World Health
Organization

PREVENTING SURGICAL SITE INFECTIONS:
IMPLEMENTATION APPROACHES
FOR EVIDENCE-BASED RECOMMENDATIONS

CONTENTS

ACKNOWLEDGEMENTS

ABBREVIATIONS AND ACRONYMS

CCiSC	Clean Care is Safer Care
CUSP	Comprehensive Unit-based Safety Program
Four E's	engage, educate, execute and evaluate
HAI	health care-associated infection
IHI	Institute of Healthcare Improvement
IPC	infection prevention and control
LMICs	low- and middle-income countries
OR	operating room
PDSA	plan, do, study, act
SAP	surgical antibiotic prophylaxis
SBAR	situation, background, assessment, and recommendation
SSI	surgical site infection
SUSP	Surgical Unit-based Surgical Program
UK	United Kingdom
USA	United States of America
WHO	World Health Organization

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INTRODUCTION

Among the range of avoidable harms associated with health care, health care-associated infections (HAI) have been described as a significant burden (1). Surgical site infections (SSIs) are the most frequent HAI in low- and middle-income countries (LMICs), and can affect up to one-third of surgical patients (2). In African countries, infection is the most frequent complication in surgery and up to 20% of women who have a caesarean section develop a postoperative wound infection, compromising their own health and their ability to care for their infants (3) (WHO, unpublished data, 2016). In higher income settings, SSI are the second most frequent HAI in Europe (4) and the United States of America [USA] (5). They threaten the lives of millions of patients each year and contribute to the spread of antibiotic resistance. In the USA, these infections are estimated to contribute to patients spending more than 400 000 extra days in hospital at a cost of an additional US$ 10 billion per year (6). SSI prevention is complex as the risk results from several factors arising from the surgical patient journey, including sometimes after discharge.

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 (7). However, no health facility or country can claim to be free of avoidable infections. Infection prevention requires behavioural change interventions. Furthermore, many health facilities do not yet have the infrastructure or established infection prevention and control (IPC) programmes in place. The recommendations contained within the World Health Organization (WHO) guidelines on core components of IPC programmes (8) underpin HAI prevention and include SSI prevention as one of the building blocks for achieving impacts on patient outcomes.

In the wider context, many approaches to preventing SSI are also relevant to improving other issues around surgical safety (3, 9, 10). This is especially relevant to surgery performed in LMICs where there is both the greatest unmet need for surgical services and the most challenges for the delivery of high-quality surgical care.

The so-called "Global Surgery" agenda (9) is an ongoing challenge and a recognized international burden. To this end, the effective deployment of SSI preventive actions represents a solution, at least in part, to one aspect of this wider challenge, including also the global burden of antimicrobial resistance agenda (11).

Much progress has been made over recent decades in designing and testing new approaches to IPC. To achieve substantial and lasting behavioural changes, it is now recognized that these approaches should be grounded in social and implementation science theory. Successful health care improvement projects must be simple enough for frontline staff to understand, sufficiently limited in scope to be accomplished without significant new resources, and relevant enough so as not to require input that participating organizations are fundamentally unable to provide.

The most successful improvement projects typically embrace a multimodal approach, which requires a strong understanding of the local context. There are many descriptions of how to undertake improvement projects, including implementation models or frameworks, as well as both anecdotal and formal descriptions of local activities. For the first time, this document presents a range of examples from different settings to stimulate next steps in planning for SSI prevention strategies.
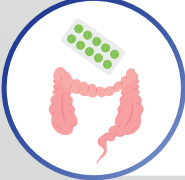
Important in informing this document, in November 2016 WHO launched its evidence-based global guidelines on the prevention of SSI (12) with the dual aim of providing guidance on a wide range of issues that influence infection risk and to overcome some inconsistencies in the interpretation of evidence and recommendations in existing national guidelines. Importantly, these guidelines have been developed to be valid for any country and amenable to local adaptation. They take account of the strength of available scientific evidence, cost and resource implications, as well as patient values and preferences. In 2017, updated evidence-based recommendations from the United States (US) Centers for Diseases Control and Prevention were also issued and deal with similar topics (13).

Figure 1.1 provides a summary of measures recommended in the *WHO Global guidelines for the prevention of SSI*.
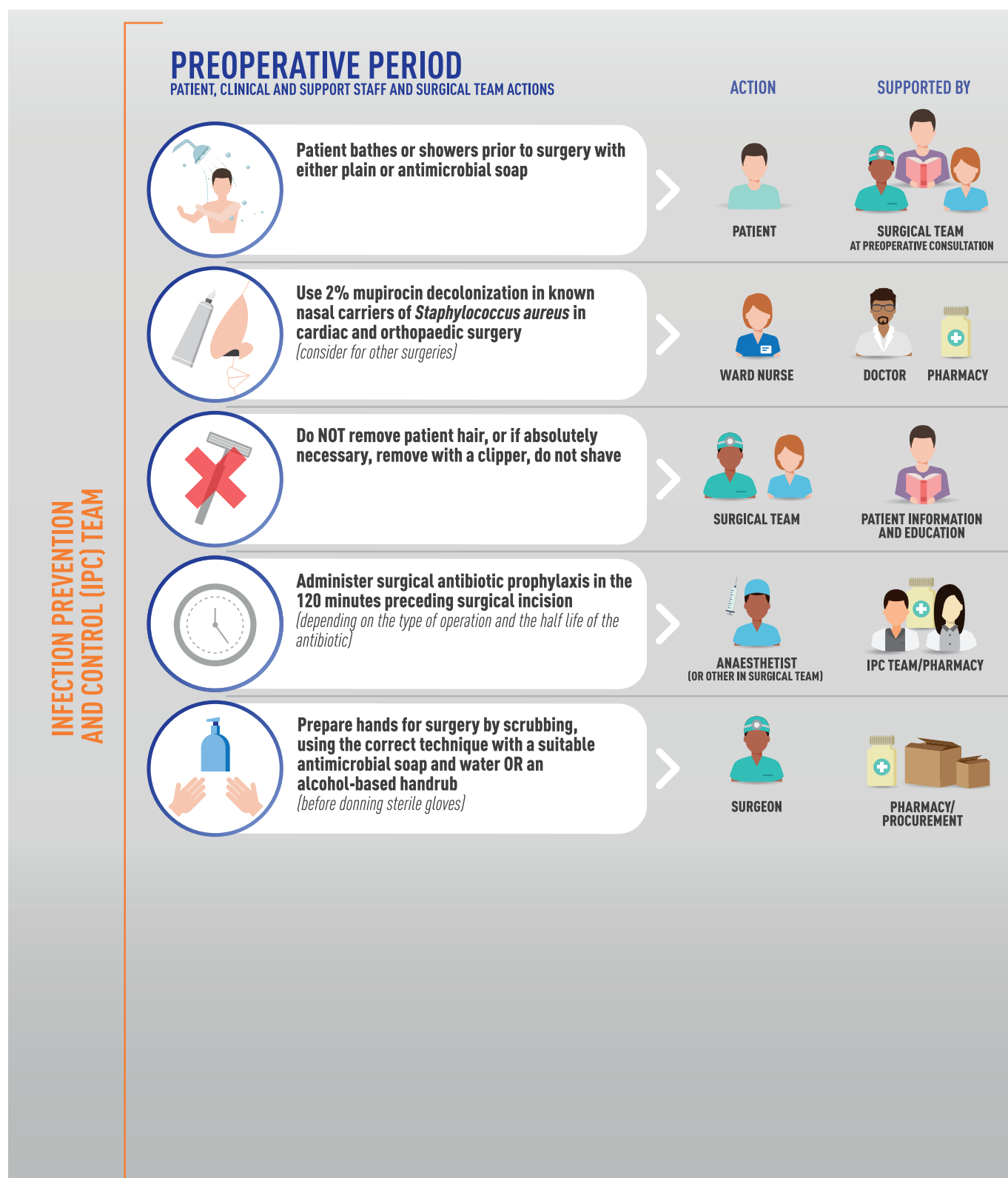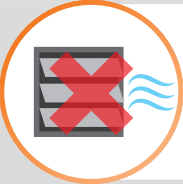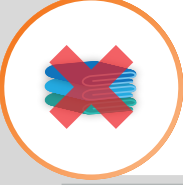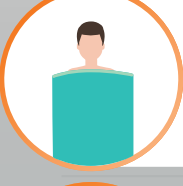
Figure 1.1.a
Surgical Site Infection Prevention Recommendations

PREOPERATIVE PERIOD
PATIENT, CLINICAL AND SUPPORT STAFF AND SURGICAL TEAM ACTIONS

	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 *Staphylococcus aureus* in cardiac and orthopaedic surgery *(consider for other surgeries)*	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 *(depending on the type of operation and the half life of the antibiotic)*	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 *(before donning sterile gloves)*	SURGEON	PHARMACY/ PROCUREMENT

INFECTION PREVENTION AND CONTROL (IPC) TEAM

Figure 1.1.a
Surgical Site Infection Prevention Recommendations

INFECTION PREVENTION AND CONTROL (IPC) TEAM

PREOPERATIVE PERIOD
PATIENT, CLINICAL AND SUPPORT STAFF AND SURGICAL TEAM ACTIONS

	ACTION	SUPPORTED BY
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 *(undergoing major surgical operations)*	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
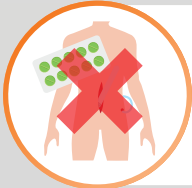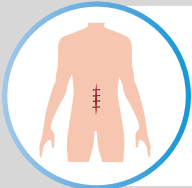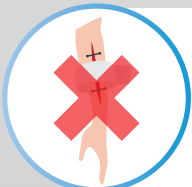
Figure 1.1.b
Surgical Site Infection Prevention Recommendations

INTRAOPERATIVE PERIOD
SURGICAL TEAM ACTIONS

	ACTION	SUPPORTED BY

Do NOT use laminar airflow ventilation systems *(not beneficial for patients undergoing total arthroplasty surgery)*

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 *(neither those with nor those without antimicrobial properties)*

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 (FiO$_2$) *(in adults undergoing general anaesthesia with endotracheal intubation)*

SURGICAL TEAM — ESTATES AND MAINTENANCE STAFF

Consider using a warming device

SURGICAL TEAM — PROCUREMENT

Consider using a protocol for intensive blood glucose control *(for both diabetic and non-diabetic adult patients)*

SURGICAL TEAM — CLINICAL STAFF

INFECTION PREVENTION AND CONTROL (IPC) TEAM

Figure 1.1.b
Surgical Site Infection Prevention Recommendations

INTRAOPERATIVE PERIOD
SURGICAL TEAM ACTIONS

ACTION   SUPPORTED BY

INFECTION PREVENTION AND CONTROL (IPC) TEAM

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

Figure 1.1.c
Surgical Site Infection Prevention Recommendations

POSTOPERATIVE PERIOD
SURGICAL TEAM, CLINICAL STAFF ACTIONS

ACTION   SUPPORTED BY

INFECTION PREVENTION AND CONTROL (IPC) TEAM

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 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

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PURPOSE OF THE DOCUMENT

TARGET AUDIENCE

The target audience of this document are all those working in the surgical and IPC fields, including patient safety and quality improvement teams.

The purpose of this document is to present a range of tested approaches to achieve successful SSI prevention implementation at the facility level, including in the context of a broader surgical safety climate.

Section I of this document describes the pathway of and lessons learned from the development and implementation of the WHO Surgical Safety Checklist on a global scale. On a global scale this is a milestone example of improving safety in surgery, including through SSI prevention, while considering principles related to implementation and dissemination.

Section II moves to outlining improvement intervention examples to decrease SSI. The first part describes the key evidence- and practice-based elements identified from scientific publications as being successful in improving processes and practices that contribute to the successful prevention of SSI in a range of countries. Ultimately, it aims to stimulate reflection and action at the local level and highlights the importance of a multifaceted approach. The second part of this section describes a project conducted in four African countries (Surgical Unit-based Safety Program [SUSP-Africa]) using a multimodal intervention combining both adaptive and technical approaches. The project aimed to implement a bundle of SSI prevention measures identified by local teams as a priority for improvement and to improve the wider safety

climate within surgical services, with a strong emphasis on local leadership. Sections I and II aim to highlight both key barriers and challenges, as well as success stories.

Building upon principles and lessons learned examples described in the previous sections, as well as insightful discussion with experts and implementers, section III describes the features of a multimodal strategy. WHO proposes this strategy for improvement and this section outlines important considerations for successful SSI prevention implementation. This section is not a practical guide to implementation, but a conceptual narrative. However, it does give examples of actions that need to happen, who needs to be involved, and provides summary checklists in the context of a SSI prevention strategy. The overall objective is to outline ideas to stimulate thinking towards targeted SSI prevention improvement steps, irrespective of the level of progress of the health care facility.

Each section starts by describing what it aims to do and who might find it helpful in planning their SSI improvement activities, based on the experience of others. Importantly, for executive boards and leaders in health care facilities, this document could be a powerful catalyst to support and stimulate others to act on implementation by providing a model to bridge the gap between the guidelines and their implementation strategy.

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SECTION I:
THE WHO SURGICAL SAFETY CHEKLIST -
AN EXAMPLE OF BRINGING GUIDELINES
TO LIFE IN THE SERVICE OF PATIENT SAFETY

3.1 Introduction

In 2006, the WHO Patient Safety Department decided to focus on improving the safety of surgical care as its Second Global Patient Safety Challenge. The First Challenge, *Clean Care is Safer Care* (CCiSC), addressed the promotion of hand hygiene to decrease HAI worldwide and resulted in the publication of evidence-based guidelines, the creation of a comprehensive toolkit reflecting an innovative multimodal implementation approach for hand hygiene improvement, and the significant engagement of ministries of health and other country leaders. Despite the differing contexts, many implementation lessons learned from CCiSC proved useful to orient the strategic approach of the Second Challenge.

