and systems for monitoring adherence).
- Lack of collaboration between cleaning staff and IPC and surgical teams.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 1.2. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

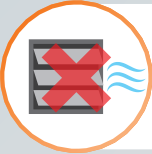
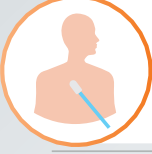
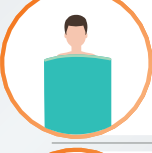
ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE (‘built it’) 	- Put in place/improve a sustainable system to reliably procure the necessary cleaning and decontamination/ sterilisation products, including a dedicated budget. - Develop/adapt a protocol/SOP to include instructions on: - formal staff qualifications, education and training and competency assessment; - cleaning; - high-level disinfection; - preparation and packaging of medical devices; - sterilizer operating procedures; - monitoring and documenting of chemical or cycle parameters; - workplace health and safety information, specific to the chemical sterilant; - handling, storage and disposal of sterilizing solutions according to the manufacturer’s instructions/local regulations; - use of physical, chemical and/or biological indicators; - quality systems; - validation of cleaning, disinfection and sterilization.
TRAINING AND EDUCATION (‘teach it’) 	- Put in place/improve a reliable mechanism for producing/using updated training resources and information for cleaning staff, sterile services staff, as well as the surgical team. - Train staff on all aspects of cleaning in the operating room according to a regular schedule, with the corresponding details provided in a SOP.
MONITORING AND FEEDBACK (‘check it’) 	- Put in place/improve a monitoring, reporting and feedback mechanism (including roles and responsibilities), regarding the: - cleaning process applied in the operating room; - standards of the sterile surgical instruments/trays (including the presence of a chemical indicator); - placement of pack indicators within patients’ records; - availability of an adequate number of fit-for- purpose devices for a surgical procedure; - process for returning surgical instruments to the sterile services department after a procedure.
COMMUNICATIONS AND REMINDERS (‘sell it’) 	- In collaboration with staff, develop/adapt prompts, posters, pictorials, algorithms on: - operating room cleaning processes; - cleaning and sterilization of surgical instruments/devices; - correct use of sterile surgical instruments/trays; - placement of pack indicators within the patients’ records.
SAFETY CLIMATE AND CULTURE CHANGE (‘live it’) 	- Develop tailored strategies to address, engage and value environmental cleaning and sterilization teams. - Engage surgical teams and sterile service department staff, to liaise and communicate on both good and inadequate practices. - Introduce/reinforce a culture that supports appropriate cleaning and sterilization services, including visible messages and commitment from senior management.

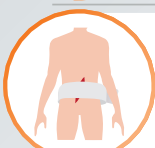
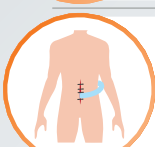
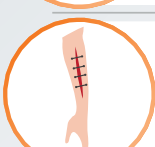
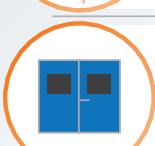
Specific WHO supporting tools already available

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

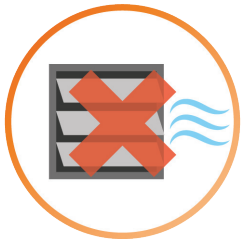
- World Health Organization. Decontamination and reprocessing of medical devices for health-care facilities. 2016
(<http://apps.who.int/iris/bitstream/handle/10665/250232/9789241549851-eng.pdf?sequence=1>).
- World Health Organization. Chapter 3.3. Importance of a clean environment in the operating room and decontamination of medical devices and surgical instruments. Global guidelines on the prevention of surgical site infection. 2016

2.3 INTRAOPERATIVE MEASURES

	ACTION	SUPPORTED BY
 Do NOT use laminar airflow ventilation systems <i>(not beneficial for patients undergoing total arthroplasty surgery)</i>	 SURGICAL TEAM	 PROCUREMENT/ESTATES AND MAINTENANCE STAFF
 Use either disposable sterile non-woven or reusable sterile woven drapes and surgical gowns	 SURGICAL TEAM	 PROCUREMENT/STERILIZATION UNIT
 Do NOT use plastic adhesive incise drapes <i>(neither those with nor those without antimicrobial properties)</i>	 SURGICAL TEAM	 PROCUREMENT
 Use alcohol-based solution containing chlorhexidine gluconate for skin preparation	 SURGICAL TEAM	 PHARMACY/PROCUREMENT
 Do NOT use antimicrobial sealants after surgical site skin preparation	 SURGICAL TEAM	 PROCUREMENT
 Administer 80% fraction of inspired oxygen (FiO₂) <i>(in adults undergoing general anaesthesia with endotracheal intubation)</i>	 SURGICAL TEAM	 ESTATES AND MAINTENANCE STAFF
 Consider using a warming device	 SURGICAL TEAM	 PROCUREMENT
 Consider using a protocol for intensive blood glucose control <i>(for both diabetic and non-diabetic adult patients)</i>	 SURGICAL TEAM	 CLINICAL STAFF

	ACTION	SUPPORTED BY
 Consider using goal-directed therapy	 SURGICAL TEAM	 PROCUREMENT
 Consider irrigating incisional wound with an aqueous povidone iodine solution before closure <i>(in clean and clean-contaminated wounds)</i>	 SURGICAL TEAM	 PROCUREMENT
 Do NOT perform antibiotic wound irrigation	 SURGICAL TEAM	 PROCUREMENT
 Consider using wound protector devices <i>(in clean-contaminated, contaminated and dirty abdominal procedures)</i>	 SURGICAL TEAM	 PROCUREMENT
 Consider prophylactic negative pressure wound therapy <i>(primarily in closed surgical incisions in high-risk wounds)</i>	 SURGICAL TEAM	 PROCUREMENT
 Consider using triclosan-coated sutures	 SURGICAL TEAM	 PROCUREMENT
 Maintain asepsis and discipline in the operating room	 SURGICAL TEAM	 CLINICAL STAFF

2.3.1. LAMINAR AIRFLOW VENTILATION SYSTEMS IN THE CONTEXT OF OPERATING ROOM VENTILATION



WHO recommendation (conditional):
Laminar airflow ventilation systems should not be used to reduce the risk of SSI for patients undergoing total arthroplasty surgery.

Scenario

Hospital management is investing in a new operating room for orthopaedic surgery and is assessing contract proposals.

Problem

Laminar airflow ventilation systems are expensive and have not been demonstrated to reduce the risk of SSI.

Case study

A small but vibrant district hospital is evaluating proposals for a new operating room for use by the orthopaedic surgeons. The orthopaedists are requesting laminar airflow ventilation, which is included in the contract proposal, but at a substantial additional cost. The financial manager and hospital chief executive officer meet with the orthopaedic surgeons and biomedical engineer to discuss whether the additional cost is worth the investment and what would need to be sacrificed if they incorporated laminar airflow ventilation into the contract.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- Use of laminar airflow ventilation systems in operating rooms are not useful to reduce the risk of SSI in patients undergoing arthroplasty.
- Health facilities should consider not to include laminar airflow ventilation systems when constructing new operating rooms. The impact of this recommendation is dependent on the effective planning and assessment of resource allocation (use of laminar flow ventilation systems versus cost savings to be allocated to other proven SSI prevention measures).

WHY

- There is very limited evidence to support the use of laminar flow ventilation in arthroplasty and the costs for its installation can be substantial (33).

WHEN

- During the planning and development phases of the building or refurbishment of operating rooms.

WHO SHOULD BE INVOLVED

- Hospital administration, financial planning and orthopaedic surgical teams.



Most frequent challenges encountered in implementing this recommendation

- Lack of knowledge about the available evidence on the real benefit of laminar airflow ventilation systems to reduce the risk of SSI.
- Lack of collaboration between health engineers, senior management and the IPC team.
- Resistance by orthopaedic surgeons to operate in rooms not equipped with laminar airflow ventilation systems.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	Establish a careful local decision-making process to consider not including laminar airflow ventilation systems when constructing new operating rooms.
TRAINING AND EDUCATION ('teach it') 	Put in place/improve a reliable mechanism for producing/ using updated training resources and information for relevant staff regarding laminar flow ventilation systems, using cost and guideline data (for example, from WHO).
MONITORING AND FEEDBACK ('check it') 	- Undertake a systematic process to understand the benefits and costs of laminar airflow ventilation systems and provide feedback to relevant players. - Put in place/improve monitoring, reporting and feedback mechanisms (including roles and responsibilities) on the use of ventilation systems as necessary. - Refer to SSI rates or plan to collect these as part of overall monitoring and concerns over ventilation.
COMMUNICATIONS AND REMINDERS ('sell it') 	In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement to remind relevant staff why laminar flow ventilation systems are not useful for SSI prevention, as well as the high investment of resources that can be used for other preventive measures.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Engage and alert all relevant staff in discussions on any processes (currently in place or planned) that may lead to laminar flow ventilation system purchase/ installation. - Take decisions collectively and seek approvals at all relevant levels. - Encourage senior management to use relevant opportunities to explain that the facility is supportive of the right surgical safety steps to prevent SSI and the need for being cost (and clinically) effective.

2.3.2 DRAPES AND GOWNS



WHO recommendation (conditional): 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. **Do not use plastic adhesive incise drapes with or without antimicrobial properties for the purpose of preventing SSI.**

Scenario

A hospital administrator looking to save money identified adhesive drapes as an unnecessary expense and requests their removal from purchase orders.

Problem

There is no evidence demonstrating that adhesive drapes prevent SSI, but surgeons use them for reasons beyond IPC.