One revolutionary innovation included the creation of the 'My 5 moments for hand hygiene' approach summarized in a clear visual presenting the required actions for health care workers in the context of their workflow (14). Hand hygiene applies to all health care settings and is a cornerstone of good public health. Similarly, the Second Challenge aimed to identify a clear, adoptable solution to ensure that every patient undergoing surgery benefits from an appropriate and timely compliance with surgical standards. The tool created for this purpose was the WHO Surgical Safety Checklist.

This section describes the pathway of and lessons learned from the development and implementation of the WHO Surgical Safety Checklist (15).

3.2 Background

Over the last 50 years, there has been an explosion in the number of health care discoveries with the potential to make life better for people everywhere, including during surgery. However, many patients continue to suffer and sometimes die when we know what to do, but do not apply our knowledge of these lifesaving discoveries into practice for every patient who needs it. A gap exists between knowing and doing because of failures in knowledge dissemination, failure of the widespread adoption of interventions and, finally, the failure to implement the use of key tools at the clinical front lines.

Assembling experts from around the globe to build guidelines that help to base efforts on the available evidence and to develop innovative approaches that benefit patients the most is a crucial step in the process of closing the gap between knowledge and benefit. But guideline creation cannot stand alone because guidelines, that is, distillations of crucial knowledge, do not come to life by themselves. Guidelines first require careful dissemination and strong implementation strategies and tools, to be adopted and understood on the frontline of care. Furthermore, guidelines and their associated tools need to be as simple as possible and

TARGET AUDIENCE

The target audience is intended to be any discipline introducing, leading or supporting SSI prevention and safer surgical care including: surgeons; surgical nurses and technical support staff; IPC focal points and teams; senior administra-tors; anaesthetists; clinical research project staff; any professionals directly providing surgical care, including individuals who are creating or supporting surgical quality improvement programmes at the system or country level.

have instructions for use and straightforward processes to ensure that they are understood and followed.

The creation of the instructions and the processes for following them is known as the *implementation* process, that is, the vital connection between guidelines [the goal] and the actions that can decrease suffering and sometimes prolong life. Failure to consider these dimensions of implementability will lead to a failure of use and no benefit to patients. Similar to CCiSC, the Second WHO Global Patient Safety Challenge dedicated to safer surgical care, provided a powerful opportunity to ensure that a process of guidance development and its application into real life would result in benefit to patients.

3.3 Developing the WHO Surgical Safety Checklist: building in implementation and dissemination from the start

The WHO Surgical Safety Checklist was developed over nearly two years with the ultimate goal to improve the quality of surgical care and surgical outcomes globally. A list of 19 essential processes and prompts for critical time points to ensure surgical safety emerged as the Checklist. Among these checkpoints, two are directly related to measures aimed at preventing SSI: one related to the timely administration of preoperative antibiotic prophylaxis when and if appropriate; and one related to ensuring sterility in the operating room (OR). A few other points of the Checklist have the potential to contribute to SSI risk prevention, that is, those related to monitoring patient oxygenation, to anticipating the risk of blood loss impairing normovolemia, and to estimating the operation duration with the aim of keeping it within standard times.

3.4 Launching the Checklist: a multifaceted approach to early engagement and dissemination

WHO used its leadership and reach to make a powerful launch of the Checklist across the world with events in different WHO regions. Furthermore, experts as well as professional societies were engaged to present, adopt and promote the Checklist. Based on experiences from CCiSC and other large-scale implementation efforts, an implementation guide describing a basic pathway to follow was created, including ideas from previous work by the Institute for Healthcare Improvement (IHI) and the Johns Hopkins Central Line Insertion Checklist (16) implementation projects. Table 3.1 summarizes the key launch activities and their aims.

KEY POINTS INCORPORATED IN SUPPORT OF IMPLEMENTATION AND DISSEMINATION

- A decision was made very early in the design process, again heavily influenced by the focus on implementability, to make the Checklist as simple as possible by limiting the scope to the OR itself.

- It was designed to fit on a single printed page and be visually friendly by being limited in the total number of items included.

- The accompanying guidelines allowed for additional content to be presented and messages to be sent to users.

- One of the most important early additions to the Checklist was a statement expressing the idea that this single tool could not possibly cover every need or context in the global surgical environment and therefore adaptation and modification to local circumstances was encouraged. The statement also served an important implementation purpose.

- The statement allowed for customization to overcome the barrier often seen at the frontlines of care in that unmodifiable tools, as a fixed expression of a guideline, do not fit local needs and practice and thus cannot and will not be used.

- To help guide end-users in the modification process, the WHO team was available to provide high-level guidance about how to modify the Checklist to meet local needs, while maintaining the spirit of the Checklist.

- Planning for dissemination also guided the creation process. Dissemination means the spread of awareness of a tool or guideline, but it does not necessarily imply either eventual adoption/uptake or implementation and use.

Table 3.1 Key activities to launch the WHO Surgical Safety Checklist and their aims	
Launch activity	**Aim**
A series of global events in different WHO regions.	To capitalize on the attendees' significant potential to adopt the checklist themselves and return home with it as enthusiastic supporters and advocates.
Gathering endorsements from professional organizations*	To actively engage those who could influence spread and adoption To use leadership to actively spread the checklist and helped create buy in within respective specialties.
Presentations at national and international meetings by providing speakers drawn from the initial expert group.	To support further spread of awareness to the checklist and guideline and to demonstrate early engagement and advocacy from key experts in different regions.

* Organizations included professional colleges, societies, associations and others representing the many professions involved in delivering surgical care.

3.5 Testing the Checklist: the importance of testing, collecting feedback and adapting

Testing the Checklist was critical before the next steps could be taken and followed a formal process.

Who was involved in the testing and where did it take place?
- The earliest testing of the checklist was conducted by experts and other contributors from 28 countries (Australia, Afghanistan, Brazil, Canada, Chile, China, Cuba, Denmark, Ethiopia, Georgia, Germany, Ghana, Hong Kong, India, Iran, Iraq, Kenya, Mongolia, New Zealand, Nigeria, Pakistan, Philippines, Switzerland, Thailand, Turkey, United Kingdom, United States, and Zambia). These were highly respected and widely known experts and thus, in a strong position to support the testing and by default dissemination.
- After considerable modification following the initial feedback, a formal pilot test was undertaken in eight sites (high and LMIC) countries to better understand how it could be used in a variety of clinical settings.

- Feedback was actively sought and collected and data were gathered on more than 7000 patients over a six-month period.

This testing process led to substantial learning about the feasibility of the tool as well as what types of modifications hospitals may need to make to the Checklist template, to maximize benefit in different settings. Universal implementation lessons were then drawn up, such as the importance of identifying local champions (for example, nurses, surgical technicians, surgeons and anaesthetists) and monitoring the Checklist use for improving staff adherence.

Pilot sites faced initially many of the same challenges that every hospital faces when trying to change practice, as outlined in Box 3.1.

BOX 3.1
Challenges included:
- gaining buy-in from all clinicians;
- educating team members on how to use the Checklist correctly;
- incorporating the Checklist into clinical practice so it is used for every patient;
- using the Checklist as intended to decrease errors and adverse events and increase teamwork and communication;
- facing and resolving system issues that needed to be resolved before being able to use the Checklist clinically;
- leading the initiative independently, when in fact coaching from an 'expert' (WHO) team was required. Almost every site required coaching at some point and all sites received visits from the WHO team.

Study results were published in the *New England Journal of Medicine* (17), thus creating an additional high-profile avenue to spread awareness of the Checklist.

Table 3.2 summarizes some additional lessons learned for implementation from pilot testing reflecting the recommended WHO multimodal improvement strategy (see Section III).

Table 3.2. Key lessons from the pilot test phase of the WHO Surgical Safety Checklist	
Component of the WHO multimodal improvement strategy*	**Lesson learned from pilot testing**
System change	The infrastructures and processes to support each Checklist item must be in place to effectively accomplish it. For example, some sites needed to change the place where they stored antibiotics and started prophylaxis administration from inpatient wards to the OR in order to ensure that it could be started within the appropriate time frame specified in the Checklist.
Training and education	Every team member needs some training with the Checklist before using it with a patient. Team members should try the Checklist for the first time using simulation training. Creating a (locally contextual) demonstration video of how the Checklist should be used can be very helpful in encouraging proper use by team members.
Evaluation and feedback	Observing teams and giving them feedback on how to improve Checklist use through coaching can improve performance.
Communications and reminders	Creating large posters of the Checklist that can be seen by all members of the surgical team can improve use.
Organizational safety climate and culture	Creating a multidisciplinary team to help lead the project at each site improves communication and encourages a broad sense of ownership. Discussing Checklist use and the project frequently at staff and physician meetings helps to build it into the local culture. It is recommended to consider modifying the Checklist to meet the local context. Sites deemed it useful to add items to their Checklist, such as appropriate prophylaxis to prevent deep vein thrombosis, thus making it a better fit to local pre-existing practice.

* For details, see Section III.

BOX 3.2

A summary of reported barriers collated through the online community approach included:

- **clinician resistance, particularly from surgeons;**
- **lack of hospital resources to support implementation;**
- **lack of education/ knowledge about how to use the checklist;**
- **resource constraints.**

3.6 Creation of an online community for additional feedback and engagement

Coincident with the Checklist launch, WHO devoted a dedicated and protected space on its web platform for a defined period of time to track and collect additional feedback about the use of the Checklist and associated materials. This virtual community allowed a means of communication to and from downloaders/actual implementers. Several surveys were administered to gather feedback from those who had attempted implementation and use of the Checklist with a particular focus on learning more about barriers and facilitators associated with the process as described in box 3.2.

Individuals also reported that Checklist modification was key to building "buy-in" and uptake of the tool, with a majority of users adding items, as well as customizing it for their local hospital by adding their name and logo to the tool.

Unfortunately, further development of the virtual community was time limited by resource constraints and this should be considered when establishing the overall dissemination and implementation process for any new (global) tools.

3.7 Engagement of key influencers to ensure successful uptake and implementation

The Checklist and implementation guide were translated in the five WHO official languages to be more accessible to the global community.

Many **WHO Country Offices** participated actively in the dissemination efforts. A number of **national governments** were also engaged and adopted the Checklist, usually through their health ministries, and encouraged implementation in their countries.

KEY LEARNINGS FROM WHO COUNTRY OFFICES AND NATIONAL GOVERNMENT ENGAGEMENT

• Significant resources were devoted to the support of implementers at the national, regional and local levels. This resulted in the availability of valuable tools to spread awareness of the checklist, dissemination of implementation materials, and the engagement of in-country champions, who were also given support where possible.

The actual uptake, implementation and clinical use of the Checklist in many of these countries was highly variable, often due to limited resources and the burden of other competing improvement initiatives related to other aspects of healthcare.

Engaging the intended audience through **scientific publications** highlighting Checklist implementation approaches was a useful addition. To date, more than 200 scientific articles related to the Checklist have been published and have helped to keep interest strong over time. These reports have primarily reinforced the value of the suggested

implementation approach and specifically touched on the challenges of effective implementation in many cases. Publications have helped to keep engagement and interest in the Checklist strong over time. A book by Dr. Atul Gawande, The Checklist Manifesto published in 2011, also helped engagement.

3.8 Creating the right culture for implementation: the Checklist journey (at national/subnational and facility level)

The importance of the local culture, in the form of improved perception of teamwork and safety climate should not be underestimated. It is associated with as much as half the improvement in clinical outcomes.

As knowledge of the effectiveness of the Checklist began to spread, **two different implementation strategies** quickly emerged. These can be identified as the mandatory versus encouraging voluntary adoption approaches – "You will!" versus "Will you?"

1. Adopting countries often **mandated** the use of the Checklist in facilities funded by the government, usually through their health ministries. Mandates can be divided into two broad groups: **mandates with and without consequences**. A consequence is an incentive of some type, either financial (giving or withholding a bonus) or regulatory (giving or withholding certification of some kind). In either case, there is directly enforced accountability for regular use of the Checklist with the following, mainly negative, points gathered from many years of real-life experiences, all of which can cause concern over reliability of **measurement** results:
• The ways in which use is measured for accountability can vary greatly, ranging from direct observation by an official observer to self-reported performance needs;
• Measurement through the use of an observation tool or staff member can also vary greatly. Did you do the Checklist [yes or no] or did you do the component parts of the Checklist or did you perform the Checklist "well"?;
• Such types of mandates sometimes prevented adoption of the Checklist in a facility by eliciting a reaction from professionals against being "told" to do something that they did not believe was important.

- Enforced mandates can result in compliance with the mandate that meets only the way that compliance is being measured, that is, the Checklist will be done to meet the measure and not to meet the intent, which usually means minimal, superficial compliance. However, anecdotal evidence suggested that unenforced, non-resourced mandates were frequently ineffective in driving implementation and actual checklist use.

2. The alternative path to implementation at scale is a **voluntary effort**. In this case, a government or other organization **champions** the use of the Checklist and invests resources in supporting dissemination, adoption and implementation. Again, real-life experiences tell us such organizations usually become implementation partners or supporters of clinical champions or facilities in the effort to bring the Checklist into practice. Examples include professional societies, hospital associations, insurance companies and non-governmental organizations.