Case study

The hospital administrator of a secondary referral hospital in a middle-income country has been asked by the surgical staff to procure disposable drapes and gowns. The surgeons complain about tears and holes in the gowns and drapes they are using and do not have a mechanism to repair them. Furthermore, they occasionally note that the gowns and drapes are moist and the head nurse and lead surgeon do not believe that these can be confirmed as sterile. The administrator is concerned about the costs and the ecological impact of the additional clinical waste generated by choosing disposable drapes and gowns and wonders whether such a change is really necessary. He reviews the WHO guidelines and meets with the surgeons to review the recommendations, noting that appropriately sterilized woven drapes are sufficient. The surgeons agree, but raise the issue of repairs and sterilization. They meet with the head operating room nurse and develop a plan for separating and repairing gowns and drapes with holes or tears. They also meet with staff from the central sterilization department to review the process of cleaning, drying, and sterilizing woven reusable gowns and drapes.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- It is essential to use sterile drapes and gowns for surgery. 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.
- The facility should have a process to ensure the reliable availability and sterility of surgical drapes and gowns, regardless of the type used. Another important aspect to be assured is impermeability. Both reusable and disposable drapes and gowns commercially available are in permeable or impermeable forms.
- When considering the type of drapes and gowns to use or change to, many different aspects need to be taken into account, such as resource implications for direct purchase costs and costs related to laundry and sterilization, as well as the effectiveness of sterilisation procedures, labour required for reprocessing (for reusable equipment) and waste disposal (for disposable equipment). The available evidence is heterogeneous and reusable and disposable equipment are probably similar in costs.
- Plastic adhesive incise drapes with or without antimicrobial properties should not be used for the purpose of preventing SSI.

WHY

- Sterile surgical drapes are used to prevent contact with unprepared surfaces and maintain the sterility of environmental surfaces, equipment and the patient's surroundings.
- Sterile surgical gowns are worn over the scrub suit of the operating team during surgical procedures to maintain a sterile surgical field and reduce the risk of the transmission of pathogens to both patients and staff.
- There is no evidence to support the use of plastic adhesive incise drapes, which might cause harm due to allergic reactions or due to pieces of the adhesive film remaining in the wound (34).

WHEN

- Drapes are applied to the patient's skin after completion of the surgical site preparation.
- Surgical gowns are worn upon entrance to the operating room until the end of the operation or when exiting the operating room.

WHO SHOULD BE INVOLVED

- Directly: surgical teams
- To support: procurement services, sterilization services, senior management and IPC teams.



Most frequent challenges encountered in implementing this recommendation

- Lack of knowledge of the available evidence about the advantages and disadvantages of using disposable, non-woven *versus* reusable woven drapes and surgical gowns.
- Lack of awareness of factors to be considered when choosing the type of surgical drapes and gowns.
- Defective sterilization procedures and poor maintenance of the fabric integrity.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	• Procure a supply catalogue to inform the procurement and purchase of drapes and gowns, including product specifications and cost. • Put in place/improve a system to ensure the continuous availability of stocks of sterile drapes and gowns, including procurement and an associated budget and roles and responsibilities for action. • Improve laundry and/or disposal systems in place for the management of used drapes and gowns. • Ensure perfect functioning of sterilization services if using reusable drapes and gowns.
TRAINING AND EDUCATION ('teach it') 	• Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff on the correct use of surgical drapes and gowns, product specifications of those in use, and on the lack of benefit of using plastic adhesive incise drapes.
MONITORING AND FEEDBACK ('check it') 	• Put in place/improve a monitoring, reporting and feedback mechanism (including roles and responsibilities) regarding: – quality of reusable drapes and gowns to ensure that there are no holes; – use of adhesive drapes in use, particularly in the early transition period of changing to non adhesive drapes, including how often new materials are used and discontinued materials are requested (as necessary); – SSI rates. • Consider a survey to understand how adhesive drapes are used, why they are requested, who uses them and under what circumstances (as necessary).
COMMUNICATIONS AND REMINDERS ('sell it') 	• In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement to notify staff of the appropriate use of drapes and gowns including discontinuation of adhesive drapes as necessary. • Consider including information to alert staff to what else could be purchased (by not using adhesive drapes).
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	• Identify champions to outline the correct use of surgical drapes and gowns and to highlight that the lack of adhesive drapes does not cause increased infection rates with implantable devices. • Engage surgeons to create and explain to colleagues other ways to ensure that drapes are secured to curved body sites (without being adhesive).

WHO supporting tools already available:

- Decontamination and reprocessing of medical devices for health-care facilities. WHO; 2016 (<http://apps.who.int/iris/bitstream/handle/10665/250232/9789241549851-eng.pdf?sequence=1>).

2.3.3 SURGICAL SITE PREPARATION



WHO recommendation (strong):
Alcohol-based antiseptic solutions
based on CHG should be used for
surgical site skin preparation in patients
undergoing surgical procedures.

Scenario

A hospital wants to convert from a povidone-iodine skin preparation solution to one based on alcohol and chlorhexidine.

Problem

The current skin preparation solution does not include alcohol, nor is it based on CHG, which reduces the risk of SSI when appropriate for the surgical site.

Case study

Based on the WHO SSI prevention guidelines, the IPC and surgical teams plan to transition to an alcohol-based antiseptic solution based on CHG in place of an aqueous iodine solution currently in use. On their first round of feedback, adherence to skin preparation is questioned by some surgical staff. The gynaecology team insists that iodine be maintained for vaginal cases and several other surgeons agree that it is needed for use on mucosal surfaces, such as during rectal and oral surgery. The clinical teams are concerned that the operating room nurses may not know which cases require CHG-alcohol vs iodine. They agree on a training plan for the operating room staff. During transition to and training for the new formula, the nursing staff raise concerns about not being able to see the prepared surgical field given the loss of colour staining that was previously present from iodine. The team further investigates adding a colouring dye, but cannot determine if the dye is sterile or would compromise the efficacy of the solution itself.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- Alcohol-based antiseptic solutions containing CHG should be preferred for surgical site skin preparation over aqueous iodine-based solutions (PVP-I).
- A process should be developed, implemented and monitored at the facility level in order to align with this recommendation.
- Clear SOPs should be developed or adapted to guide appropriate surgical skin preparation using a standardized technique.
- Adequate supplies should be supported by procurement plans and budget. Market options and local production should be evaluated, including addressing product quality and the need for being visible on skin. A dye (e.g., E122 = azorubine) can be added to colourless solutions to make the product visible on the patient's skin.
- 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. Thus, alternative disinfectants should be available for the indications.
- Potential allergic reactions to CHG and other adverse events linked to alcohol- and CHG-based antiseptic solutions should be investigated and recorded.
- Alcohol-based antiseptic preparations represent a potential fire risk in the operating room because they may ignite if used in the presence of diathermy and they must be allowed to dry by evaporation. Therefore, 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.

WHY

- Appropriate surgical site preparation is critical to reduce the microbial load on the patient's skin as much as possible before incision of the skin barrier.
- Alcohol-based antiseptic solutions for surgical site skin preparation are more effective compared to aqueous solutions in reducing SSI.
- Alcohol-based solutions containing CHG are more effective in reducing SSI rates compared to alcohol-based solutions containing PVP-I (35).

WHEN

- Perioperatively, with time built in to allow for drying before draping.

WHO SHOULD BE INVOLVED

- Directly: surgical teams.
- To support: procurement and pharmacy services, senior management and IPC and quality improvement teams.

**Most frequent challenges encountered in implementing this recommendation**

- Lack of resources to prioritize procurement of alcohol-based antiseptic solutions containing CHG.
- Difficulties to procure alcohol-based antiseptic solutions containing CHG.
- Absence of SOPs for the appropriate performance of surgical hand preparation.
- Lack of knowledge about the higher efficacy of alcohol-based solutions over aqueous formulations for surgical hand preparation.
- Surgeons' reluctance to use colourless solutions, which do not delineate the surgical site area.
- Concerns about possible harm associated with the use of solutions containing alcohol and/or CHG (skin tolerance, allergies, religious concerns, fire risks).

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	- Put in place/improve: - a sustainable system to reliably procure and deliver adequate supplies of skin preparation solution, including a dedicated budget; - a service/unit to produce alcohol-based antiseptic solution locally,* including a process for adding dye as necessary, if unavailable or unaffordable from the market. - Define and agree on roles and responsibilities for those who will ensure continuous availability and placement of supplies in a position suitable to clinical workflow and agreed upon with surgeons. - Develop/adapt an SOP for appropriate surgical skin preparation using a standardized technique (including roles and responsibilities).
TRAINING AND EDUCATION ('teach it') 	- Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff (based on a needs assessment) on appropriate skin preparation, including the appropriate technique, as well as providing evidence to support the use of alcohol-based solutions and CHG. - Engage staff in interactive sessions, simulation and practical training using standardized tools, such as the WHO poster and training video, using a range of training modes deemed appropriate for the local situation (short sessions at grand rounds, existing meetings, topic embedded in formal, planned training sessions). - Also consider providing as necessary the evidence on how the risk of burns, etc. from alcohol-based solutions can be managed.
MONITORING AND FEEDBACK ('check it') 	- Put in place a monitoring, reporting and feedback system (including roles and responsibilities) regarding: - staff knowledge about surgical skin preparation; - continuous procurement of appropriate products; - consumption of surgical skin preparation solutions; - tolerance and acceptability of surgical skin preparation solutions; - adherence with appropriate surgical skin preparation techniques; - SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement to be used to champion the need for appropriate skin preparation solution (with added dye as necessary), including in collaboration with patient representatives as deemed appropriate.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Put in place visible signage showing surgeon and other key leader commitment to reliable surgical skin preparation, for example, a memo issued to all relevant hospital staff, a photo with a statement and signature placed in the surgical operating room, a video message to be played on computers/TVs. - Discuss appropriate surgical hand preparation and the SSI risk during staff meetings, etc. - Encourage senior management to use relevant opportunities to explain that the facility is supportive of the right surgical safety steps to prevent SSI.

* Use the following formula: isopropanol: 62.7% g/g + chlorhexidine digluconate (18.8% g/g solution); 12.1% g/g + distilled water up to 100%.

WHO supporting tools already available at:

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

- Skin preparation video
- Surgical site infection surveillance perioperative data collection form
- IPC training – prevention of surgical site infection – slides 67-69

2.3.4 ANTIBIOTIC-COATED SEALANTS



WHO recommendation (conditional):
Antimicrobial sealants should **not** be used after surgical site skin preparation for the purpose of reducing SSI.

Scenario

Surgeons are using skin sealants in their private clinic and would like to use them also in the public hospital to prevent SSI.

Problem

Skin sealants add costs and are not effective in preventing surgical infections.

Case study

A group of surgeons who share a private practice request the public hospital where they work to provide an antimicrobial skin sealant to reduce surgical infections on the wards. They cite poor wound care and dressing changes as an issue and argue that the use of a skin sealant will save time and money in dressing changes. The surgical director reviews the literature and WHO recommendations and notes that the use of antimicrobial skin sealants is not recommended as a means of preventing SSI.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- Antimicrobial sealants should not be used after surgical site skin preparation for the purpose of reducing SSI.
- A local process for ensuring this practice is not routine should be instituted.