Voluntary uptake by nature can be highly variable because success requires a number of steps that might not be embedded in a voluntary process, including systematic efforts to create awareness of the Checklist, convince local champions to adopt the effort and then support for that champion throughout the implementation process with necessary resources.

3.8.1 General lessons from large-scale mandated implementation efforts

Large-scale efforts driven by mandates were undertaken in many settings with variable success over time and provided universal lessons not tied to a specific setting or location type. Most large-scale mandated efforts involved **active dissemination** of the Checklist through awareness campaigns and meetings.

In many cases, **local champions** played a key role in successful implementation and were aided by the incentive of the mandate to make their implementation actions more effective. The **type of performance measurement varied** from self-reporting to actual direct observations and auditing. Although the result of this approach was often an uneven uptake of the Checklist, there were examples of well-structured mandates that led to widespread and effective adoption over time.

Modifying the Checklist benefits organizations by:
- engaging clinicians in the project and improving buy-in;
- creating a sense of ownership;
- allowing organizations to address local needs and culture.

Even if the Checklist did not change dramatically, the sheer process of reviewing each item and ensuring that that it met the needs of the environment where it was being implemented increased the probability of successful implementation.

Risks when modifying the Checklist included:
- removing items that were proven to be beneficial to patient care and improving teamwork, thus making the Checklist less effective;
- adding too many items to the original ones, making the Checklist more difficult to execute in the clinical environment;
- modifying the formatting of the Checklist, making it difficult to read and complete.

It was important to ensure that any changes provided evidence-based benefits for the patient. Thus, the Checklist was tested outside of the OR in a simulation situation to check the change matched with local culture and workflow, before use on a patient.

3.8.2 General lessons from large-scale voluntary implementation efforts

There has been an extensive global uptake of the WHO Surgical Safety Checklist outside of mandated efforts. Information gathered through the WHO website when the tools were launched provided evidence of global interest and some degree of adoption and use driven by local champions. Voluntary implementation efforts at scale have taken place in several settings and there are valuable lessons to be learned from these.

GENERAL KEY FEATURES OF THIS APPROACH WERE:

- Efforts at the national and sub-national level were **driven by many different governmental bodies and other organizations**. Ministries of health, departments of health, hospital and provider groups championed these efforts with varying results. Participation in these implementation programmes was usually entirely voluntary;
- These programmes were often **delivered through large collaborative models** that used modified WHO materials as their foundation;
- The WHO materials were often **modified** to include general principles from other large-scale implementation efforts, such as the work of the United States IHI and others;
- The programmes usually **interacted** with individual institutions.

The implementation lessons are best summarized in a list of principles **organized at two levels:** the governmental level and the facility level. They can contribute to the design of any large-scale improvement implementation effort.

3.8.3 Learning from national and facility voluntary implementation

National/sub-national level

Leverage existing relationships

In many instances, it is the existing relationship that will entice a hospital or clinician to participate in a programme that is not mandated, for example, Checklist implementation. These relationships continue to be important as the programme evolves over time because they help to keep hospitals engaged in the work and increase the likelihood that participating organizations will provide important feedback about the programme.

Make the commitment to participate using a visible effort

Another key to getting hospitals to commit to voluntary projects is by asking organizations to, for example, sign a pledge to join the project. Pledges can take many forms, but when you are trying to work with a wide range of organizations, making the pledge visible to the public can encourage organizations that would not have otherwise committed to the work to join the project.

REAL LIFE EXAMPLE

- One organization was trying to get every hospital in their state to participate in a programme.
- They had each hospital executive sign their name to a poster that was displayed in the lobby of their organization.
- This poster was also brought to every meeting that they held to publicly show which organizations had committed to the work.
- They did this until every hospital committed to doing the work.

Publicly acknowledging commitment to the work is also key when engaging professional organizations. Many voluntary programmes collaborate with professional organizations to help spread the word about the project and to engage frontline clinicians in the work. These organizations are often asked to sign letters of endorsement and their names are listed as supporting organizations on the programme's website. This approach is similar to that taken by the successful CCiSC programme and the subsequent WHO *SAVE LIVES: Clean Your Hands* campaign.

Create a leadership team to help guide the programme

It is important to have a multidisciplinary team that can serve as the central leadership to provide guidance, clinical expertise, and feedback. Members can also act as ambassadors for the programme, promoting it at other facilities, highlighting it to professional organizations that they belong to, and speaking in support of the programme at national and sub-national meetings.

KEY POINTS FOR FORMING A LEADERSHIP TEAM, THINK ABOUT THE FOLLOWING:

- include representatives from every discipline that will be touched by the work;
- ensure that the team is representative of the various types of facilities participating in the project in terms of setting, size, specialties, and ownership;
- convene the team on several occasions throughout the implementation project;
- change team members over the course of the project to ensure that a wide range of facilities are represented.

Modify the programme to fit local culture and needs:

Each setting is different. When implementing a project such as the Checklist, the first step that needs to be taken by the leadership team is to ensure that the Checklist meets the specific needs of the participating hospital. The following steps should be taken by the programme and leadership teams:

- review each item on the Checklist for relevance and cultural fit;

- delete items from the checklist that are not relevant to the setting, sending an important message that the Checklist is intended for the local environment. For example, many Checklist initiatives in the USA removed the Checklist item confirming that the pulse oximeter was on the patient and functioning because this item is a standard of care that has a low likelihood of being missed;

- review the Checklist in its entirety, examining it for gaps that could be addressed by additional items.

REAL LIFE EXAMPLE

- One Checklist initiative sought to build on their recent efforts to incorporate briefings/ debriefings as standard practice in surgical procedures.
- They modified the Checklist template with specific briefing/debriefing sections.
- This allowed them to encourage better communication in in the OR.

Deliver associated education in multiple ways, multiple times

Education to support the implementation efforts should be delivered in a variety of ways, such as internet-based webinars, in-person meetings, skills training and coaching sessions. In the most successful national/sub-national Checklist programmes, education and training has been delivered in multiple ways and offered to participating facilities multiple times over the course of the programme. Programmes leveraged subject matter experts, professional organizations, ministries of health and others to help deliver education related to the Checklist. Most participating organizations are often not able to attend all of the implementation activities offered and different types of activities attract a broad group of facilities to the programme.

Internet-based webinars

Webinars offer a relatively inexpensive way to share information and ideas about the implementation programme and allow to reach many individuals at one time. They are also convenient because they allow participants to join the educational session no matter where they are. When using webinars, think about the following aspects.

- Make webinars interactive
  - Poll participants about their experiences, barriers that they are facing and steps that they have taken to try to overcome these.
  - Have participants draw and write on slides to share information with the programme team and participants.
  - Open the phone lines and ask participants to share their experiences and/or ask questions. For this to work well, you may want to ask a participant ahead of time to start the dialogue. Getting the first person to talk is the hardest part.
  - Post recordings of the webinars on the project website so participants can watch it if they were unable to join the "live" session or share the information with colleagues.

In-person meetings

Participants benefit greatly from in-person meetings so that they can share their experiences and learn from peers. On several occasions, participants come to the meetings feeling as though the work has been done and is no longer required or that they have hit a barrier that they cannot overcome. By the end of the meeting, attendees feel re-energized to continue the work and leave with actionable next steps to try. When using in-person meetings think about the following aspects.

- Repeat content that you delivered in other ways – it is important to repeat content, even if previously presented. Participants are often unable to take in your entire message at one time and the individuals that attend the in-person meetings may be different from those that participate in other educational activities.

- Incorporate opportunities for participants to share their stories and to talk to each other. While the educational content presented may not greatly differ from the webinars, meetings should allow to learn about implementation from peers, hear stories directly from individuals, and discuss concepts and plans with each other.

• Engage participating organizations by asking them to be on a panel or present. Asking specific people to have formal speaking roles on a panel or to share their story is a powerful way to engage individuals and their organizations further in the work.

• Consider asking less-engaged facilities to formally participate in a meeting so they will send participants and learn more about the work. Some Checklist initiatives increased physician participation by asking physicians to represent their hospital on the panel or to help facilitate portions of the meeting.

• Couple programme meetings with those organized for other purposes to increase attendance and minimize costs, thus taking advantage of every opportunity to interact with and support frontline implementers.

• Hold meetings in a variety of locations to minimize the burden and cost of travel to participants.

Teamwork skills training

One Checklist initiative sought to further engage organizations in the work by offering a surgery-specific team training programme. This training taught participants the underlying communication and teamwork skills for the OR, such as speaking-up using structured language, closed-loop communication, and how to use the Checklist as a teamwork and communication tool. Offering teamwork skills training not only engaged facilities that were not originally interested in using the Checklist, but it also provided participating organizations with practical skills that they could use within their own facility at a relatively low cost. When designing and delivering skills training course, think about the following:

• make the skills specific to the clinical environment that you are working in;

• create 20-minute presentations followed by short exercises so participants can practice the skills in the meeting;

• give participants materials to take back to their organizations.

Coaching visits

Coaching visits can be added to provide more direct support and guidance to local implementation teams and to gather more direct information about the progress of implementation efforts at the frontlines of care. This provides

implementers with direct feedback that informs the next steps of their Checklist effort. These visits can also give the programme team an opportunity to further build their relationships with implementers. Consider the following when implementing coaching visits:

• train coaches in what to look for and how to give constructive feedback;

• visit hospitals multiple times over the course of the programme, if possible;

• use the coaching visits to help the programme team understand what is going well and what organizations need help.

Monitor the work without overburdening participating organizations

Lessons learned highlighted that data collection can be a burden to hospitals and often detract from the resources and time that they are able to dedicate to implementation.

CONSIDER THESE KEY POINTS WHEN THINKING ABOUT MONITORING

• collect as much information as possible from the programme team's interactions with participants, either through the webinars, large meetings or coaching visits.

• encourage local implementation teams to administer a culture survey and to observe the performance of the Checklist in their ORs - share the results of the survey and observations with the partnership team.

• consider how information can be collected through other monitoring processes already in place.

At the facility level

Implementing any type of change is difficult and takes time. Even projects that seem simple and intuitive are difficult to put into place because they require people to change the way they perform their jobs and behave.

While implementing the Checklist appeared to be easy at facility level, the reality was that the Checklist asked OR team members to change their workflow, say words that they have never said before, and use a tool that they have never used. Although simple in concept, executing

BOX 3.3

Facilities reported the following challenges:

- **clinician resistance, more commonly from surgeons;**
- **misuse/underuse of the Checklist;**
- **lack of buy-in to use the Checklist;**
- **lack of hospital leadership support.**

BOX 3.4

Facilities predisposed for failure by:

- **implementing the Checklist without testing it and ensuring it worked for their culture and workflow;**
- **not allowing themselves enough time to implement it;**
- **imposing a date for all the ORs to use the Checklist when teams were not ready to use it with patients;**
- **using the Checklist in a way that detracted from one of the main goals of the Checklist, which was to facilitate communication and teamwork.**

the Checklist in a way that facilitated **team communication** for every surgical patient required a **major shift in culture** in every hospital setting. This was not easy and took time and hard work. Key learnings are summarized in boxes 3.3 and 3.4.

Facilities also highlighted other findings:

- the Checklist was no longer in use, following their initial implementation effort. In most cases, individuals reported that there were no efforts in place to support and encourage its continual use;
- they could always improve on Checklist use, even if they thought that they were using it well.

In response to feedback, a facility-level implementation pathway was built to avoid common barriers and enable organizations to derive the most benefit from using the Checklist (http://www.safesurgery2015.org/safe-surgery-checklist-implementation-guide.html). It walked organizations through the process of implementing the Checklist, starting slowly and gradually building consensus across the organization over time. Table 3.3 presents an example of the implementation pathway and the steps that can be universally applied to many improvement initiatives.

Table 3.3. Checklist implementation pathway	
Step	**Description**
1. Recruit a team	Build a multidisciplinary team responsible for planning and executing your implementation effort. This team should include at least one representative from each role in the OR and at least one administrative representative.
2. Understand the work	It is essential for the implementation team to have an in-depth understanding of the Checklist. They will be asked to teach and coach their colleagues in its use and will most likely be challenged by some of their colleagues regarding the purpose, supporting evidence and benefits of this work.
3. Assess your environment	Assess how things are currently done at your facility, how people feel about their work, and what people think about safety and teamwork by administering a culture survey and observing teams in the OR. This information will help you create a plan that works for your facility. Every facility is different and has unique needs that will need to be addressed.
4. Decide: are we ready?	It is important to take a pause, reflect on the data you collected in Step 3 and determine whether your facility is ready to commit to the work. Some facilities may decide that they will not introduce the checklist in its entirety, while others are ready to proceed with the entire Checklist. Use this opportunity to present your findings and proposed plan to leadership and ask them for their help.
5. Customize and test	One of the key tasks of your implementation team is to modify the Checklist to ensure that it meets your facility's needs. Each time you make a change to the Checklist, ensure that it is tested outside of the OR to test that the changes match your culture and workflow. Never use a Checklist with a patient if it has not been tested outside of the OR first (for example, in a simulation situation).
6. Plan your expansion	Pause and create a plan that describes in detail what your team will do, how and when, to expand Checklist use in your facility (Steps 7 to 10). It is best to start small and build slowly. Remember to remain flexible, this plan will most likely need to be changed as you do the work.
7. Have 1-on-1 conversations	Harness the power of a personal conversation to connect people with the idea and purpose of the Checklist and directly ask for their help. Your team will need to reach every person whose role is touched by the Checklist. (that is, anyone who works in the OR) with a 1-on-1 conversation before that person uses the Checklist. This is an essential step that helps engage everyone that will be asked to use the Checklist. Organizations that employed these conversations reported minimal resistance from frontline clinicians.
8. Promote the checklist	Create broader awareness of the work, spark curiosity and reinforce the idea of a shared mission to improve surgical safety by promoting the project throughout your facility. Internal publicity can take many forms such as demonstration videos, bulletin boards, badges, e-mails, collecting stories and newsletters. Promotion is *not* a replacement for 1-on-1 conversations.
9. Train and spread	Once surgical team members have been introduced to the idea and benefits of using the Checklist in a 1-on-1 conversation, they need to be trained to properly use the checklist before they are asked to use it with a patient. The goal of training is to provide an explanation and demonstration of how the Checklist will be used, followed by an opportunity for the team to practice using the Checklist away from the OR.
10. Watch and coach	Coaching is the third part of the learning progression that begins with a 1-on-1 conversation and continues with hands-on training. It is a vital part of every successful implementation because it helps lead individuals and teams to achieve a better performance and sustain effective Checklist use over time.
11. Continually improve	You now face a different challenge, that is, how to sustain the work and improve it over time. As soon as we turn our attention towards the next problem to be addressed, our attention shifts and the Checklist work may start to slide a little. Never stop looking and talking to surgical team members about the work. You can do this through watching and coaching, collecting stories and administering annual culture surveys.

It is also important to continue to have an implementation team that oversees this project. Think about changing implementation team members from time to time and updating the content on your Checklist to meet your organization's changing needs. |

In summary, employing the specific concepts that are included in the described 11 steps facilitates system change in a facility by engaging physicians in quality improvement, getting people out of their silos, and providing a process for continuous improvement. The implementation process itself can help change the organizational culture and build a quality improvement infrastructure for future work. Approaching implementation in a multidisciplinary fashion and being consistent with WHO recommendations and experiences of a stepwise improvement approach is also important.

Even if an organization was not ready for the entire Checklist, there were incremental steps to help move towards eventual full implementation. For example, some facilities chose to initially implement only one section of the Checklist or even to begin to change practice by asking teams to do one Checklist item. This resonates once again with the experiences of implementing the WHO 'My 5 moments for hand hygiene.'

3.9 The challenges of bringing the WHO Surgical Safety Checklist to low- and middle-income countries

Bringing the Checklist to surgical settings beyond high-income countries presented unique challenges in dissemination, adoption and implementation.

3.9.1 Spreading knowledge of the Checklist

- **Challenge** - Spreading knowledge of the Checklist was more difficult than in high- income countries due to **limited communication channels**.

- **Solution** - **Partnering** with ministries of health, not-for-profit organizations, charities, students, national professional societies and other expatriates in support of dissemination was critical. It often took multiple touchpoints through multiple organizations and individuals to successfully connect with a clinician working in a facility. The Checklist spread more rapidly in countries where there were strong clinical champions. Often these champions helped design and/or test the Checklist.

3.9.2 Addressing resources

In high-income countries, facilities have greater resources and often have extensive prior experience with process improvement. In the LMIC setting, the improvement infrastructure is often entirely lacking because of the need to devote almost all available resources to daily care provision. Overburdened health facilities frequently view quality improvement initiatives as "luxuries" that they just cannot afford due to the overwhelming physical, infrastructural and financial constraints and limitations. Furthermore, staff time is typically fully allocated to specific activities related to clinical care and documentation.

- **Challenge** – Due to competing priorities, governments often **lacked resources** to support implementation of the Checklist at frontline facilities. On several occasions, governments that committed to the work would send the Checklist materials to facilities, but were not able to offer other resources or training for its implementation. Visits to facilities in LMICs found that they had seemingly "implemented" the Checklist and although it was often observed in the facility, there was no evidence of its actual use in any capacity.

- **Solution** - Most Checklist items did not require new resources, even in very resource-constrained facilities. Thus, emphasizing **how to implement without new resources** was critical. The Checklist was designed as a template potentially usable in all surgical settings worldwide. It prompted the team to discuss plans, address concerns, verify critical information and confirm that critical processes had been completed. This involved existing human resources in the first instance and can be achieved as a first step in addressing implementation and, more importantly, to identify gaps for its support. Implementation of parts of the Checklist should be possible in almost any setting.

3.9.3 The Checklist is difficult to implement in its entirety

To achieve any level of success, project goals are often different in LMIC settings. Instead of Checklist implementation focusing on improving teamwork and communication, it was essential to first ensure that the basic processes underlying many of the Checklist items were in place.

- **Challenge** - For example, the Checklist asks the anaesthesia professional to confirm that antibiotics have been administered within 60 minutes of skin incision. In many LMIC settings, the availability of resources will vary. Antibiotics may not be readily available at the right times and when they are, the **process of antibiotic administration is often flawed**.

- **Solution** - Work was done to **adapt workflow**, including when and where antibiotics are given. Instead of administering antibiotics on the ward, antibiotics now come with the patients to the OR to ensure administration within one hour of incision. Prior to this change, most antibiotics were given several hours prior to skin incision, where their efficacy was not high. In terms of the WHO-recommended multimodal strategy, this encompasses system change, education and training, awareness-raising, evaluation and feedback and adjusting the organization's safety climate and culture.

- **Challenge** – A **local approach** to address SSI was considered important.

- **Solution** - One approach to learn from is a programme developed by Lifebox (www.lifebox.org), a not-for-profit organization dedicated to improving the safety of surgery worldwide. Lifebox developed a checklist-based implementation programme focused on preventing SSI. Known as 'Clean Cut' (Checklist Expansion for Antisepsis and Infection Control – Customization, Use, and Training), it aims to support the **improvement of IPC processes embedded in basic surgical principles** and accepted standards of care. It uses the checklist as a means of engaging and building a clinical team to promote best practices, together with a data monitoring and feedback strategy, and links the team and performance data with specific strategies for improving compliance with standards by aligning the practices with the standards, similar to the WHO multimodal improvement strategy. Clean Cut targets six specific perioperative standards: the antiseptic preparation of skin; maintenance of the sterile field through appropriate gowning/draping/gloving; confirmation of sterility of surgical instruments; appropriate timing and use of antibiotics; counting and tracking of surgical swabs; and the performance of a verbal "time out" prior to skin incision. Clean Cut walks the local surgical staff through a process of mapping out the upstream steps for each of the recommended infection prevention standards as a way to identify specific breakdowns and barriers and to facilitate the development of contextually relevant solutions. Early field experience shows that this approach can successfully identify system issues and improve adherence to perioperative standards of care (http://www.lifebox.org/clean-cut/).

In most LMIC settings where success has been achieved, strong champions have also been identified or significant support provided from external sources. There are many instances of successful, sustained adoption at the facility level to demonstrate that success is possible, that the Checklist is able to be implemented in these settings, and that efforts to spread its dissemination and encourage implementation should not stop. The same steps outlined in the Checklist implementation pathway also apply to LMIC settings.

3.10 Summary of general lessons from the WHO Surgical Safety Checklist to consider for implementation

KEY POINTS WHEN DESIGNING AN IMPLEMENTATION AND IMPROVEMENT PROJECT REMEMBER TO:

- **develop a strategy for dissemination** of the intervention at an early stage - dissemination should be thought of as a campaign to raise awareness of the intervention;
- **think about implementability from the beginning** - if a tool is too complicated to implement, it will not be used;
- develop a strategy to **encourage adoption** of the intervention at an early stage;
- build a **multidisciplinary team** to help design and undertake the project. There should be representatives from every discipline that the project will touch. It is also helpful to have experts from a variety of clinical settings. These individuals can also serve as your clinical champions to spread the work;
- be prepared to **learn** about implementation when you are testing the intervention.

When working with organizations to make change, keep in mind:
- interventions that require additional support in the form of equipment, staff or other materials require parallel efforts to be successful, examples of this have been outlined in previous sections – this can be classed as **system change**;
- implementation goals depend on the setting and are dependent on sound **monitoring and feedback**, based on WHO recommendations (8). Additionally, collect feedback on the

implementation process from participants at every opportunity;

- continually promote and iterate programme activities (**reminders and communication**);
- provide **education and training** based on the input and needs of participating organizations/ individuals;
- every facility can make some type of change, even if they are unable to implement the entire programme – this is dependent on the local safety climate and **culture change**.

Table 3.4 summarizes strategies that facilitated the implementation of the WHO Surgical Safety Checklist and provides examples of how these concepts can be applied when changing patient care at scale or within an individual organization.

Table 3.4. Summary of strategies to facilitate the implementation of the WHO Surgical Safety Checklist		
Strategy	**National/state level applications**	**Hospital level applications**
Leverage existing communication channels, networks and relationships	• Use existing meetings to present the work and convene participants. • Disseminate information through professional organizations, (not-for-profits and others).	• Re-purpose teams that work on other quality improvement projects. • Share information about the project at every opportunity, staff/physician meetings, grand rounds, and within existing committees.
Develop and support clinical champions	• Build a state-level committee that consists of representatives from disciplines touched by the work and a variety of facility types. • Offer a variety of programme activities for individuals to learn about the project. • Create materials to walk organizations through the key steps of implementation and offer advice on how to overcome common barriers. • Convene facility champions so that they can share their experiences and help each other solve problems.	• Build a multidisciplinary team that consists of at least one representative from every discipline touched by the project. • Provide clinical champions with resources and time to implement the project.
Support implementation through coaching	Conduct hospital site visits to learn about implementation and provide feedback to organizations. Remember coaches need to be trained in how to give feedback.	Create a coaching programme leveraging your implementation team and clinical champions. Remember coaches need to be trained in how to give feedback.
Encourage incremental change	Provide guidance on how to implement the project in smaller parts or how to put some components into place when an organization is not ready for the entire project.	If needed, implement parts of the project instead of the entire programme.
Build in implementability; modification of interventions to meet the local context should be encouraged and supported through guidance	• Plan an intervention that can be implemented and modified. • Create templates and programme materials that meet the needs specific to your environment. Consider culture, resources, and prior quality improvement projects that may inform the work.	Modify programme materials to meet your organization's culture and workflow following guidance provided by national and state programme teams.
Build leadership support	• Gather a national leadership team to guide the work.	Create a facility-level leadership team to guide the work and provide resources for it.

4

SECTION II: IMPROVEMENT INTERVENTION EXAMPLES FOR SURGICAL SITE INFECTION REDUCTION

4.1 A review of the evidence framed around the *Four E's* model

4.1.1 Introduction

The barriers to delivering high quality, safe care are often similar across different health systems.

This section describes the key evidence- and practice-based elements identified as being successful in improving processes and practices that contribute to preventing SSI in a range of countries.

It is based on examples from scientific publications reporting interventions to improve adherence to evidence-based clinical recommendations and reduce SSI. Notably, the importance of a multimodal approach for successful SSI prevention is also highlighted. Furthermore, it summarizes key barriers and challenges with the intention to stimulate reflection and action at the local level.

The section does not analyse quality improvement methodologies and its content is framed around a specific model named the *Four E's* (**engage, educate, execute and evaluate**) (18), which are considered as critical factors for success in improvement programmes. The *Four E's* represent the implementation-focused arm of the larger "Translating evidence into practice framework" (18), based around summarizing the evidence, identifying

barriers to implementation, measuring and then implementing. The original definitions of the *Four E's* are included at the start of each subsection. This implementation model has been used to translate evidence into interventions and programmes based on this model have previously achieved significant and sustained reductions in the prevention of central line-associated bloodstream infection (19) and ventilator-associated pneumonia (20).

This model facilitates the pairing of technical and adaptive (culture change) work required to foster the translation of evidence into bedside practice. It should be noted from the outset that more than one of the *Four E's* can/ should be implemented at the same time in a unified approach, based on the local situation and context. The use of this implementation approach in four African hospitals is described and provides an extended example of this method.

TARGET AUDIENCE

The target audience is intended to be any team introducing, leading or supporting SSI prevention through improvement strategies including: IPC professionals or health workers with responsibility for IPC monitoring or improvement; sterile services; maintenance/ engineering staff; surgeons; surgical nurses; technical support staff; anaesthetists; senior managers; and any professionals directly providing surgical care or involved in quality improvement programmes.

4.1.2 Facilitating successful improvement using engagement, education, execution and evaluation

Engagement means the involvement of all relevant staff in the facility to explain why the intervention is important and to achieve buy-in and commitment.

KEY ELEMENTS USED FOR ENGAGEMENT IN SSI PREVENTION INTERVENTIONS

WHO WAS ENGAGED?

- Perioperative clinical staff/teams and other frontline staff that directly care for patients.
- Senior management/administrators.
- Senior clinicians.
- A mix of staff cadres or multidisciplinary committees that included both management and clinicians (senior and frontline), physicians and nurses, and staff from other related disciplines (for example, IPC, microbiology, quality improvement, patient safety, pharmacy, informatics, etc.).

WHAT WORKED FOR ENGAGEMENT?

- **Senior management dedication**. The chief executive officer of a hospital making an announcement and taking the lead in a hospital-wide initiative to reduce SSI, and the vice-president administrative physician acting as the project champion (one of the most powerful engagement examples).
- **Clinical leader dedication**. Physician and nursing leadership engagement for review and feedback on policies, guidelines and protocols originally developed by the surgical team.
- Use of one or more engagement **tools** to achieve buy-in and lead change, such as those aimed at utilizing local leadership, clinical champions, peer networks, teamwork and multidisciplinary teams.
- Writing and pledging commitment in **a statement**.
- **Endorsement** of technical/clinical policy (by all surgeons and anaesthetists).