WHY

- Antimicrobial skin sealants are sterile, film-forming cyanoacrylate-based sealants commonly applied as an additional antiseptic measure after standard skin preparation of the surgical site and prior to skin incision. The sealant is intended to remain in place and block the migration of flora from the surrounding skin into the surgical site by dissolving over several days postoperatively. It also keeps the skin edges intact and free from moisture until the skin has sealed. However, there is no evidence that the use of antimicrobial sealants is beneficial in reducing the SSI rate (36).
- The cost of antimicrobial sealants is a potential resource concern and the investment of resources could be directed towards other more useful preventive practices.

WHEN

- In the pre/intraoperative period.

WHO SHOULD BE INVOLVED

- Directly: surgical teams.
- To support: procurement services, senior management.



Most frequent challenges encountered in implementing this recommendation

- Lack of awareness/knowledge that the evidence does not show any benefit of sealants in reducing the SSI rate.
- Resistance and misperception by surgeons who are convinced that sealants are beneficial.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	Establish a careful local decision-making process to consider not purchasing sealants, including presentation of data on cost-effectiveness and proposals for investing resources in other preventive measures.
TRAINING AND EDUCATION ('teach it') 	Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff on the lack of benefit of using antimicrobial skin sealants in staff training resources and sessions, using the available international guideline evidence.
MONITORING AND FEEDBACK ('check it') 	- Consider a survey to understand how sealants are used, why they are requested, who uses them and under what circumstances (as necessary). - Refer to SSI rates or plan to collect these as part of overall monitoring and concerns over skin closure.
COMMUNICATIONS AND REMINDERS ('sell it') 	In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement to remind relevant staff why sealants are not useful for SSI prevention and that they represent an investment of resources that can be used for other preventive measures.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Identify surgeon champions who do not use sealants. - Target surgeons who would like to use antimicrobial skin sealants and may even tell their patients that this is an important item to use after skin closure. - Encourage senior management to use relevant opportunities to explain that the facility is supportive of the right surgical safety steps to prevent SSI and the need for being cost (and clinically) effective.

2.3.5 INTRA- AND POSTOPERATIVE ADMINISTRATION OF 80% FRACTION OF INSPIRED OXYGEN (FiO₂)



WHO recommendation (conditional):
Adult patients undergoing general anaesthesia with tracheal intubation for surgical procedures should receive an 80% FiO₂ intraoperatively and, if feasible, in the immediate postoperative period for 2-6 hours to reduce the risk of SSI.

Scenario

Anaesthesiologists are currently using FiO₂ in the 30-35% range during surgery after induction and intubation, but they have been mandated to use high FiO₂ for all intubated patients during surgery.

Problem

High FiO₂ (80%) should be used to reduce surgical infections by delivering high oxygen levels to the wound.



Case study

The anaesthesia team at a tertiary care hospital debate whether to follow recent WHO and United States Centers for Disease Control and Prevention guidelines recommending the use of high FiO₂ during surgery to prevent SSI. One group is concerned about pulmonary and cardiovascular complications associated with high FiO₂ levels, while the other would like to comply more directly with the WHO guidelines on higher FiO₂ to prevent infections. The team also notes that independent from this debate, monitoring oxygen saturation in the postoperative period is not always possible because a few pulse oximeter devices are available and insufficient for all patients. One anaesthetist and one surgeon are particularly invested in this discussion and they facilitate discussions and focus groups with the anaesthesia and surgical teams to analyze the evidence on the effectiveness of high FiO₂ in reducing the risk of SSI and its safety. Recent evidence synthesized by WHO convince the majority to standardize this intervention by developing an SOP and advocating for system change to enable its implementation. Therefore, the core team also asks to meet with senior managers to gather support for this intervention and proposes using cylinder oxygen as a means to administer higher FiO₂ for all patients during recovery, as well as requesting the procurement of more pulse oximeters for use in the facility, including the surgical services.

Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- A decision-making process should be undertaken in the facility to consider the administration of 80% FiO₂ in adult patients undergoing general anaesthesia with endotracheal intubation for surgical procedures intraoperatively and through a high flow mask in the immediate postoperative period for 2-6 hours to reduce the risk of SSI.
- An evidence-based protocol/SOP should be developed/adapted by the anaesthesia team outlining standardized approaches for administering high FiO₂.
- The impact of this recommendation is dependent on effective, local implementation and evaluation strategies as well as relevant resources.
- In LMICs, oxygen availability (procurement and distribution) and the related costs may be a problem and there might be other IPC priorities. The implementation of this recommendation, as well as the need for oxygen for other critical clinical uses, should drive an increased access to oxygen. The local production of oxygen in hospitals should also be encouraged.
- To maximize success of the intervention, normothermia and normovolemia should be maintained.
- Although monitoring oxygen saturation does not directly reflect the effect of this intervention, it is recommended as good practice - primarily for hypoxia detection in all patients undergoing general anaesthesia during surgery and in the postoperative period, irrespective of the concentration of inspired oxygen received.

WHY

- The administration of 80% FiO₂ is specifically beneficial in patients undergoing procedures under general anaesthesia with endotracheal intubation for the purpose of reducing the risk of SSI. Indeed, the type of anaesthesia independently modifies the effect of hyperoxygenation, that is, administering high FiO₂ through neuraxial anaesthesia with a nasal cannula or facemask may not achieve the same effect. In neuraxial anaesthesia with a facemask or nasal cannula, the control of ventilation (and thereby control of the actual administration of the high FiO₂ to the lungs) is limited and was considered different from the intervention with mechanical ventilation. (37, 38).
- The success of the intervention has been proved only when implemented in patients intubated during the operation and receiving 80% FiO₂ through a high flux mask in the immediate postoperative period. This should be considered as part of the intervention.
- The evaluation of all relevant available evidence on the safety of this intervention in surgical patients shows no substantive evidence to discourage the use of high FiO₂ in this population.

WHEN

- In the intraoperative and postoperative periods.

WHO SHOULD BE INVOLVED

- Directly: anaesthesia, surgical and ward teams.
- To support: procurement and engineering/facility services, senior management, IPC team.

**Most frequent challenges encountered in implementing this recommendation**

- Lack of awareness/knowledge of the evidence on the benefit of high FiO₂ for preventing SSIs and its safety.
- Resistance by anaesthetists who are not comfortable with use of high FiO₂ due to the risk of adverse events.
- Ingrained training habits regarding FiO₂ administration.
- Difficulties in the continuous and affordable procurement of oxygen.
- Lack of availability of adequate equipment for oxygen delivery, that is, oxygen cannisters/piped oxygen, oxygen concentrators, high flow masks.
- Lack of evidence-based protocols for the appropriate intraoperative and postoperative administration of high FiO₂.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE "HOW OF IMPROVEMENT"	
SYSTEM CHANGE ('built it') 	- Put in place/improve a sustainable system to reliably procure and deliver oxygen concentrators or cylinders, high flow masks and pulse oximeters, with a dedicated budget and outlined roles and responsibilities (to ensure the appropriate location of equipment, its replacement, as well as reporting to procurement on insufficient supplies or malfunctioning equipment). - Develop/adapt a protocol/SOP to guide high FiO₂ administration according to the recommendation (including roles and responsibilities).
TRAINING AND EDUCATION ('teach it') 	- Put in place/improve a reliable mechanism for producing/ using updated training resources and information for anaesthetists and/or any clinical/surgical staff dedicated to anaesthesia (for example, medical officer anaesthetists) on: - administration of 80% FiO₂ by intubation during the operation and using a high flow mask in the immediate postoperative period; - monitoring oxygen saturation.
MONITORING AND FEEDBACK ('check it') 	- Put in place a monitoring, reporting and feedback system (including roles and responsibilities) regarding: - use of high FiO₂ and adherence to the protocol/SOP; - routine monitoring of oxygen saturation in the recovery period; - availability of oxygen and the necessary equipment and their appropriate location; - adverse events associated with high FiO₂ administration; - perception and knowledge about using high FiO₂; - SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	In collaboration with staff, develop/adapt reminders and messages to be used during clinical or department meetings and targeted at those involved in this intervention.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Organize meetings and focus group discussions with all the right people to discuss the evidence about the effectiveness and safety of this intervention and aim to take a collective decision on the implementation of the recommendation. - Aim to have an anaesthesiology staff champion coordinate this activity and the development of a protocol/SOP embedded within other anaesthesia processes (rather than a new standalone activity that adds a burden of work). - Engage senior management to support this intervention and use relevant opportunities to explain it in the context of the facility commitment to the right surgical safety steps to prevent SSI.

2.3.6 MAINTAINING NORMAL BODY TEMPERATURE (NORMOTHERMIA)



WHO recommendation (conditional): Consider using warming devices in the operating room (OR) and during the surgical procedure for patient body warming with the purpose of reducing SSI.

Scenario

Patients are displaying signs of hypothermia, especially at times when the OR is cold (in evenings during emergency surgery), and thus at risk of complications including SSI.

Problem

Maintaining normothermia is challenging if there are no warming devices available for use in the OR.



Case study

A busy district hospital in a middle-income country performs many emergency operations, especially on the abdomen and the extremities. While temperatures during the day are warm, the operating room can become quite cold at night. Although the recovery room nurses suspect that patients are routinely hypothermic following surgery, the shivering observed during recovery is typically explained as due to the anaesthetic.

The operating room head nursing obtains a thermometer and gives the recovery nurses the task of documenting temperatures of all patients on their arrival to the recovery area as part of the measurement of initial vital signs. She notes that the temperature of patients, particularly after long operations, is routinely $<36^{\circ}\text{C}$. She brings this up with the head of surgery who is impressed with the information collected and the initiative of the nursing team. Subsequently, he brings this information to the attention of all surgical, anaesthetic, and nursing staff during one of their monthly educational meetings. The group then chooses a lead from each discipline to identify potential solutions to prevent intraoperative hypothermia. After carefully reviewing the data collected by the recovery nurses, they conclude that the main risk factors for postoperative hypothermia are operating at night, abdominal cases lasting longer than one hour, and extremity cases lasting longer than two hours. While the hospital is not using any warming devices at the moment, they determine that they can heat the emergency operating room at night with a portable heater to keep the room warm while waiting to evaluate whether warming devices can be procured. All patients undergoing extremity operations are to be routinely covered with extra blankets, which are kept with the bed linen. All patients undergoing emergency abdominal operations, regardless of the time of day, have a final intra-abdominal lavage with sterile saline warmed to 40°C in a heated bath and all intravenous fluids will be warmed using the same technique. They also integrate the elements retained to maintain normothermia in the local surgical safety checklist.

Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- A decision-making process should be undertaken in the facility to consider the use of body warming devices in the operating room and during the surgical procedure to avoid patient hypothermia, with the purpose of reducing the risk of SSI. Health facilities should ensure this occurs as much as possible.
- Warming devices can span fluid warmers, simple or radiant or electric blankets, forced-air warming, circulating hot water devices and radiant warmers. There is uncertainty about what is the optimal device for warming the patient.
- Raising the room temperature in order to avoid patient hypothermia is not an ideal solution as it may cause thermal discomfort for the surgical staff, with an increased risk of dripping sweat onto the surgical site.

WHY

- The maintenance of normothermia ($>36^{\circ}\text{C}$) has a significant benefit in reducing the risk of SSI when compared to non-warming standard care (39).
- There are also additional relevant benefits of warming strategies, such as a decrease in myocardial events, blood loss and transfusion requirements.

WHEN

- Perioperatively. Note: there is insufficient evidence to identify a target temperature to be reached and maintained but for practical purposes a temperature of 37°C should be the goal.

WHO SHOULD BE INVOLVED

- Directly: surgical teams
- To support: procurement services, senior management and IPC, quality improvement and patient safety teams.



Most frequent challenges encountered in implementing this recommendation

- Lack of recognition of hypothermia as a risk factor for SSI and other complications.
- Lack of protocols for measuring intra- and postoperative temperature.
- Lack of resources to procure devices to appropriately warm patients undergoing surgery.
- Lack of an identified person responsible for ensuring normothermia.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	- Put in place/improve a sustainable procurement system to reliably procure and deliver warming devices supplies with outlined roles and responsibilities (replacement, reporting to procurement where supplies are insufficient) and a dedicated budget. - Ensure an appropriate placement of warming devices in the operating room area so that they are readily available within the work flow.
TRAINING AND EDUCATION ('teach it') 	- Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff on: - actions to prevent hypothermia; - patient temperature monitoring; - characteristics and use of the available devices (practical sessions 'walking through' the identified products and their placement).
MONITORING AND FEEDBACK ('check it') 	- Put in place/improve a monitoring, reporting and feedback mechanism (including roles and responsibilities) regarding: - understanding which patients are at risk for postoperative hypothermia; - standard monitoring of patient temperature postoperatively; - how often warming devices are missing when needed; - SSI rates. - Integrate active and passive warming measures into a preoperative briefing or checklist. - Aim to establish a data collection system looking at patients with postoperative complications associated with hypothermia (especially if warming practices do not improve).
COMMUNICATIONS AND REMINDERS ('sell it') 	In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement to constantly alert staff to the risk of hypothermia and the importance of and methods for patient warming.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Encourage the surgical team to discuss how to ensure normothermia and how to close procurement or implementation gaps, if any (for example, ward briefings) etc. - Aim to have a surgical champion coordinate this activity. but embedded within other surgical processes (rather than a new standalone activity that adds a burden of work). - Encourage senior management to use relevant opportunities to explain that the facility is supportive of the right surgical safety steps to prevent SSI.

2.3.7 USE OF PROTOCOLS FOR INTENSIVE PERIOPERATIVE BLOOD GLUCOSE CONTROL



WHO recommendation (conditional):
Consider the use of protocols for intensive perioperative blood glucose control for both diabetic and non-diabetic adult patients undergoing surgical procedures to reduce the risk of SSI.

Scenario

Anaesthesiologists would like to start controlling intraoperative glucose, but are concerned that this new practice might introduce harm to patients as they have not been trained in this practice.

Problem

High blood glucose levels are associated with an increased incidence of wound infections, but hypoglycaemia during surgery is potentially harmful to patients.

Case study

A group of anaesthesia providers has debated performing intensive glucose control for patients undergoing prolonged operations. Only one has been trained in performing this routinely; however, she is the most junior clinician. The anaesthesia group is concerned about hyperglycaemia due to the increased risk of infection, but they are more concerned about hypoglycaemia as they will be blamed for any intraoperative problem that may arise from this. In addition, they do not have glucose monitoring equipment routinely available. As they debate this new practice, the overwhelming response from the group is that this new practice is too risky and could introduce harm to patients who are already at high risk. The clinical staff do not feel comfortable administering insulin to lower high measured glucose levels, nor do they have the materials or budget to add this practice to their workflow. Furthermore, the consequences of a poor outcome from hypoglycaemia during surgery will be blamed on them directly and outweigh the risks of an infection which has multiple potential causes.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- A decision-making process should be undertaken in the facility to consider the use of protocols for intensive perioperative blood glucose control for both diabetic and non-diabetic adult patients undergoing surgical procedures, especially for patients undergoing cardiac surgery and other major surgical procedures.
- An evidence-based protocol should be developed/adapted to put in place and/or standardize this practice and ensure that it is done safely.
- The implementation of this recommendation requires local expertise in glucose control practices and its impact is dependent on relevant resources and the considered local benefits.
- Blood glucose target levels are not standardized and vary in different intensive blood glucose control protocols, but usually they are ≤ 150 mg/dL (8.3 mmol/L) and are achieved by intravenous insulin administration. Assurance that episodes of hypoglycaemia will be avoided is essential.
- The effectiveness of this intervention is not proven for the paediatric population.

WHY

- A protocol with more strict blood glucose target levels could have a significant benefit in reducing SSI rates when compared to a conventional protocol (no target-level blood level definition is universally clear) (40).
- Apart from patients cared for in intensive care units, patients are more likely to receive a conventional protocol and this should be addressed, despite resource and ability concerns.

WHEN

- In the perioperative period: usually in the operating room and in the postoperative period.
- Duration and timing of glucose control differ in the various intensive blood glucose control protocols. In different studies, duration in the postoperative period varied from 18 hours and “until enteral nutrition” to a maximum of 14 days.

WHO SHOULD BE INVOLVED

- Directly: anaesthesiology and surgical teams
- To support: pharmacy and procurement services, senior management.



Most frequent challenges encountered in implementing this recommendation

- Lack of understanding of the importance of hyperglycaemia and its effect on SSI.
- Lack of expertise to manage intensive perioperative blood glucose control.
- Lack of materials and resources to routinely and appropriately monitor intra- and postoperative glucose.
- Discomfort or unfamiliarity with protocols for glucose monitoring.
- High workload during anaesthesia and surgery that preclude appropriate glucose monitoring.
- Fear of patient harm due to hypoglycaemia.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	• Put in place/improve a sustainable system to reliably procure and make glucose monitoring equipment readily available, with a dedicated budget. • Develop/adapt a protocol/SOP to guide intensive perioperative blood glucose monitoring and control (including roles and responsibilities).
TRAINING AND EDUCATION ('teach it') 	• Put in place/improve a reliable mechanism for producing/ using updated training resources and information for any clinical/surgical staff dedicated to anaesthesia (for example, medical officer anaesthetists) on: – blood glucose monitoring; – use of intensive perioperative blood glucose control; – prevention and management of hypoglycaemia.
MONITORING AND FEEDBACK ('check it') 	• Put in place/improve a monitoring, reporting and feedback mechanism (including roles and responsibilities) regarding: – whether all staff are compliant with the protocol; – availability of resources to monitor blood glucose levels; – any adverse events linked to the use of the protocol; – SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	• In collaboration with staff, develop/adapt reminders about the protocol (for example, algorithms for execution to be displayed, pocket cards). • Make sure that the protocol/algorithms are highly visible in the operating room. • Develop a plan for the delivery of messages related to the protocol and the importance of glucose control during clinical or department meetings, as well as and for the integration of new staff.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	• Involve staff in discussions on how to implement the protocol. • Aim to have an anaesthesiology staff champion coordinate this activity, but embedded within other anaesthesia processes (rather than a new standalone activity that adds a burden of work). • Encourage senior management to use relevant opportunities to explain that the facility is supportive of the right surgical safety steps to prevent SSI.

2.3.8 MAINTENANCE OF ADEQUATE CIRCULATING VOLUME CONTROL/NORMOVOLEMIA



WHO recommendation (conditional):
Consider the use of goal-directed
fluid therapy (GDFT) intraoperatively
to reduce the risk of SSI.

Scenario

Anaesthesiologists would like to be more have a more formal discussion around fluid administration during surgery, but do not have any experience with goal-directed fluid therapy.

Problem

Hypo- and hypervolaemia are both potentially associated with higher risk of SSI and affect other clinical outcomes, but specific fluid management strategies require expertise and appropriate equipment.

Case study

A group of anaesthesia providers in a busy district hospital would like to be more purposeful about how they administer intraoperative fluids. A few of them are aware of the studies on GDFT, but they lack experience with these techniques and also frequently lack ancillary mechanisms to monitor haemodynamic status, such as arterial lines and central venous pressure. They have some emergency medication for rescue resuscitation, such as epinephrine (adrenaline) and dopamine, but they do not have pumps to administer this in very specific, titratable amounts. They also administer many anaesthetics via the spinal route, which tends to cause profound hypotension requiring fluid boluses. The team meets to discuss options for GDFT and determines a mechanism to use a combination of heart rate, blood pressure and urine output (for catheterized patients) to direct fluid resuscitation. They also decide to use low-dose dopamine for patients clearly presenting with hypotension from spinal anaesthesia (that is, not yet undergoing surgery or without evidence of blood loss or sepsis). They meet weekly to discuss issues and potential problems that have occurred over the past week.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- A decision-making process should be undertaken in the facility to consider the use of GDFT in the intra- and postoperative periods to reduce the risk of SSI.
- An evidence-based protocol should be developed/adapted to put in place and/or standardize this practice and ensure that it is done safely.
- The implementation of this recommendation requires local expertise in fluid management practices and its impact is dependent on relevant resources and the considered local benefits.
- Optimization of GDFT is preferably based on dynamic pre-load parameters (that is, pulse pressure variation, systolic pressure variation) derived from arterial catheter measurements (when an arterial line is indicated) or minimal invasive alternatives.
- The impact of this recommendation is dependent on relevant resources and the considered local benefits.
- The effectiveness of this intervention is not proven for paediatric patients.

WHY

- Perioperative GDFT has a significant benefit in reducing the SSI rate compared to standard fluid management (41).
- The need for specific fluid management strategies, such as GDFT or restrictive fluid management, may be used during surgery for other purposes, considering that both fluid overload and hypovolaemia are likely to affect other clinical outcomes.

WHEN

- In the intra- and postoperative periods.

WHO SHOULD BE INVOLVED

- Directly: anaesthesiology and surgical teams.
- To support: pharmacy and procurement services, senior management.



Most frequent challenges encountered in implementing this recommendation

- Lack of understanding of the importance of appropriate fluid resuscitation and its effect on SSI.
- Lack of expertise, resources and monitoring devices to routinely and appropriately monitor hemodynamics and resuscitation endpoints.
- Discomfort or unfamiliarity with protocols and processes for appropriate GDFT.
- High workload during anaesthesia and surgery that preclude appropriate GDFT.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”

SYSTEM CHANGE ('built it') 	• Put in place/improve a sustainable system to reliably procure supplies of necessary rescue drugs, intravenous pumps and other materials, with a dedicated budget. • Develop/adapt a GDFT protocol (or similar document) outlining standards and roles and responsibilities.
TRAINING AND EDUCATION ('teach it') 	• Put in place/improve a reliable mechanism for producing/ using updated training resources and information for any clinical/surgical staff dedicated to anaesthesia (for example, medical officer anaesthetists) on: – monitoring volaemia; – use of the GDFT protocol.
MONITORING AND FEEDBACK ('check it') 	• Put in place/improve a monitoring reporting and feedback mechanism (including roles and responsibilities) regarding: – compliance with the (new) GDFT protocol; – monitoring of fluid resuscitation volume and the need for rescue drugs (such as average fluid volume administration per hour, hemodynamics, etc.); – reliable availability of supplies for GDFT; – any adverse events linked to the use of the protocol; – SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	• In collaboration with staff, develop/adapt reminders about the protocol (for example, algorithms for execution to be displayed, pocket cards, etc.). • Make sure that the protocol/algorithms are highly visible in the operating room.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	• Involve staff in discussions on how to implement the protocol. • Aim to have an anaesthesiology staff champion coordinate this activity, but embedded within other anaesthesia processes (rather than a new standalone activity that adds a burden of work). • Encourage senior management to use relevant opportunities to explain that the facility is supportive of the right surgical safety steps to prevent SSI.

2.3.9 INCISIONAL WOUND IRRIGATION



WHO recommendation (conditional): Consider the use of irrigation of the incisional wound with an aqueous povidone iodine (PVP-I) 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.

Scenario

The pharmacy notes that antibiotic irrigation has been used more frequently during surgery and wants to evaluate why this is happening.

Problem

It is appropriate to perform wound irrigation with aqueous iodine solution instead of using an antibiotic irrigation solution to prevent SSIs, but surgeons prefer the latter because they feel that it is more effective.

Case study

The pharmacist of a small district hospital has noticed that the amount of antibiotic used for surgical wound irrigation has increased since the arrival of a new obstetric surgeon. She determines that the surgeon is using antibiotic irrigation routinely following caesarean delivery. Based on the WHO guidelines, she approaches the surgeon about switching to aqueous iodine for wound irrigation and provides a cost comparison. They agree to follow wound results for several weeks to determine if there is a change in SSI outcomes.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- A decision-making process should be undertaken locally to consider using irrigation of the incisional wound with an aqueous PVP-I solution before closure for the purpose of preventing SSI and not saline or antibiotic solutions, particularly in clean and clean-contaminated wounds.
- An evidence-based protocol should be developed/adapted to put in place and/or standardize this practice in order to ensure that it is done safely, as well as identifying surgical procedures for which it applies.
- In settings with limited resources, there are cost and procurement implications for the devices (for example, pulse pressure devices) used for wound irrigation and there may be concerns about the sterility of solutions used.
- The effectiveness of irrigation of the incisional wound with an aqueous PVP-I solution is not proven for paediatric patients.

WHY

- Incisional wound irrigation with PVP-I solution is beneficial compared to irrigation with a saline solution.
- There is no evidence that irrigation of the incisional wound with antibiotic solutions is beneficial to reduce the risk of SSI and this practice is associated with an unnecessary risk of contributing to AMR (42).

WHEN

- Intraoperatively, before closure of incisional wounds.

WHO SHOULD BE INVOLVED

- Directly: surgical teams.
- To support: pharmacy and procurement services, senior management and IPC teams.



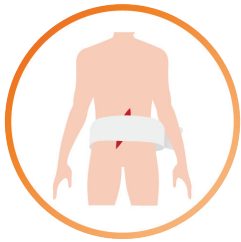
Most frequent challenges encountered in implementing this recommendation

- Lack of knowledge about the appropriate selection of irrigation solutions and additives.
- Ingrained habits regarding the use of saline or antibiotic solutions for wound irrigation.
- Lack of appropriate supplies (PVP-I) for wound irrigation.
- Poor communication or lack of relationship between surgical/operating room staff, pharmacy/procurement staff and the IPC team.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	- Put in place/improve a sustainable system to reliably procure PVP-I solutions for wound irrigation, with a dedicated budget. - Develop/adapt a protocol (or similar document) outlining standard practices and a list of surgical procedures indicated for wound irrigation, including roles and responsibilities.
TRAINING AND EDUCATION ('teach it') 	- Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff (and/or embed information in existing training opportunities) on appropriate wound irrigation. - Reinforce biological mechanisms to explain and support the reasons for the use of PVP-I for wound irrigation. including reference to preventing AMR.
MONITORING AND FEEDBACK ('check it') 	- Put in place/improve a monitoring, reporting and feedback mechanism (for example, chart review), including roles and responsibilities regarding: - reliable availability of materials for appropriate incisional wound irrigation; - staff adherence to the protocol for irrigation practices; - cost analysis where possible; - SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement to promote appropriate wound irrigation practices.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Involve staff in discussions about using an aqueous PVP-I solution and <u>not</u> saline or antibiotic solutions for wound irrigation. - Identify surgical champions to promote this practice. - Encourage senior management to use relevant opportunities to explain that the facility is supportive of the right surgical safety steps to prevent SSI.

2.3.10 WOUND PROTECTOR DEVICES



WHO recommendation (conditional):
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.

Scenario

A general surgeon would like to introduce the use of a wound protector to the hospital, including to his surgical partners.

Problem

Wound protector devices may be of benefit for reducing SSI, but commercial devices can be costly.

Case study

A new general surgeon specializing in colorectal surgery would like to introduce a wound protector to the hospital, including to his surgical partners. He has used similar devices during his training and found them useful for both preventing SSIs and providing fascial retraction during surgery. A commercial device is available, but expensive, and the hospital management resists. The surgeon decides to assign a medical student to the task of performing a systematic review of any studies on the cost-effectiveness of wound protectors to reduce SSI and other complications. He intends to use these data to discuss again with the hospital management.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- A decision-making process should be undertaken locally to consider using wound protector devices in clean-contaminated, contaminated and dirty abdominal surgical procedures for the purpose of reducing SSI.
- A process to assess the type of devices available from the market and their cost should be put in place; in settings with limited resources, this intervention may not be prioritized compared to other preventive measures to reduce SSI.
- The effectiveness of this intervention is not proven for paediatric patients.

WHY

- These devices are intended to reduce wound edge contamination to a minimum during abdominal surgical procedures, including contamination from outside (clean surgery) and inside the peritoneal cavity (clean-contaminated, contaminated and dirty surgery). They comprise a non-adhesive plastic sheath attached to a single or double stiff ring that firmly secures the sheath to the wound edges.
- Single- or double-ring wound protector devices have been shown to be beneficial in reducing the rate of SSI compared with regular wound protection (in adult patients) (43).

WHEN

- In the intraoperative period.

WHO SHOULD BE INVOLVED

- Directly: surgical teams.
- To support: pharmacy and procurement services, senior management.



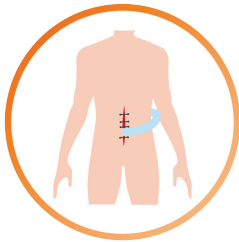
Most frequent challenges encountered in implementing this recommendation

- Lack of knowledge of the way wound protector devices work and their benefit to reduce SSI following clean-contaminated, contaminated and dirty abdominal surgical procedures.
- Difficulties to procure wound protector devices.
- Lack of financial support.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	- Put in place/improve a sustainable system to evaluate the cost and reliably procure wound protector devices. - Develop/adapt a protocol (or similar document) outlining how to use wound protector devices and a list of surgical procedures indicated for their use, including roles and responsibilities.
TRAINING AND EDUCATION ('teach it') 	Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff (and/or embed information in existing training opportunities) on indications for and how to use wound protector devices, including available evidence of their benefit.
MONITORING AND FEEDBACK ('check it') 	- Put in place/improve a monitoring, reporting and feedback mechanism (including roles and responsibilities) regarding: - use of wound protector devices in recommended surgical procedures; - reliable availability of wound protector devices in the operating room; - SSI rates. - Consider knowledge and perception surveys on use of wound protectors, if necessary.
COMMUNICATIONS AND REMINDERS ('sell it') 	In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement, on the appropriate use of wound protector devices, including practical materials (for example, pictorial material or a video illustrating the device and how to use it).
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Gather the support of all senior influencers and champions when introducing the use of wound protector devices. - Encourage senior management to use relevant opportunities to explain that the facility is supportive of the right surgical safety steps to prevent SSI.

2.3.11 PROPHYLACTIC NEGATIVE PRESSURE WOUND THERAPY



WHO recommendation (conditional): Consider the use of prophylactic negative pressure wound therapy (pNPWT) in adult patients on primarily closed surgical incisions in high-risk wounds, for the purpose of the prevention of SSI, while taking resources into account.

Scenario

The surgeons at a busy urban hospital have seen an improvised negative pressure device used at a neighbouring private clinic and would like to introduce a similar one to help with wound care in some high-risk surgical wounds.