- **Agreement** on a written plan of action with plans agreed and endorsed by the multidisciplinary team and the facility management (for example, an antibiotic prophylaxis policy).
- Regular and periodic **meetings** with all those engaged to identify stakeholders' expectations, brainstorm about causes and effects, plan and map implementation, review progress and measure outcomes.
- **Case-based teaching videos and standardized scripts** for nurses to give comprehensive patient reports in intensive care units and wards, as well as techniques of assertion, closed-loop communication, and a **structured situational briefing** framework (the situation, background, assessment and recommendation [SBAR] tool).

Overall, what were considered to be the success factors in the context of engagement?

- **Hospital executive directors** facilitating access to needed resources and helping to overcome organizational barriers.
- **Enthusiastic champions**, preferably several leaders or multi-level leadership across all organizational levels of health care facilities with the dedication and determination to reach the goal, induce change and improve patient outcomes.
- **Local implementation teams** comprising multiple clinical specialties, administrators and leadership (demonstrated in LMICs in particular).
- **Responsibilities of each member** of the implementing team clearly identified including **clear timelines** within action plans.

Government involvement has also been noted, in particular to support the uptake of the WHO Surgical Safety Checklist.

Patient engagement has also been reported, for example, awake patients signing the daily cleaning checklist for their rooms to improve compliance.

Table 4.1. Summary of key engagement elements

What	Who	Why
Engagement of frontline clinical staff in multidisciplinary working	Includes surgeons, anaesthesia providers, perioperative nurses, pharmacists and IPC specialists.	Facilitates audit by identifying opportunities for improvement, development of interventions, measurement of progress, and provision of feedback regarding SSI rates.
Team leadership, including champions	Whoever is identified at the local level.	Provides coaching opportunities, facilitates group meetings and aids monitoring of progress.
Partnerships	Between senior management and administrators and clinical staff.	Helps the alignment of improvement efforts with organizational priorities, navigation of challenges to changing organizational practice, and fosters accountability in clinicians for SSI rates.
Availability of the 'right' tools	The intervention team and clinical staff, supported by senior facility leadership.	Mobilizes staff, describes actions with clear timelines, helps reach agreement, facilitates brainstorming, planning and progress review, as well as comprehensive reports.

Education means efforts to share the evidence supporting the interventions among all those involved.

KEY ELEMENTS USED FOR EDUCATION IN SSI PREVENTION INTERVENTIONS

WHO WAS TRAINED?

Frontline staff were the key focus for training on measures to reduce SSI.

WHAT WORKED FOR TRAINING?

- **Bolus teaching methods** (that is, a single, relatively large training session) were traditionally popular for first or general exposure to the topic.

- **Pre- and post-tests of knowledge and attitudes** to assess success of the educational intervention were common.

- **Less traditional (non-bolus, more innovative) methods** included grand rounds and multidisciplinary clinical rounds, *ad hoc* lectures, briefings, posters, handbooks, meetings, practical workshops, webinars, bedside huddles and live simulations.

- **Efforts additionally focused on the role of patients** in the implementation of prevention strategies. This was often seen as particularly important in LMICs and may be conducted through patient information posters, patient instruction for preoperative procedures (for example, showering and bowel preparation) or a patient-centred educational curriculum on an interactive tablet by using the teach-back method of adult learning.

Overall, what were considered to be the **success factors** in the context of education?

- **A mix of teaching modalities** aligned to guideline recommendations and policies.

- **Timing and intensity** of education:
  - intensive training of the team *before* the start of the actual implementation is beneficial, particularly as a foundation of interdisciplinary collaboration;
  - when implementation is *new* to a certain speciality or settings, intensive training should be undertaken during the implementation process, *before* implementation or *before* any data are collected.

- **Making training and education available to all** teams and clinical staff, with a focus on the rationale and goals of the changes intended in patient care to prevent SSI.

- **Education focused on the clinical process**. Example: focused training of registrars and fellows in skin preparation technique and drying time resulted in more attention to details.

Education and training are used in the majority of improvement strategies, but it is only one part of achieving overall improvement. The success factors described here have been found in high-income and LMICs. Education and training interventions in isolation are rarely assessed against SSI rates – usually some specific technical changes are also employed.

Table 4.2. Summary of key education elements		
What	**Who**	**Why**
Large group workshops, didactics, grand rounds and in-service sessions	Delivered to frontline staff.	Used to introduce new evidence-based interventions.
Smaller academic rounds, focus groups, role play, peer education, one-to-one bedside training	Delivered to frontline staff.	Used to introduce new evidence-based interventions.
Intensive training spanning months	Delivered to frontline staff.	Prior to initiation of implementation projects, it can provide a focus on exact clinical processes.
Access to educational materials via refresher courses, online videos, webinars, bulletins and brochures.	For frontline staff.	For reinforcement and quick reference.

Execution means designing an (SSI) intervention 'toolkit', which will include the strategy targeting the barriers, standardization and independent checks, as well as learning from mistakes. This is all aimed at changing the process by which care is delivered to ensure consistent care standards for all patients.

KEY ELEMENTS USED FOR EXECUTION

WHO WAS INVOLVED IN EXECUTION?

The local implementation team, including those previously identified (that is, during and agreed upon in the engagement phase), tended to be those involved, but this will be dependent upon any local decisions throughout the process and considering any identified modifications to achieve success.

WHAT WORKED FOR EXECUTION?

- For LMICs, **specific tools** supported execution, for example, the WHO Surgical Safety Checklist, protocols and policies were the most commonly used (see also section III).

- **A range of models and associated tools**, such as bundle algorithms, implementation of the Comprehensive Unit-based Safety Program (CUSP) (21) and quality improvement techniques (for example, Plan, Do, Study, Act [PDSA] or Rapid-Cycle PDSA [http://www.ihi.org/resources/Pages/Tools/PlanDoStudyActWorksheet.aspx]), as well as risk-based approaches (for example, the Lean paradigm [https://leankit.com/learn/lean/3-key-concepts-of-lean-process-improvement/] was used to identify process inefficiencies and then the implementation of a 'different dressing' bundle for high- and low-risk surgical patients).

- **Larger scale facility initiatives** have also been applied with some success.

Overall, what were considered to be the success factors in the context of execution?

- Irrespective of the setting, **local ownership and adoption** through identification of the most likely risk factors determining SSI, followed by integrating preventive measures accordingly into the local clinical workflow with a way of evaluating success.

- **Appointing a person, committee or team to lead** and execute the change/'toolkit'.

- **Writing procedures for each step required, while assigning clear responsibilities.**

- **Timely review of execution strategies** to understand local barriers and allow for modifications.

- **Employing specialized professional(s)** or companies was reported to be useful for collecting special data, understanding root causes, identifying risk factors, proposing solutions, developing policies/guidelines, integrating solutions into practice and/or observing and auditing practices.

SOME SPECIFIC, PRACTICAL EXAMPLES:

- automatic stop orders to avoid SAP continuation after the procedure (one study estimated that a total of approximately 600 hours of staff time were used in meetings related to the development, implementation and evaluation of the antibiotic prophylaxis policy);
- transitioning from paper wrap to metal containers for instrument sets and postoperative care of surgical wounds;
- a policy for pre-approval of immediate and rapid processing in the sterile processing department;
- equipment cleaning resources manual;
- rapid sterilization 'hand-off' communication tool;
- changing vendor contracts (for example, to deliver surgical instruments 48 hours before surgery with a penalty clause if breach of contract);
- placing a sticker over surgical dressings with contact information and instructions on how to deal with concerns of integrity or contamination of the dressing;
- engaging the attending physician/surgeon to directly observe and confirm execution of improved skin preparation;
- telephone calls to patients before surgery to remind them to begin the manual bowel preparation with oral antibiotics and to perform preoperative bathing.

Table 4.3. Summary of key elements of execution

What	Who	Why
Protocols, pathways and policies	Aimed at frontline staff. Supported by the multidisciplinary team.	To well delineate information and allow for ease of execution of evidence-based recommendations.
'Bundling' of care processes	Aimed at frontline staff. Supported by the multidisciplinary team.	Standardization of key interventions for easier execution.
Checklists	Aimed at frontline staff.	Considered a tool to improve quality of care.
Order sets, electronic reminders, automatic stops (for antibiotics) as long- term facility-wide initiatives	Aimed at frontline staff. Supported by the multidisciplinary team and senior management.	Create double-checks and prompts for consistent care across all levels.
Safety and quality improvement models	Aimed at frontline staff. Supported by the multidisciplinary team and senior management.	Facilitate stepwise implementation and rapid identification of process inefficiencies.

Evaluation means to regularly assess performance measures and unintended consequences. This can facilitate progress monitoring against care processes and outcomes and should always involve timely feedback.

KEY ELEMENTS USED FOR EVALUATION:

The key elements described here are based on a mix of monitoring of practices/processes and SSI rates.

WHO WAS INVOLVED IN EVALUATION?

The local multidisciplinary team, including those previously identified (this is, during and agreed upon in the engagement phase), tend to be those involved, but this will be dependent upon any local decisions and expertise.

WHAT WORKED FOR EVALUATION?

- **Direct observation (of processes) conducted by a senior nurse or physician**.

- **Combined chart audit and direct observation** to measure the percentage of patients with recommended measures, for example, preoperative preparation.

- **Targeted monitoring, auditing and evaluation tools**, either utilized or generated, were reported to be useful to track progress and evaluate performance including:

  – a surgical auditing tool;
  – a novel surgical checklist;
  – a preoperative checklist;
  – an environmental cleaning algorithm;
  – the WHO Surgical Safety Checklist;
  – a modified WHO Surgical Safety Checklist;
  – statistical process control chart;
  – specific or general surveillance
  – a surgical infection prevention collaborative data collection tool;
  – a bundle compliance – checklist;
  – web-based data entry tool (example given was The International Quality Improvement Collaborative for Congenital Heart Surgery in Developing World Countries Registry);
  – annual benchmark reporting and presentation at mortality reviews;
  – preoperative evaluation of patient compliance with pre-hospital preparation.

Overall, what were considered to be the success factors in the context of evaluation?

- Surgical teams found **timing** important, that is, it was more beneficial to focus on measuring and improving compliance with current process measures *before* implementing specific interventions to address persistent SSI rates. This facilitated the identification of defects in implementation and, when combined with direct discussion with providers, allowed a better understanding and recognition of contributing factors, gaps and barriers to implementation.

- **Sharing** evaluation results of process measurement generated *opportunities to educate and engage* diverse perioperative teams from multiple disciplines. This helped to increase awareness and allow for the correction of gaps in processes/patient care.

- **Real-time feedback** and quarterly reports served to keep staff informed and engaged. For example, the level of engagement and cooperation among key groups, such as cardiac surgery anaesthetists, was found to be critical in creating culture change.

- **Personalized feedback** was used to alert individual clinicians to substantial deviations from practice among colleagues.

- **External review** of implementation/evaluation management, as well as processes, was also highlighted as beneficial.

Table 4.4. Key elements of evaluation		
What	**Who**	**Why**
Direct observation (with or without chart audit) of clinical processes	Performed by surgical team, of all clinical staff.	To create a sense of accountability and motivation to drive improvement. Can be seen as a benchmark to drive improvement.
Targeted monitoring tools	To be used by clinical staff/teams.	To track progress and evaluate performance to further plan for improvement.
Monitoring with personalized feedback	Of and to clinicians and surgeons specifically.	Can be seen as a benchmark of processes to drive improvement.
Real-time feedback to units or the entire hospital	To all clinicians/staff and hospital leadership.	Allows transparency and teams/units to assess their own progress and identify improvement activities.
External review	Experts in the field (to review implementation management/ review of evaluation of processes undertaken by clinical staff).	Beneficial to clarify the approach being used and provide validation of successful evaluation strategies.
Prospective surveillance with feedback	To surgeons and clinical staff.	To drive SSI reduction.

4.1.3 Summary of success factors and barriers to improvement

Summary learnings from all *Four E's* in relation to success factors are:

- Multidisciplinary/cross-departmental working, leadership and partnership – buy-in, engagement and sensitization;
- mental working, leadership and partnership – **buy-in, engagement and sensitization**;
- Mix of education and training methods – **enhanced by real-life simulations, locally developed**;
- Provision of tools such as protocols, checklists, algorithms, guidance prompts and reminders – **simplifies concepts and streamlines execution of processes**;
- Monitoring, data collection and timely personalized feedback – **stimulates improvements in process and outcome**.

Barriers were also encountered as summarised in Box 4.1.

BOX 4.1
Barriers to improvement – what might contribute to failure?

- **Application of one element only (unimodal approaches, for example, training only).**
- **Not involving multiple levels (for example administration, clinicians, staff) or disciplines (for example, physicians, nurses, specialist consultants, housekeeping).**
- **Lack of time dedicated to implementation, in particular for training and education (in LMICs, this time investment contributed to SSI reduction).**
- **Lack of direct leadership involvement (for example, administration, clinicians) to facilitate and demonstrate local culture change.**
- **Associated costs or perceived additional costs.**
- **Poor access to supplies in support of action to address known risk factors.**
- **Poor communication.**
- **Lack of awareness of the need to address the problem.**
- **Previous beliefs of health workers and management; culture/ traditions may directly contradict the (new) approach to patient care (for example, infection rates are "low" or cannot be controlled, routine prophylactic antibiotics are effective, infected cases are solely due to poor infrastructure).**
- **Lack of data to support improvement efforts.**
- **Non-attendance or non-compliance with educational activities.**

TARGET AUDIENCE

The target audience is intended to be any discipline introducing, leading or supporting SSI prevention including; IPC focal points and teams; senior administrators; surgeons; nurses; technical support staff; pharmacists; anaesthetists; and any professionals directly providing surgical care as well as quality improvement leads.