Problem

High-risk wounds are frequently complicated to manage and can be the source of infection; NPWT can improve wound healing in high-risk wounds, but can be resource intensive.

Case study

A number of surgeons at a busy urban hospital also work at a private clinic and use a pNPWT device frequently for their high-risk surgical wounds. They have observed that it seems to reduce wound care efforts by the nursing staff and helps with wound healing, as well as being well-tolerated by patients. While they note that such a device would be useful in the hospital, they are not prepared to develop it or train the nurses on how to manage it. One surgeon engages a surgical registrar and a medical student interested in surgery to develop a training programme for the nurses and explore how they might be able to introduce the device. The registrar and student spend time at the private clinic and with the collaboration of the nurses there, they develop a curriculum and create a training programme that incorporates the nurses from the private clinic to help with training and education.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- A decision-making process should be undertaken locally to consider using prophylactic negative pressure wound therapy (pNPWT) in adult patients on primarily closed surgical incisions in high-risk wounds for the purpose of reducing SSI.
- pNPWT consists of a closed sealed system used on primarily closed surgical incisions, connected to a vacuum pump, which maintains negative pressure on the wound surface.
- Before adopting their use, a process to assess the type of pNPWT devices available on the market and their cost is critical in both HIC and LMICs as these devices are expensive; in settings with limited resources, this intervention may not be prioritized compared to other preventive measures to reduce SSI.
- It may be possible to construct a non-portable, locally-made pNPWT device at low cost for LMICs.

WHY

- In primarily closed surgical incisions in high-risk wounds (for example, in the case of poor tissue perfusion due to surrounding soft tissue/skin damage, decreased blood flow, bleeding/haematoma, dead space or intraoperative contamination), pNPWT could have a benefit in reducing the risk of SSI in adult patients (44).

WHEN

- In the perioperative and postoperative periods.

WHO SHOULD BE INVOLVED

- Directly: surgical teams.
- To support: wound management teams, procurement services, and senior management.



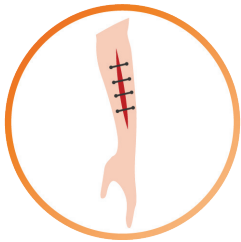
Most frequent challenges encountered in implementing this recommendation

- Lack of knowledge of the way pNPWT devices work and their benefit to reduce SSI.
- Lack of local suppliers for pNPWT or materials for local production.
- Lack of financial support.
- High workload of ward staff.
- Unavailability of training/education on how to place, use or manage pNPWT devices.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	- Put in place/improve a sustainable system to evaluate the cost and reliable procurement of pNPWT devices and/or equipment to construct it locally. - Develop/adapt a protocol (or similar document) outlining the use of pNPWT (including roles and responsibilities). - If a pNPWT device is constructed locally, develop a clear procedure and ensure that the necessary expertise is available.
TRAINING AND EDUCATION ('teach it') 	Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff (and/or embed information in existing training opportunities) on indications for and how to use pNPWT devices, based on the protocol on appropriate pNPWT use and including available evidence.
MONITORING AND FEEDBACK ('check it') 	- Put in place a monitoring, reporting and feedback system (including roles and responsibilities regarding: - reliable availability of pNPWT devices in the surgical service; - appropriate use of pNPWT; - cost of pNPWT devices; - SSI rates. - Consider a qualitative assessment of acceptability of pNPWT.
COMMUNICATIONS AND REMINDERS ('sell it') 	In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement to display information about the appropriate use of pNPWT devices, including practical materials (for example, pictorial material or a video illustrating the device and how to use it).
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Secure the support of all senior influencers and champions when introducing the use of the pNPWT devices. - Involve the surgical team in standardizing this practice (through the protocol) and learn from the use of pNPWT by facilitating discussions on how this intervention is implemented.

2.3.12 ANTIMICROBIAL-COATED SUTURES



WHO recommendation (conditional):
Consider the use of triclosan-coated sutures for the purpose of reducing the risk of SSI, independent of the type of surgery.

Scenario

Several general surgeons in a referral hospital request that triclosan-coated sutures be made available in suture supplies.

Problem

Triclosan-coated suture may reduce the risk of SSI, but they can also be more costly than non-coated sutures.

Case study

The general surgeons in a tertiary referral hospital want to start using triclosan-coated sutures for all clean-contaminated, contaminated, and dirty abdominal incisions. They request that they be included in the suture supplies available to them during surgery. The hospital administrator refuses their request as each suture would cost more than what is currently paid for all non coated sutures. The surgeons meet with the hospital administrator and the procurement office to discuss the decision and present data demonstrating the potential benefits of triclosan-coated sutures to reduce infection. The overall infection rate for abdominal surgery in the hospital is reported to be 1.4%, but the team believes this to be an underestimate. Regardless of the actual number of infections, they all agree that the number needed to treat to decrease the infection rate would likely keep the additional cost from being economical, and the extra costs would mean that other types of suture could not be purchased. Finally, everyone decides not to purchase the coated sutures until they have improved local data on surgical infection rates following laparotomy.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- A decision-making process should be undertaken locally to consider using triclosan-coated sutures for the purpose of reducing the risk of SSI.
- The impact of this recommendation is dependent on relevant resources and the considered local benefits.
- A process to assess the products available from the market and their cost should be put in place; in settings with limited resources, this intervention may not be prioritized compared to other preventive measures to reduce SSI.
- If the use of antimicrobial coated sutures is considered locally, the manufacturer's instructions should be evaluated for any contraindications, particularly for paediatric patients.

WHY

- Evidence showed that antimicrobial-coated sutures have significant benefits in reducing SSI rates in patients undergoing surgical procedures when compared to non-coated sutures (the effect seemed to be independent of the type of suture, procedure or wound contamination classification). The recommendation refers to triclosan coated sutures because all relevant studies available when it was formulated, tested this type of sutures (45, 46).

WHEN

- Intraoperatively.

WHO SHOULD BE INVOLVED

- Directly: surgical teams.
- To support: procurement services, senior management and IPC teams.



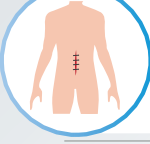
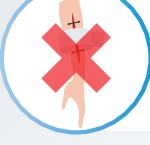
Most frequent challenges encountered in implementing this recommendation

- Lack of understanding and knowledge about the benefit of using coated sutures to reduce SSI.
- Ingrained practice patterns.
- Lack of financial support.
- Poor communication between surgical/operating room staff and procurement.
- Difficulties procuring triclosan-coated sutures.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	- Put in place/improve a sustainable system to evaluate the market options and the cost of triclosan-coated sutures compared with benefits, including their reliable procurement. - Ensure that a dedicated, ongoing budget is agreed upon. - Put in place a protocol/SOP for the use of coated sutures if planned as a routine part of standard materials provided for surgeons performing laparotomy, for example, within a protocol outlining roles and responsibilities.
TRAINING AND EDUCATION ('teach it') 	Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff (and/or embed information in existing training opportunities and surgical staff updates) on the use of antimicrobial-coated sutures, including the available evidence of potential benefits.
MONITORING AND FEEDBACK ('check it') 	- Put in place a monitoring, reporting and feedback system (including roles and responsibilities) regarding: - outcomes following laparotomy at the facility to assess the historic accuracy of documented infections and determine if costs could be saved by using coated sutures (suture costs weighed against the benefits of their use and the potential savings from reduced infections; - reliable availability of coated sutures; - SSI rates. - Assess the evidence of the efficacy of coated sutures for the prevention of SSI by collating valid data. - Consider staff perception surveys as necessary to inform training and reminders.
COMMUNICATIONS AND REMINDERS ('sell it') 	In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement to prompt about the use of antimicrobial-coated sutures as necessary.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	- Gather the support of all senior influencers and champions when introducing the use of antimicrobial-coated sutures. - Engage surgeons to demonstrate visible commitment to a culture that supports regular updates to each other in order to make collective decisions about any further process changes.

2.4 POSTOPERATIVE MEASURES

		ACTION	SUPPORTED BY
	Do NOT prolong surgical antibiotic prophylaxis in the postoperative period	 CLINICAL STAFF	 SURGEON  PHARMACY AND POLICY (STOPPING DELIVERY)
	Do NOT continue surgical antibiotic prophylaxis due to the presence of a drain Remove wound drain when clinically indicated	 SURGICAL TEAM AND CLINICAL STAFF	 ANTIBIOTIC POLICY IN PLACE
	Administer 80% FiO₂ for 2–6 hours post-op	 WARD NURSE	 DOCTOR PRESCRIPTION (AND PROTOCOL IN PLACE), ESTATES/MAINTENANCE STAFF
	Evaluate and manage wound appropriately, including cleansing, dressing and care, according to the given wound situation	 CLINICAL STAFF	 DOCTOR REVIEW
	Do NOT use advanced dressings of any sort (use standard dressings instead)	 WARD NURSE	 PROCUREMENT AND SURGICAL TEAM

2.4.1 SURGICAL ANTIBIOTIC PROPHYLAXIS PROLONGATION



WHO recommendation (strong):
Do not prolong surgical antibiotic prophylaxis after completion of the operation.

Scenario

The IPC team notes that surgical antibiotic prophylaxis (SAP) is being administered for up to a week following surgery.

Problem

Surgeons are reassured by prolonging SAP to avoid infections for several days after the operation. However, they do not realize that this does not work and that it increases the potential for AMR in the surgical service.

Case study

A lead surgeon has issued a memo to his staff stating that SAP must be continued postoperatively to prevent surgical infections. The IPC team repeatedly requests a meeting with him to adjust the policy to reflect WHO guideline recommendations, but is unsuccessful. One IPC team member makes contact with a new surgical registrar who notes that her previous hospital gave SAP within 120 minutes of incision and almost never continued antibiotics postoperatively. The IPC team works with the registrar to present the WHO and United States Centers for Disease Control and Prevention guidelines to the surgical staff, including data on administration and antibiotic stewardship. Following the presentation, they engage with the hospital administration, other surgeons and the pharmacists to revise the protocol for antibiotic use and continue to work to convince the lead surgeon to join in the effort.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- SAP should not be prolonged after completion of the operation. Instructions about SAP discontinuation should be clear within the local standardized SAP protocol.
- Adherence to this recommendation should be monitored along with the other key aspects of appropriate SAP included in the local protocol.
- This information is connected to the one on timing for SAP administration, which includes also other key principles for appropriate SAP.