These barriers broadly corroborate findings from other IPC studies as well as the barriers outlined in the WHO Guidelines for hand hygiene in health care (22) and in the national and facility (23, 24) manuals for supporting implementation of the WHO Guidelines on core components of infection prevention and control programmes (8). Therefore, it can be assumed that mitigating steps should be taken to address such barriers at the outset of an improvement programme rather than waiting to find solutions at a later stage. Such steps can be considered as part of the preparedness phase of an implementation model.

For more information on a cycle of improvement to support taking action as described previously, see section 4.5 on the use of a multimodal infection control and patient safety intervention in four African countries.

4.2 Use of a multimodal infection control and patient safety intervention in four African countries

4.2.1 Introduction

It is recognized that SSIs are the most frequent HAI in LMICs and that specific prevention measures are highly effective, but often poorly implemented for a number of reasons. In the previous part of section II, implementation approaches used for SSI reduction interventions have been summarized, mostly from high-income countries. Conversely, evidence is very limited from LMICs and focuses mainly on single interventions, such as improving SAP.

One of the functions and interests of WHO is to undertake research to explore whether interventions demonstrating success in high-income settings are equally effective and feasible with adaptations in settings with limited resources and in different cultural environments.

This section describes such a research project. The Surgical Unit-based Safety Program (SUSP-Africa), based on previous successful studies using the Comprehensive Unit-based Safety Program (CUSP) method developed in the USA (21), was implemented and tested nationwide in the USA and in four African countries during the same time period.

The SUSP-Africa project was a quasi-experimental study conducted between July 2013 and December 2015 in five hospitals in Kenya, Uganda (two hospitals), Zambia and Zimbabwe. It consisted of a multimodal intervention combining both adaptive and technical approaches, that is the implementation of a bundle of SSI prevention measures identified by local teams as a priority for improvement (technical), as well as the enhancement of the broader safety climate in surgical services, with a strong emphasis on local leadership (adaptive). The project was successfully implemented in all but one hospital (Zimbabwe) where unanticipated obstacles hampered completion of all steps of the programme.

The methodology and results of the study were published in the *Lancet Infectious Diseases* in 2018 (7). Although this section refers to this publication for the key findings, it also reports additional information and lessons learned from SUSP-Africa, which represents one of the milestones of the new WHO multimodal strategy for SSI prevention described in Section IV.

4.2.2 Background to the SUSP-Africa multimodal intervention approach

As in any improvement process, a stepwise implementation approach was used for the SUSP-Africa project. It included five phases and a range of tools used across all hospital sites.

Step-wise implementation phases

- Phase 1. *A preparation phase* during which teams including the external project support experts and local senior surgeons (surgical team leads) adapted or co-developed tools and protocols. During this phase, local core teams 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 relevant 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* consisting of the roll-out and implementation.

- Phase 4. *Follow-up assessment* conducted over a 10-month period represented the first evaluation period of the impact of the intervention.

- Phase 5. *Sustainability assessment* through 6 months after phase 4 which represented the longer-term follow-up evaluation when the intervention had become part of 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 CUSP and the use of a range of adaptive, safety climate-orientated tools (21, 25).

Using the *Perioperative Staff Safety Assessment* tool (26) designed to help surgical teams to assess the gaps that most frequently cause SSI in the local context, the measures to be improved upon by all sites included:

i)   preoperative patient bathing;
ii) avoiding hair removal or performing it with clippers;
iii) appropriate surgical hand preparation;
iv) appropriate surgical skin site preparation;
v)   optimal antibiotic prophylaxis;
vi) improvement of OR discipline.

SAP and surgical site skin preparation, including the use of an appropriate skin disinfection product and the avoidance of hair removal, were considered particularly defective.

The adaptive approach specifically aimed at creating or improving the local safety climate and motivating local teams to comply with SSI prevention measures implemented through the intervention. It included 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 was 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 aimed to support infrastructure development to improve teamwork and help teams to learn from mistakes.

4.2.3 Actions carried out to improve on the SSI prevention process and outcome measures

Activities and actions consistently carried out at each site, with additional local adaptations and initiatives are described in the published article and in the related online Appendix (7).

A number of tools available through CUSP and WHO were adapted and used at the local level. Some of these have now been reviewed and finalized, while others are available in their original form (see Table 4.5).

Table 4.5. Tools used in SUSP- Africa	
Tools used in SUSP- Africa	**Source**
A surveillance protocol, two data collection forms and a data entry system	Updated version available at: http://www.who.int/infection-prevention/tools/surgical/evaluation_feedback/en/.
Information sheets describing prevention measures, including a surgical antibiotic prophylactic protocol	Original versions available at: http://www.who.int/infection-prevention/countries/surgical/en/ and updated as "Key facts"; documents now available at: http://www.who.int/infection-prevention/tools/surgical/training_education/en/.
Instructions on local production of alcohol-based handrub for surgical scrubbing and patient skin preparation solution	Updated versions available at: http://www.who.int/infection-prevention/tools/surgical/system_change/en/.
Posters, for example, on surgical scrub technique	Original versions available at: http://www.who.int/infection-prevention/countries/surgical/en/ and any new resources can be found here http://www.who.int/infection-prevention/tools/surgical/reminders-advocacy/en/.
Training and education presentations	Updated version available at: http://www.who.int/infection-prevention/tools/surgical/training_education/en/.
Perioperative staff safety assessment tool	Original form available at: https://www.ahrq.gov/professionals/quality-patient-safety/hais/tools/surgery/tools/applying-cusp/perioperative_asst.html.
A hospital survey on patient safety	Original form available at: https://www.ahrq.gov/sops/quality-patient-safety/patientsafetyculture/hospital/index.html.
Learning from defects tool – perioperative setting	Original form available at: https://www.ahrq.gov/professionals/quality-patient-safety/hais/tools/surgery/guide-appcusp.html.
Executive safety rounds kick-off template	Original form available at: https://www.ahrq.gov/professionals/education/curriculum-tools/cusptoolkit/modules/engage/index.html.
Understand the science of safety video	Updated version available at: http://www.who.int/infection-prevention/countries/surgical/en/ and http://www.who.int/infection-prevention/tools/surgical/safety_climate/en/.

Any other new resources related to culture change can be found here http://www.who.int/infection-prevention/tools/surgical/safety_climate/en/.

In SUSP-Africa, each hospital established SSI surveillance for the duration of the project. SSI surveillance is particularly challenging in settings with limited resources, but it was a key pillar of the SUSP approach, together with monitoring compliance of the key preventive measures implemented. Important factors that supported the surveillance activity were:

- a protocol was developed specifically for this project, adapted from methods described by the US Centers for Diseases Control and Prevention;

- both elective and emergency operations were included and sites enrolled an intake of patients reflective of their overall surgical case load, with the aim of recruiting approximately 50 operations per month;

- 30-day follow-up after all operative procedures was conducted and used inpatient chart reviews, outpatient clinic attendance and telephone calls for contact with patients, as well as requests to send pictures to monitor wound status;

- data collection was performed by staff in ORs and by IPC staff postoperatively; one additional member of the nursing staff in each hospital was employed to lead surveillance activities.

4.2.4 Key lessons from the SUSP-Africa experience

According to the experience of the teams and mentors implementing SUSP-Africa, key lessons included the necessity to define the prerequisites to start such a project, to identify the factors most likely leading to success (Box 4.2), and to overcome the challenges (Box 4.3) that slowed down or hampered implementation.

Prerequisites for starting a SUSP project

A hospital/surgical department needs to be able to:

- commit to intensive implementation of the project for 24 months while ensuring longer-term sustainability and progressive embedding in routine practices;
- assemble a multidisciplinary team to include at least IPC, anaesthesiology, and surgery units;
- engage a senior level executive as part of the team;
- implement actions to improve perioperative teamwork, communication and the safety culture;
- regularly meet as a team to implement interventions and monitor performance;
- submit a minimal set of standardized surgical outcome data monthly.

Important overall points regarding execution of the SUSP Africa intervention were:

- it was primarily led by local core teams, each including at least one senior local surgeon;
- external experts provided some training and mentorship on project management and data collection, mostly at a distance through webinars and monthly telephone calls, and each site received one visit (3-4 days);
- three inter-country meetings were held over the project duration, starting from the preparation phase;
- a small budget was allocated to each hospital with the recommendation that it should not be used for procurement of equipment or products related to the project or for salaries, with the exception of costs linked to research and data collection.

A key success of the intervention was its gradual integration into routine clinical practice and the local production or procurement of specific products became part of the regular budget. Hospital staff in these institutions were highly motivated to improve their practices and local project leaders were influential members of their respective departments.

BOX 4.2

Summary of the key lessons learned from SUSP-Africa

Use multimodal strategies for SSI prevention interventions (not just checklists and bundles):

- have a stepwise action plan for an improvement intervention;
- map prevention recommendations according to the surgical patient journey so as to engage all levels of the local team as necessary;
- empower teams and involve frontline staff;
- engage leadership from the outset;
- let teams take the lead on adaptation;
- build on and catalyse collective and individual ownership;
- use data to create awareness;
- award teams and work with a safety culture spirit;
- recognize the resource investment required, including the completion of assessment, observation and monitoring and learning from defects tools – consider how to embed these practices in the local routine work flow.

INNOVATIONS THAT LED TO SUCCESS IN THE DIFFERENT HOSPITALS INCLUDED:

- some hospitals put in place systems to trace patients included in surveillance follow- up by using links to other clinics in the area (a monitoring and feedback component);

- one hospital added colour dye to locally-produced skin preparation solution to allow surgeons to see their adherence to recommendations for skin preparation (a system change factor);

- OR infrastructure was addressed to enhance OR discipline, for example, prevent door openings (a system change factor);

- town hall meetings and monthly rounds were timed to suit existing meetings (supported organizational safety climate and culture);

- a video by a regional surgical lead to personalize the story of the SUSP-Africa intervention (supported organizational safety climate and culture);

- local creation of eye-catching materials to raise awareness and engage (a communication and awareness-raising component);

- a label system for tracking surveyed patients.

Obstacles and challenges were also encountered. Most of these are typical when promoting improvement and change, especially when resources are limited and other health priorities may require investment.

5

SECTION III: THE WHO MULTIMODAL APPROACH AS A PROVEN AND SUCCESSFUL WAY TO IMPLEMENT SURGICAL SITE INFECTION PREVENTION RECOMMENDATIONS INTO PRACTICE

5.1 Introduction

Over the last decade, IPC research, together with field implementation, has clearly demonstrated that behavioural change and reduction of HAI are achievable. These are best achieved by applying multiple improvement elements integrated within a multimodal strategy using a multidisciplinary team approach.

A multimodal improvement strategy consists of several elements or components (three or more; usually five) implemented in an integrated way with the aim of improving an outcome and changing behaviour (8, 22, 23). At its core, a multimodal approach or strategy supports the translation of guideline recommendations into practice within health care with a view to changing health worker behaviour, engaging all those involved in the change, and ensuring that actions are relevant to the local setting. It is widely accepted that focusing on only one approach to ensure infection prevention will not achieve or sustain behaviour change and this is also true of SSI prevention. It is common and normal to find people resistant to change. Long-term improvement approaches are often perceived to be too complex and it is a significant challenge to convince people that *it is possible* and something sustainable to be achieved to prevent failure.

This section describes the features of a multimodal strategy that WHO proposes for the implementation of SSI prevention recommendations.

This is the result of insightful discussion with experts and implementers from around the world and it also builds upon the approaches and lessons learned from experiences presented in the previous sections. Importantly, this WHO multimodal approach has its foundations in the proven and effective WHO model used for hand hygiene improvement worldwide over the last decade (27-29). The proposed strategy covers what you need to know, what actions need to happen, who needs to be involved for the implementation of SSI prevention recommendations, and provides summary checklists for action. These represent an outline of ideas to stimulate thinking and to plan actions, including those which require local adaptation and prioritization.

The objective is to support targeted SSI prevention improvement steps, whatever the type and level of progress of the health care facility. Following the successful application of this model and the use of additional supporting implementation resources and improvement tools, the outcome should be a reduction in SSI.

> **"It always seems impossible until it's done"**
> *Nelson Mandela*

TARGET AUDIENCE

The target audience is intended to be any discipline introducing, leading or supporting SSI prevention; IPC and quality improvement focal points and teams; senior administrators; surgeons; surgical nurses; technical support staff; anaesthetists; and any professionals directly providing surgical care or involved in quality care improvement.

5.2 Background

This section is inspired by the WHO hand hygiene improvement model (22, 27, 28) and is also specifically based on the manuals supporting the implementation of the core components of IPC programmes at national and acute health care facility level (23, 24). As examples, it reflects strategies aimed at improving adherence to evidence-based clinical practices and SSI outcome, as well as WHO's experiences of applying a multimodal improvement strategy for the prevention of HAI.

The development of the WHO multimodal hand hygiene improvement strategy was based on the literature on implementation science, behavioural change, spread methodology, diffusion of innovation and impact evaluation. The core of the strategy was conceived at the Geneva University Hospitals and Faculty of Medicine (Geneva, Switzerland) and proved to be effective in significantly reducing HAI hospital-wide and to be cost effective (27, 30).

From a recent literature review undertaken to inform the WHO guidelines on the core components for IPC prevention programmes, evaluation of the evidence from 44 studies showed that multimodal strategies are effective in improving IPC practices and reduce HAI (31). It has also been estimated that more than 80% of studies retrieved for a 2016 literature review used multimodal interventions to reduce SSI incidence and thus protect patients.

5.3 The multimodal approach explained in detail

The five most common components of a multimodal strategy as applied to hand hygiene and described by WHO are shown in Figure 5.1. Importantly, these five components can be applied to any IPC improvement programme (Box 5.1).

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

1a. System change – alcohol-based handrub at point of care

+

1b. System change – access to safe, continuous water supply, soap and towels

+

2. Training and education

+

3. Evaluation and feedback

+

4. Reminders in the workplace

+

5. Institutional safety climate

BOX 5.1

Five key elemens identified by WHO for infection prevention and control multimodal strategies in a health care context

1 the system change needed to enable IPC practices, including infrastructure, equipment, supplies and other resources;

2 training and education to improve health worker knowledge;

3 monitoring and feedback to assess the problem, drive appropriate change and document practice improvement;

4 reminders and communications to promote the desired actions, at the right time, including campaigns;

5 a culture of safety to facilitate an organizational climate that values the intervention, with a focus on involvement of senior managers, champions or role models;

More specifically, the five elements can be applied to SSI prevention as described in Box 5.2.

Table 5.2. The five components of the multimodal strategy applied to SSI prevention	
Component	**Description**
System change	Refers to ensuring that the health-care facility has the necessary infrastructure and 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 and make execution easier and safer. This is often considered to be essential when introducing or making changes in the health-care setting and it must be taken into account at all times.
Training and education	Effective, practical training and education methods (aligned to evidence-based SSI prevention recommendations) are one important part of achieving improvement. Insufficient knowledge, particularly of SSI recommendations, their evidence base and the reasons why they are important, is a key barrier to change.
Monitoring and feedback	Regular monitoring and evaluation of recommended practices and procedures, infrastructures and available resources and supplies, and health worker knowledge and perception of the problem, coupled with timely feedback of SSI rates and risk factors for SSI, is vital if improvement is to be achieved. Evaluation and feedback should not be seen as a component separated from implementation or only to be used for scientific purposes, but rather as an essential step in identifying areas deserving major efforts and in feeding crucial information into the local action plan, including measurement of the changes induced by implementation (particularly when undertaking continuous monitoring) and to ascertain whether the interventions have been effective, thus providing a degree of assurance.
Reminders and communications for awareness-raising (previously 'reminders in the workplace')	Communications and reminders in the workplace are key to prompting and reminding health workers about the importance and relevance of practices to prevent SSI and are particularly important at the point of care. They are also a means of informing patients and their 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 about the standards that they should assure.
Institutional safety climate and culture change	The institutional safety climate and culture refer to creating an environment and the perceptions that facilitate awareness-raising about SSI prevention at all levels. 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 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 risk factors.

Thus, the multimodal strategy involves 'building' the right system, 'teaching' the right things, 'checking' the right things, 'selling' the right messages and, ultimately, 'living' IPC throughout the entire health system (Figure 5.2).

Figure 5.2
The five steps of the WHO multimodal improvement strategy: 'build it', 'teach it', 'check it', 'sell it', 'live it'.

1. Build it
(system change)

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

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

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

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

2. Teach it
(training & education)

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

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

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

3. Check it
(monitoring & feedback)

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

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

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

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

4. Sell it
(reminders & communication)

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

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

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

5. Live it
(culture change)

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

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

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

Scientific evidence and global experience show that each component of the WHO strategy is crucial. In general, no component can be considered optional if the objective is to achieve an effective and sustainable impact. 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 components might be given more emphasis than others or might be practically implemented in different ways. Regular assessment allows health facilities to direct efforts to all, some or one of the components at any given time.

In section II, we explored another implementation model (the *Four E's:* engage, educate, execute and evaluate) (18) outlining the critical factors for success in improvement programmes and used it to review the literature related to interventions aimed at improving surgical practices and reducing SSI. This approach and the WHO multimodal strategy have in common that they point out '*how*' improvement programmes can be organized to successfully support and enable the implementation of technical prevention measures (for example, protocols for the appropriate insertion and maintenance of central-line catheters). In other words, they provide the

framework for creating the supportive and enabling environment and climate for organizational and behavioural change to happen across teams and in the specific setting where they are applied.

To demonstrate the similarities between the two models, WHO gathered expert consensus and undertook a thematic analysis of the *Four E's* approach to compare it to the WHO multimodal strategy (32) (Figure 5.3). The aim was to promote a consistent global approach that has the potential to facilitate adaptation and implementation of IPC guidelines into practice. It is clear that there are congruence and synergies between the two proven approaches even where this is not readily evident and despite the different language used. In summary, system change equates to executing (the right things in the right place at the right time), training and education clearly equates to educate in the *Four E's* model, evaluation and feedback equates to engaging and evaluating, reminders in the workplace (or reminders and communication) equates to engagement, and finally institutional safety climate (or culture change) equates to the actions running through all components/*Four E's*. Therefore, the relevance of applying the WHO multimodal strategy for the prevention of SSI well concurs with the existing evidence for the proven efficacy of the *Four E's* model.

Figure 5.3
Visual representation of the similarities and relationship between the WHO multimodal improvement strategy and the *Four E's* approach


Mapping two improvement strategies

System change
Training and Education
Monitoring and Feedback
Reminders and Communications
Culture change*

Engage
Educate
Execute
Evaluate
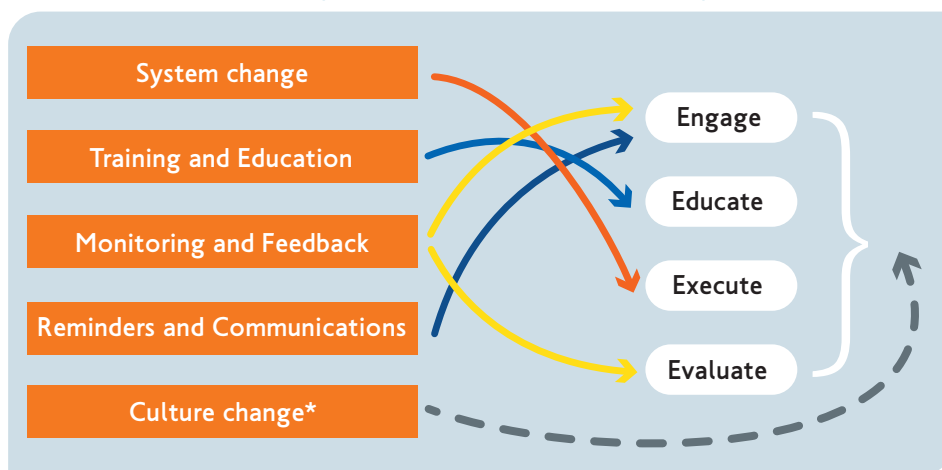
*Is achieved by all noted components among other actions

5.4 Applying the multimodal approach to SSI prevention to achieve improvement

The preventive measures included in the WHO SSI recommendations are now addressed within the context of the five components of the multimodal improvement strategy to describe how health facilities can apply this approach in their local context and translate the recommendations into practice.

Of note, this is not a practical manual to guide implementation of an SSI improvement programme. Furthermore, the concepts included here are complemented by the implementation model presented in the *Interim practical manual supporting implementation of the WHO Guidelines on core components of infection prevention and control programmes,* which includes a five-step cycle of improvement to support IPC intervention implementation (Figure 5.4). The work required to ensure that the entire facility is ready to undertake the intervention/change required should not be underestimated. This is critical for success and demonstrates the facility's culture around improvement and safe, quality care.

Figure 5.4
Five-steps cycle of improvement to support IPC intervention implementation

Step 5
Sustaining the programme over the long-term

Step 1
Preparing for action

Step 2
Baseline assessment

Step 3
Developing and executing the plan

Step 4
Evaluating impact

Multimodal improvement strategy embedded within each step in the cycle of continuous improvement
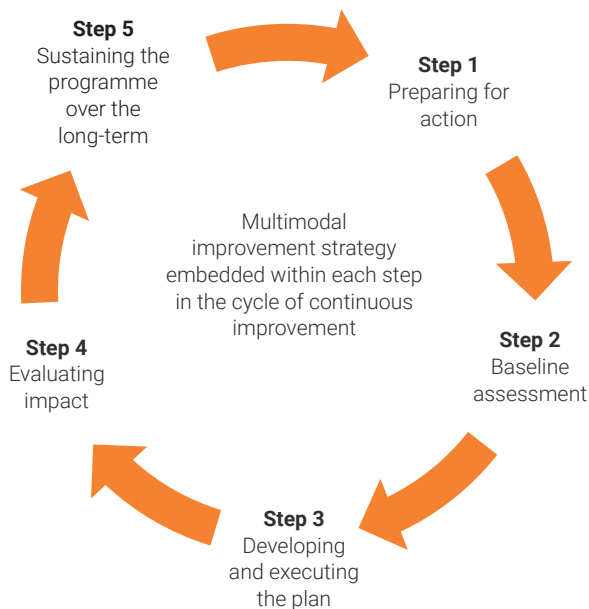
A. System change – ensure that the facility has the right infrastructure and resources to implement and maintain the recommendations

WHAT DO YOU NEED TO KNOW?

System change refers to ensuring that the health-care facility has the necessary infrastructure and 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 and make execution easier and safer. This is often considered to be essential when introducing or making changes in the health-care setting and it must be taken into account at all times.

Table 5.3 includes the WHO SSI prevention recommendations that mostly require system change (in particular. procurement of specific equipment) for effective implementation. It is important to consider that other key SSI prevention measures, which are not the object of the 2016 WHO evidence-based recommendations, may also require system change (for example, sterilization of surgical equipment).

Table 5.3 Examples of WHO SSI prevention recommendations requiring system change		
Preoperative	**Perioperative**	**Peri- and postoperative**
– Patients with known nasal carriage of *S. aureus* should receive intranasal applications of <u>mupirocin 2% ointment</u> with or without a combination of chlorhexidine gluconate body wash. – SAP should be administered <u>before the surgical incision</u>, when indicated (thus requiring SAP to be in the right place at the right time). – Surgical hand preparation should be performed either by scrubbing with a suitable <u>antimicrobial soap and water or using a suitable alcohol-based handrub</u> before donning sterile gloves. – <u>Alcohol-based antiseptic solutions based on chlorhexidine gluconate</u> for surgical site skin preparation should be used in patients undergoing surgical procedures. – In patients undergoing any surgical procedure, hair should **NOT** be removed or, if absolutely necessary, only be removed with a <u>clipper</u>. – Consider the administration of <u>oral or enteral multiple nutrient-enhanced nutritional formulas</u> for the purpose of preventing SSI in underweight patients who undergo major surgical operations. – Mechanical bowel preparation alone (without the administration of <u>oral antibiotics</u>) should NOT be used in adult patients undergoing elective colorectal surgery.	– <u>Warming devices</u> should be used in the OR and during the surgical procedure for patient bodywarming with the purpose of reducing SSI. – <u>Protocols</u> for intensive perioperative blood glucose control should be used for both diabetic and non-diabetic adult patients undergoing surgical procedures (potentially with changes to support monitoring). – <u>Goal-directed fluid therapy</u> should be used intraoperatively for the purpose of reducing SSI. – Either <u>sterile, disposable non-woven or sterile, reusable woven drapes and surgical gowns</u> can be used during surgical operations for the purpose of preventing SSI. – Consider the use of <u>irrigation</u> of the incisional wound with an <u>aqueous povidone iodine solution</u> before closure for the purpose of preventing SSI, particularly in clean and clean-contaminated wounds. – Adult patients undergoing general anaesthesia with endotracheal intubation for surgical procedures should receive 80% fraction of inspired <u>oxygen</u> intraoperatively and, if feasible, in the immediate postoperative period for 2–6 hours.	– Advanced dressing of any type should **NOT*** be used over a standard dressing on primarily closed surgical wounds for the purpose of preventing SSI.

*Note: system change may need to address <u>removal</u> of wrong products.

WHAT ACTION NEEDS TO HAPPEN?

A number of steps will likely be required to ensure the necessary infrastructure and resources are in place for action to address recommendations that require any system change. Human factors theory is a useful point of reference to consider when undertaking system change (33).

The health-care organization needs to ask itself some key questions:

What are the limitations of our current system/infrastructure that prevent us from implementing actions to improving SSI prevention?

Do we know how to re-allocate existing resources or deploy resources within the facility, including when improvement is slower than expected?

Are the resources and equipment for SSI prevention available to the relevant user at the right time and in the right place (that is, the design of the current working environment is supportive of workflow, including SSI prevention resources and equipment)?

Are they properly stored, easy to access, timely supplied, tracked and maintained, usable and meet current safety and policy standards?

Do we need to introduce barriers to discourage the unsafe use of resources and equipment?

Do we need to procure, produce, identify, allocate or prepare for the improvement to take place and for the system change to be sustainable in order to help staff to prevent SSI?

Asking such questions will help the health-care organization to determine where the leverage points are located in the local system and which of them is worth acting upon in order to transform a limitation into an action step for preventing SSI. Additional local risk assessment should consider the interactions between health workers and the system in order to assess the reasons for not progressing adherence to a WHO SSI prevention recommendation. Lack of resources may be one of these. It may also be necessary to ensure that the system prevents health workers from performing unsafe acts. For example, stopping hair removal will not be realistic if razors are still available in all wards/preoperative areas.

EXAMPLE 1

If it is intended to perform patient preoperative screening to determine nasal carriage of *S. aureus* prior to receiving intranasal applications of mupirocin 2% ointment with or without a combination of chlorhexidine gluconate body wash, is the laboratory service available/able to identify carriers? Is the equipment available for both screening and treatment?