WHY

- A large number of studies shows that SAP prolongation has no benefit to reduce SSI (47).
- Correct use of SAP, in particular avoiding its unnecessary prolongation, is important to prevent the emergence of AMR pathogens that can cause serious infections to the patient.
- SAP prolongation should not be a compensation for poor IPC practices and poor routine behaviour.
- It does not improve wound outcomes in “dirty” environments where sterility in the operating room is not guaranteed.

WHEN

- In the postoperative period.

WHO SHOULD BE INVOLVED

- Directly: surgical teams.
- To support: pharmacy services and IPC and quality improvement teams.



Most frequent challenges encountered in implementing this recommendation

- Absence of standardized evidence-based protocols for appropriate SAP, including its discontinuation after the operation.
- Unclear roles and responsibilities about who is in charge of ensuring that antibiotics are not given after the operation unless an infection is suspected or diagnosed.
- Lack of awareness/knowledge of the evidence for not prolonging prophylactic antibiotics following surgery.
- Resistance by surgeons who are not comfortable stopping antibiotics in the postoperative period.
- Ingrained practice habits regarding antibiotic administration.
- Pressure from patients around extending antibiotic use after surgery.
- Lack of protocols for stopping antibiotics postoperatively.
- Incentives/pressure from pharmaceutical companies/distributors to inappropriately prolong antibiotic administration.
- Poor communication/relationship between IPC and surgical teams.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

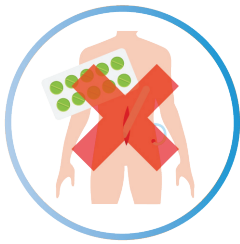
ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	• Include clear instructions about SAP discontinuation within the locally adapted SAP protocol.* • Put in place/improve a sustainable system to ensure that SAP orders are not continued after the operation (connected 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.

* See section on SAP timing.

WHO supporting tools already available at:
<http://www.who.int/infection-prevention/tools/surgical/en/>

- IPC training – prevention of surgical site infection – slides 72-73
- Handle antibiotics with care in surgery - Infographic
- Surgical Unit-based Safety Programme (SUSP) leaders' video
- Surgical site infection surveillance perioperative data collection form

2.4.2 ANTIBIOTIC PROPHYLAXIS IN THE PRESENCE OF A DRAIN AND OPTIMAL TIMING FOR WOUND DRAIN REMOVAL



WHO recommendation (conditional):
Perioperative antibiotic prophylaxis should not be continued in the presence of a wound drain for the purpose of preventing SSI. Drains should be removed when clinically indicated.

Scenario

The IPC team notes that surgical patients with wound drains are routinely receiving antibiotics postoperatively without any clear indication.

Problem

The surgical team is convinced that drains are an important risk factor for postoperative infection and thus antibiotic prophylaxis should be given.

Case study

The IPC team notes that antibiotics are routinely continued in surgical patients postoperatively for no specific indication, particularly when drains are present. During a team discussion, the surgeons note the need for antibiotics when drains are present to prevent infections, especially since they consider the wards to be particularly dirty. The IPC team presents the WHO and United States Centers for Disease Control and Prevention recommendations regarding the discontinuation of routine antibiotics for patients with drains. Despite their review of the data, the surgeons do not alter their practice and continue to administer postoperative antibiotics.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- The presence of a wound drain should not lead to the continuation of perioperative antibiotic prophylaxis postoperatively for the purpose of preventing SSI. A local decision-making process should be undertaken to ensure avoidance of this practice.
- Instructions about no need for perioperative antibiotic prophylaxis in the presence of a drain should be clear within the local standardized and evidence-based SAP protocol and/or other protocols for the appropriate use of antibiotics in surgical services.
- Drains should be removed when clinically indicated. Clear SOPs on appropriate drain management should be developed and made available to staff.
- This information is connected to the others on the timing for SAP administration and SAP discontinuation postoperatively, which include also other key principles for appropriate SAP.

WHY

- There is no evidence to suggest that the continuation of perioperative antibiotic prophylaxis in the presence of a wound drain is beneficial to prevent postoperative infections (48).
- Correct use of antibiotics, in particular avoiding unnecessary prophylaxis in the presence of a drain, is important to prevent the emergence of antimicrobial-resistant pathogens that can cause serious disease to the patient.

WHEN

- In the postoperative period.

WHO SHOULD BE INVOLVED

- Directly: surgical teams.
- To support: pharmacy services and IPC and quality improvement teams.



Most frequent challenges encountered in implementing this recommendation

- Absence of standardized and evidence-based protocols for the appropriate use of antibiotics/SAP in surgical services, including avoiding perioperative antibiotic prophylaxis in the presence of a wound drain.
- Lack of awareness/knowledge of the evidence for no benefit of using perioperative antibiotic prophylaxis to prevent infection in the presence of a wound drain.
- Resistance by surgeons who are not comfortable stopping antibiotics in the postoperative period.
- Ingrained training habits regarding antibiotic administration.
- Pressure from patients around extending antibiotic use after surgery.
- Lack of protocols for stopping antibiotics postoperatively.
- Incentives/pressure from pharmaceutical companies/distributors to inappropriately prolong antibiotic administration.
- Poor communication/relationship between IPC and surgical teams.
- Ingrained practice habits and fear of infections if antibiotics are not used among the surgical team.
- Poor communication or a lack of relationship between surgical and IPC teams.
- Perceived advantages of ongoing antibiotic use by patients.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision-making according to the facility needs and goals.

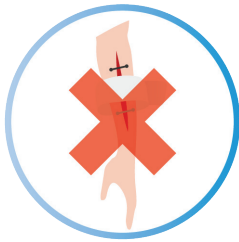
ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”

SYSTEM CHANGE ('built it') 	• Develop/put in place clear instructions, in a locally agreed format, about no need for perioperative antibiotic prophylaxis in the presence of a drain, preferably within the locally adapted SAP protocol and/or other protocols related to the appropriate use of antibiotics in surgical services. • Put in place/improve a sustainable system (including roles and responsibilities) to ensure that antibiotics are not given in the presence of a drain, unless an infection is suspected or diagnosed (connected to orders in electronic patient records, if existing). • Develop/improve a protocol (or similar document) for appropriate drain management, including encouraging drain removal in a timely manner when no longer clinically needed.
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 the appropriate use of antibiotics in surgical services and removal of drains, including the available evidence.
MONITORING AND FEEDBACK ('check it') 	• Conduct knowledge and perception survey(s) on the use of antibiotics. • Put in place a monitoring, reporting and feedback system (including roles and responsibilities) regarding: – staff knowledge and perception about the need for antibiotic prophylaxis in the presence of a drain; – frequency of the prolonged SAP use in the presence of drains; – removal of drains when clinically indicated; – SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	• In collaboration with staff, develop/adapt reminders and agree upon their most relevant placement on appropriate drain management and removal of drains, including appropriate antibiotic use in surgical services, and display them in the most suitable areas.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	• Engage leaders and champions among surgical and anaesthesiology staff to drive change on appropriate drain management, including avoiding perioperative antibiotic prophylaxis. • Engage senior management to issue messages on a regular basis to support this change that are also linked to reducing AMR in the facility.

WHO supporting tools already available at:
<http://www.who.int/infection-prevention/tools/surgical/en/>

- Handle antibiotics with care in surgery - Infographic

2.4.3 ADVANCED DRESSINGS



WHO recommendation (conditional):
Do not use any type of advanced dressing over a standard dressing on primarily closed surgical wounds for the purpose of preventing SSI.

Scenario

The surgeons at a busy hospital caring for many injured patients including burn patients, would like to start using hydrocolloid and hydrogel advanced dressings for difficult wound, but the ward nurses are resistant to implement this change.

Problem

The surgical team is convinced that drains are an important risk factor for postoperative infection and thus antibiotic prophylaxis should be given.

Case study

The plastic and burn surgeons at a busy hospital have noted that the wounds of ward patients are particularly complex, and have introduced the idea of using advanced dressings, including hydrogels and hydrocolloid, for wound care. They also motivate this proposal arguing that these advanced dressings have a benefit in preventing SSI and therefore, they request the hospital to include these in the dressing supplies available to the surgical ward nurses and plan educational sessions to train the nurses on how to apply and use them. The nurses are concerned as they care for large numbers of wounds and they prefer to use the standard dressings; thus, they are reluctant to change. A research nurse also makes a rapid review of the literature, but she does not find any clear evidence of advanced dressing benefit in preventing SSI. The nurses express their concerns to the surgeons and the hospital administration. The senior managers also supported by the procurement services, consider these arguments and agree that this change would be not sufficiently justified and costly.



Suggestions for making improvements at local level – how do I change the situation to meet the evidence-based recommendation?

SUMMARY OF THE RECOMMENDATION: WHAT, WHY, WHEN AND WHO

WHAT HAS TO BE ADDRESSED

- Advanced dressings should not be preferred over standard dressings (dry absorbent dressings) on primarily closed surgical wounds for the purpose of reducing SSI.
- A local process for ensuring that these dressings are not routinely used should be instituted.

WHY

- There is no evidence that using advanced dressings significantly reduces SSI compared to standard dressings. A wide range of dressings are available and their use may not be clear to all staff. Advanced dressings are mainly hydrocolloid or hydrogels or fibrous hydrocolloid or polyurethane matrix hydrocolloid dressings and vapour-permeable films (prophylactic NPWT is dealt with in a separate chapter) (49).
- Availability of advanced dressings may be limited in LMICs. In addition, their purchase might represent a financial burden in a context where the investment of resources could be directed towards other more useful preventive practices.
- Possible harms associated with the use of advanced dressings have been reported. Allergic reactions or skin irritations may develop with silver-containing dressings. With ionic silver dressings, there could be possible exposure of patients and health workers to nanoparticles. Microbial resistance to silver and polyhexamethylene biguanide may develop.

WHEN

- In the postoperative period.

WHO SHOULD BE INVOLVED

- Directly: surgical teams, ward and wound management teams.
- To support: procurement services, senior management and IPC teams.



Most frequent challenges encountered in implementing this recommendation

- Lack of awareness/knowledge that the evidence does not show any benefit of advanced dressings in reducing the SSI rate.
- Lack of wound care protocols.
- Ingrained practice patterns, including resistance and misperception by staff who are convinced that they are beneficial to reduce workload and SSI.
- Sales pressure from manufacturers/distributors.
- Perceived advantages of advanced dressing use by patients.

The table below should be read in conjunction with the explanations and details on the WHO multimodal improvement strategy provided in Part 2.1. It provides a summary of actions to consider when implementing the strategy to improve the situation regarding this recommendation in a practical way. These are suggestions that proved to be effective to help achieve sustainable improvement, but they require local decision making according to the facility needs and goals.

ELEMENTS OF THE MULTIMODAL STRATEGY - THE “HOW OF IMPROVEMENT”	
SYSTEM CHANGE ('built it') 	• Establish a careful local decision-making process not to purchase advanced dressings, including presentation of data on cost-effectiveness and proposals for investing resources in other preventive measures. • Put in place /improve a sustainable procurement system to reliably source and deliver standard dressings, including a dedicated budget. • Develop/adapt a protocol (or similar document) for wound management, which outlines the use of standard dressings on primarily closed surgical wounds, when necessary.
TRAINING AND EDUCATION ('teach it') 	• Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff on the lack of benefit of using advanced dressings (using the available international guidelines as evidence). • Put in place/improve a reliable mechanism for producing/ using updated training resources and information for staff on the use of standard dressings on primarily closed surgical wounds in a range of formats and embedded into other wound management training (use the WHO video on caring for a postoperative wound).
MONITORING AND FEEDBACK ('check it') 	• Consider a survey to understand why advanced dressings are requested, how they are used, who uses them and under what circumstances (as necessary). • Put in place a monitoring, reporting and feedback system (including roles and responsibilities) regarding: – availability of standard dressings; – use of standard dressings (feedback on their acceptability and tolerability); – wound management practices; – SSI rates.
COMMUNICATIONS AND REMINDERS ('sell it') 	• In collaboration with staff, develop/adapt/ implement reminders and agree upon their most relevant placement on appropriate postoperative wound management practices, for example, posters, flyers or stickers, including on the use of standard dressings. • Develop a range of messages that remind relevant staff why advanced dressings are not useful for SSI prevention, including the fact that they represent an investment of resources that can be used for other preventive measures.
SAFETY CLIMATE AND CULTURE CHANGE ('live it') 	• Identify champions to promote the use of standard dressings in the surgical team. • Secure the commitment of senior leaders to promote cost-saving activities, while demonstrating their knowledge of best practices for SSI prevention, for example, at town hall meetings.

WHO supporting tools already available at:

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

- Focus on caring for a patient with a postoperative wound – poster
- Focus on caring for a patient with a postoperative wound – video
- IPC training – prevention of SSI – slides 91-97



SUGGESTIONS OF TOOLS THAT COULD BE DEVELOPED AT LOCAL LEVEL

Suggestions of tools that could be developed at local level

- Template plan for reliably producing and delivering training and information resources (note: this could then be used when necessary for any SSI recommendations).
- Template plan for reliably delivering products, for example, to patients and hospital departments.
- Data collection tools.
- Local protocols.
- A roles and responsibilities protocol for ensuring that products are reliably available and placed in the right location/s; this must include the relevant clinical staff (note: this could then be used when necessary for any SSI recommendations).
- Training slides/other materials.
- Patient leaflets and other booklets.
- Posters and infographics.
- Draft scripts for senior facility leaders.
- A draft grand rounds schedule for all SSI prevention topics.
- Advocacy documents for influencing central procurement departments.
- Knowledge and perception tests – WHO key facts document can help inform this tool.
- Draft script/messages for community leaders.
- Draft social media messages.
- Video messages.
- Targeted business cases.
- Template SOPs.

4

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ANNEXES

Appendix 1

The Surgical Unit-based Safety Programme (SUSP) approach to implementing an intervention.

The SUSP approach comprises a multimodal intervention combining adaptive and technical approaches and aimed at improving the safety climate in surgical services, with a strong emphasis on local leadership and implementation of a bundle of SSI prevention measures identified by local teams as a priority for improvement.

A stepwise implementation approach was used, including five phases and a range of tools.

Step-wise implementation phases

- Phase 1 - *a preparatory phase* - where teams, including the external project support experts and local senior surgeons' (surgical team leads) hospitals, adapted or co-developed tools and protocols. During this phase, local core teams also identified the key SSI prevention measures to be prioritized and prepared all the necessary conditions for the start of SSI surveillance and the roll-out of the intervention, for example, procurement of equipment.
- Phase 2 – *a baseline assessment* conducted over a 10-month period, included the start of SSI surveillance and monitoring of a range of process indicators related to key SSI prevention measures.

- Phase 3 - *the intervention* - the roll-out of the intervention.
- Phase 4 - *follow-up assessment* conducted over a 10-month period – this represented the first evaluation period of the impact of the intervention.
- Phase 5 - *sustainability assessment* (6 months) – represented the longer-term follow-up evaluation when the intervention had become integrated in the regular process of care.

The multimodal intervention comprised two integrated components:

1. six technical SSI prevention measures to be implemented or improved;
2. an adaptive approach based on the Comprehensive Unit-based Safety Programme (CUSP) (<https://www.ahrq.gov/professionals/education/curriculum-tools/cusptoolkit/index.html>) and the use of a range of adaptive, safety climate-oriented tools.

The adaptive approach specifically aimed to create or improve the local safety climate and motivate local teams to comply with SSI prevention measures implemented through the intervention. An adaptive approach includes actions

to explore and discuss local beliefs about patient safety, to engage local leadership, to identify and support local champions, to improve communications, and promote accountability of frontline staff and teams. The approach is supported by a range of tools including the use of educational videos, posters, and discussion-oriented exercises, including tools to facilitate the engagement of executives and teams, identify defects, barriers to improvement and mitigation measures. It also aims to support infrastructure development that will improve teamwork and help teams to learn from mistakes.

A number of tools available through CUSP and WHO were adapted and used at local level. For example, the 'Perioperative Staff Safety Assessment Tool' was designed to help surgical teams to assess the gaps that most frequently cause SSI in the local context.

Activities and actions consistently carried out at each site, with additional local adaptations and initiatives are described in the published article (10).

Appendix 2

WHO guideline summary for surgical hand preparation.

WHO recommendation from the global guidelines for the prevention of SSI (strong): Surgical hand preparation should be performed by scrubbing with either a suitable antimicrobial soap and water or using a suitable alcohol-based handrub (ABHR) before donning sterile gloves

WHO recommendations from the guidelines on hand hygiene in health care:

- A.** Remove rings, wrist watch and bracelets before beginning surgical hand preparation (II). Artificial nails are prohibited (IB).
- B.** Sinks should be designed to reduce the risk of splashes (II).
- C.** If hands are visibly soiled, wash hands with plain soap before surgical hand preparation (II). Remove debris from underneath fingernails using a nail cleaner, preferably under running water (II).
- D.** Brushes are not recommended for surgical hand preparation (IB).
- E.** Surgical hand antisepsis should be performed using either a suitable antimicrobial soap or ABHR before donning sterile gloves, preferably with a product ensuring sustained activity (IB).
- F.** If quality of water is not assured in the operating room, surgical hand antisepsis using an ABHR is recommended before donning sterile gloves when performing surgical procedures (II).
- G.** When performing surgical hand antisepsis using an antimicrobial soap, scrub hands and forearms for the length of time recommended by the manufacturer, typically 2–5 minutes. Long scrub times (for example, 10 minutes) are not necessary (IB).
- H.** When using an alcohol-based surgical handrub product with sustained activity, follow the manufacturer's instructions for application times. Apply the product to dry hands only (IB). Do not combine surgical hand scrub and surgical handrub with alcohol-based products sequentially (II).
- I.** When using an ABHR, use sufficient product to keep hands and forearms wet with the handrub throughout the surgical hand preparation procedure (IB). The technique for surgical hand preparation using ABHRs is illustrated in Fig. 7.
- J.** After application of the ABHR as recommended, allow hands and forearms to dry thoroughly before donning sterile gloves (IB).

Figure 7.

Surgical Handrubbing Technique

- Handwash with soap and water on arrival to OR, after having donned theatre clothing (cap/hat/bonnet and mask).
- Use an alcohol-based handrub (ABHR) product for surgical hand preparation, by carefully following the technique illustrated in Images 1 to 17, before every surgical procedure.
- If any residual talc or biological fluids are present when gloves are removed following the operation, handwash with soap and water.



1

Put approximately 5ml (3 doses) of ABHR in the palm of your left hand, using the elbow of your other arm to operate the dispenser.



2

Dip the fingertips of your right hand in the handrub to decontaminate under the nails (5 seconds).



3



4



5



6



7

Images 3-7: Smear the handrub on the right forearm up to the elbow. Ensure that the whole skin area is covered by using circular movements around the forearm until the handrub has fully evaporated (10-15 seconds).



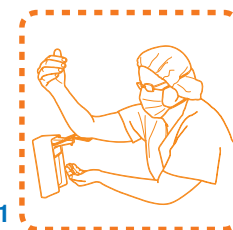
8



9



10



11



12

Images 8-10: Now repeat steps 1-7 for the left hand and forearm.

Put approximately 5ml (3 doses) of ABHR in the palm of your left hand as illustrated, to rub both hands at the same time up to the wrists, following all steps in images 12-17 (20-30 seconds).

Cover the whole surface of the hands up to the wrist with ABHR, rubbing palm against palm with a rotating movement.



13

Rub the back of the left hand, including the wrist, moving the right palm back and forth, and vice-versa.



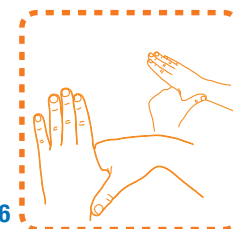
14

Rub palm against palm back and forth with fingers interlinked.



15

Rub the back of the fingers by holding them in the palm of the other hand with a sideways back and forth movement.



16

Rub the thumb of the left hand by rotating it in the clasped palm of the right hand and vice versa.



17

When the hands are dry, sterile surgical clothing and gloves can be donned.

Repeat this sequence (average 60 sec) the number of times that adds up to the total duration recommended by the ABHR manufacturer's instructions. This could be two or even three times.



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