EXAMPLE 2

In recent years, many facilities have switched to using disposable clipper heads when hair removal is absolutely necessary. Does your facility use disposable clipper heads or if your setting lacks the resources for disposable clippers, have you put in place a safe procedure to decontaminate clipper heads and blades so that they can be reused?

WHO NEEDS TO BE INVOLVED?

Implementation of IPC improvement programmes is usually the responsibility of the IPC lead or team. However, by definition, multimodal strategies require the involvement of multidisciplinary teams (see *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*) and SSI prevention approaches require these more than others. When addressing system change, the facility should define the objectives to achieve for each of the SSI recommendations and identify the appropriate human resources to be integrated among the different disciplines by clearly outlining roles and responsibilities from the outset.

To ensure that the necessary system change happens according to the SSI prevention measures intended to be improved in the programme developed at the facility level, it will be important to involve all those working in or associated with the change process including:

- senior managers – to ensure that they authorize and support financially the change;

- procurement services and pharmacists – to ensure appropriate product selection and timely procurement;

- IPC team – to support the selection and implementation of the change or those with any responsibility for quality or service improvement, especially in LMICs where IPC teams may not yet be in place (this might also include clinical epidemiologists or researchers involved in improvement projects);

- surgical team (OR, ward and outpatient services) – to be involved from the outset in decision-making about the change and its implementation; anaesthetists – same as surgical team, as appropriate;

- sterilization services – same as surgical team, as appropriate;

- engineers – to support infrastructure change and ergonomics, as appropriate;

- Trainers – to support knowledge transfer about the evidence and rationale motivating the change and any instructions about the correct use of any new equipment or supplies.

As an example of system change regarding the recommendation of 'In patients undergoing any surgical procedure, hair should **NOT** be removed or, if absolutely necessary, only be removed with a clipper, these are the key actions required:

1) acquire the relevant information to assess current practices in order to assess gaps in practice and detect strengths such as champions who could further advocate for the recommendation;
2) if your health care facility does not have any policy/protocol already in place, target all those involved to propose the adoption of the recommendation and encourage individual and multidisciplinary actions;
3) if the local approach needs to be updated to appropriately meet the recommendation, target those involved and discuss updates and action needed including the availability of clippers if hair removal is absolutely necessary.

As an example of system change regarding the recommendation of 'Patients with known nasal carriage of *S. aureus* should receive intranasal applications of mupirocin 2% ointment with or without a combination of chlorhexidine gluconate body wash', these are the key actions required:

1) acquire the relevant information to assess current practices in order to assess gaps and detect strengths;
2) if your health care facility does not have any policy/protocol already in place, target all those involved to propose the adoption of the recommendation and encourage individual and multidisciplinary actions including provision of laboratory services and procurement;
3) if the local approach needs to be updated to appropriately meet the recommendation, target those involved and discuss updates and action needed.

Table 5.4
Summary checklist of actions for system change to be achieved for any of the WHO SSI recommendations
There is visible commitment from management to address infrastructure and resource needs.
Assessment of current limitations and strengths for improving adherence to SSI recommendations has been carried out.
Budget has been secured for infrastructure and resource needs (this may require business cases to be developed).
An action plan for implementing any new infrastructure and resource needs is available, including the exact location and by when this should be achieved.
An identified, dedicated team exists to implement the action plan with clear roles and responsibilities.
A clear system for staff to record learning from defects related to infrastructure and resources is available and accepted within the culture of the facility as a learning tool.
An approach for ongoing checks on the infrastructure and resources is established within the monitoring and feedback plans of the facility.
All facility documentation, for example, policies, standard operating procedures, procurement plans, as well as education and training contents, are updated to reflect the infrastructure and resources that will support safe implementation and SSI prevention.
Valid and reliable tools to support the required system change have been identified and are available.

It is important to note that apart from establishing the right infrastructure and resources, other aspects of the multimodal strategy will also have to be addressed to make any change happen.

B. Traing and education

WHAT DO YOU NEED TO KNOW?

*Effective, practical **training and education** methods (aligned to evidence-based SSI prevention recommendations) are one important part of achieving improvement. Insufficient knowledge, particularly of SSI recommendations, their evidence base and the reasons why they are important, is a key barrier to change.*

This element of the multimodal strategy pertains to all WHO SSI prevention recommendations. The role of training is of paramount importance to ensure empowerment of health workers and education is a constant in health-care quality and safety. Training and education should be targeted at all disciplines involved in patient interactions in support of an improvement continuum, especially as staff within health facilities can change frequently. For sustained improvement in surgical safety, we highlight here some of the infection prevention modifiable risk factors that may require specific, targeted training in support of the WHO recommendations. Importantly, training should be tailored in a way that engages and helps the audience understand how the required changes fit within their clinical workflow using a range of training approaches.

WHAT ACTION NEEDS TO HAPPEN?

A number of steps will likely be required to ensure that training and education actions lead to the change in behaviour and practice that needs to be achieved. Trainers may wish to consider training content developed by WHO (http://www.who. int/infection-prevention/tools/surgical/training_ education/en/) and/or should design new resources in line with the SSI recommendation and the objectives related to the system change to maximize the complementarity among the different elements of the multimodal strategy. Training modalities should be planned according to the specific practices needed to implement the recommendation, while taking into account the limitations and strengths of the local context. The recommendation on training and education as a core component of effective IPC programmes (8) clearly indicates the efficacy of team and task-based strategies that are participatory and include bedside and simulation. In addition, the facility manual supporting the implementation of the recommendations provides ideas, tips and examples to help trainers achieve these aims (23).

The facility needs to ask itself some key questions:
- *Do we have staff who are competent in delivering targeted training?*
- *Do we have the right materials and equipment to deliver the training (related to system change*)?*
- *Which staff need to be trained and how can we ensure that staff can attend training sessions?*

* It is also important to ask if any system change has been made or is needed so that the training delivered is realistic to the setting, for example, if training on use of negative pressure devices takes place, the actual device needs to be available for use.

EXAMPLE

If staff cannot leave the clinical area for specific training sessions, then training can be facilitated at the place of work (point of care) and/or embedded in existing opportunities. Do you use gatherings such as town hall meetings to highlight key training points on SSI prevention?

WHO NEEDS TO BE INVOLVED?

The content of training sessions should provide an overall vision of the shared objectives and deliver content tailored to the role and responsibilities of each staff discipline most relevant to the behavioural change you want to achieve. **Clinical leaders and management** should endorse the training process in order to enhance the involvement of health workers. To address the risk factors associated with SSI, **all** those working in or associated with surgery will be important at different stages of the change process.

The following is a suggestion for **targeting key staff** for training when implementing SSI recommendations.

- If you do not currently practice a recommendation, target all staff involved in surgical care.

- If you suspect or know that a recommendation is not adhered to, target those who are actively involved in the provision of care associated with the recommendation. For example, for surgical hand preparation, ensure that surgeons and OR staff are present.

- If you are introducing a new product/equipment, management staff, those who will procure and maintain the product and those will who use the product, such as anaesthetists and surgical staff, should be present.

- Additionally, **observers** who record compliance with SSI prevention measures need to receive the same training so that there is no disparity in what is expected to be practiced and what is planned to be monitored.

- Health-care facilities may also choose to undertake **patient engagement** programmes and train patients to be part of the process of SSI detection.

Table 5.5
Summary checklist of actions for training and education to be achieved for any of the WHO SSI recommendations
There is visible commitment from management and clinical leaders to ensure that training and education is delivered in an effective, timely manner.
Budget is available to ensure the right materials and media are available for training.
An action plan to roll-out targeted, specific training is available and has been viewed and approved by all relevant others.
An identified, dedicated and competent team who will deliver the training exists.
A clear system for reporting on and possibly recording training sessions is available and allows feedback to management and all staff on progress on reaching training targets, for example, number of staff by discipline.
An approach for ongoing checks on knowledge and perception is in place to assess the training and education sessions.
All facility documentation, for example, policies, standard operating procedures and procurement plans, are up to date with the content of the training materials.

It is important to note that apart from providing training and education, other aspects of the multimodal strategy will also have to be addressed to make any sustainable improvement happen in practice. Some further practical examples are available at the end of this section to help you on your journey.

C. Evaluation and feedback

WHAT DO YOU NEED TO KNOW?

*Regular monitoring and evaluation of recommended practices and procedures, infrastructures and available resources and supplies, and health worker knowledge and perception of the problem, coupled with **timely feedback** of SSI rates and risk factors for SSI, is vital if improvement is to be achieved.*

Evaluation and feedback should not be seen as a component separated from implementation or only to be used for scientific purposes, but rather as an essential step in identifying areas deserving major efforts and in feeding crucial information into the local action plan, including measurement of the changes induced by implementation (particularly when undertaking continuous monitoring) and to ascertain whether the interventions have been effective, thus providing a degree of assurance.

Continuous or periodic monitoring and assessments are a fundamental part of SSI reduction and these activities are already a part of everyday practice in many countries. This includes evaluation of and feedback on both improvement processes/practices and SSI outcome. In the context of a multimodal improvement strategy, the examples given here focus on process and are based on the WHO SSI recommendations. Information on SSI surveillance can be found in the *WHO Global guidelines on the prevention of SSI* (12). A WHO protocol and forms with adaptations for settings with limited resources are also available (http://www.who.int/infection-prevention/tools/surgical/evaluation_feedback/en/). These also include process indicators for key SSI prevention measures (for example, surgical hand preparation or surgical site skin preparation). Evaluation and timely and targeted feedback will often drive actions around the other four multimodal components.

WHAT ACTION NEEDS TO HAPPEN?

A number of steps will likely be required to ensure that selected indicators and feedback actions reflect the overall objective of the SSI prevention intervention and are consistent with system changes and training and education content. Planning for evaluation and feedback should involve primarily the IPC team and eventually engage everyone in order to create an understanding of the importance of local data. Knowledge of the local situation through the use of data and other information is critical to create situation awareness and trigger teamwork. Selecting the right process, infrastructure and knowledge indicators to reflect system and practice change are essential elements and require the expertise of the IPC team.

Furthermore, SSI surveillance is the critical component of the assessment framework of a SSI improvement programme. Surveillance data are essential for improvement and can be a most persuasive factor when faced with a situation where clinicians do not think change is required.

The conduct of monitoring and surveillance activities requires the support and agreement of the facility leadership and the chiefs of the targeted surgical services as it is linked to patient safety and performance assessment and may require some additional resources (for example, dedicated time of trained staff and microbiological investigations in some cases). Building monitoring and surveillance capacity will require some degree of training of the person identified as the lead for surveillance (most likely, the IPC lead) and those dedicated to data collection, usually the nurses and physicians working in the wards or departments where surveillance is conducted. If this expertise does not yet exist, this should form the initial priority focus for your plans. Consider what expertise is available in nearby health facilities and nationally to support this activity.

The facility needs to ask itself some key questions:
- *Do we know what are the key processes we want to monitor and how?*
- *Do we have staff who are competent in undertaking monitoring and feedback?*
- *Do we have the right resources to conduct monitoring?*
- *Which staff need to be trained to ensure effective monitoring and feedback?*
- *Are there fora where feedback can be delivered?*
- *Is the organization prepared for receiving feedback and acting upon it?*
- *Have we asked staff members how they could contribute to improvements following evaluation and feedback?*

EXAMPLE

Targeted feedback is an important part of improvement and behaviour change. Has your facility consulted and agreed on different formats for providing feedback to different staff groups?

Examples of targeted process evaluation and feedback

- If the use of alcohol-based antiseptic solutions containing chlorhexidine gluconate for surgical site skin preparation is one of the planned objectives for reducing SSI, monitoring of preoperative skin disinfection and feedback on interim results need to be organized.

- If improving surgical hand preparation is one of the planned objectives for reducing SSI, assessing the use of the correct product (scrubbing with a suitable antimicrobial soap and water or using an appropriate alcohol-based handrub) and technique, together with feedback of the results of compliance observations need to be organized.

- If avoiding hair removal (or using a clipper in case of absolute necessity) in patients undergoing any surgical procedure is one of the planned objectives for reducing SSI, monitoring of this needs to be organized in the preoperative period either in the ward or in the OR, including feedback on interim results.

- If correct SAP administered at the right time (within two hours before surgical incision) is one of the planned objectives for reducing SSI, monitoring of antibiotic administration and feedback on interim results need to be organized.

WHO NEEDS TO BE INVOLVED?

Each staff discipline most relevant to the change you want to see should be engaged in order to trigger collaboration in evaluation and feedback plans. Roles and responsibilities, including coordination activities, must be clearly outlined from the outset. To address the risk factors associated with SSI prevention, all those working in or associated with surgery will be important at different stages of evaluation and feedback and associated action plans. The following is a suggestion for targeting key staff.

• If you do not currently practice a recommendation, target all staff who are critical for the application of the recommendation and meant to perform best practices so that they are fully aware of the evaluation and feedback action plans by the role of the observers.

• If you suppose or know that a recommendation is not adhered to, target those who are actively involved in the provision of care associated with the recommendation you are evaluating. For example, for surgical hand preparation, ensure that surgeons are aware that monitoring will take place and involve them in the process, measurement indicators and plans for feedback and subsequent action.

Always ensure that shared decision-making endeavours lead to acceptable process measures/ indicators for any monitoring and feedback and that this is the outcome of a productive multilateral approach. Processes (or changes in processes) are then more likely to be integrated into daily practice. Additionally, data gathered locally as part of evaluation and feedback endeavours can be included in interactive discussions during training sessions to provide a coherent and motivational approach for the change you want to see.

Table 5.6
Summary checklist of actions for evaluation and feedback to be achieved in relation to any of the WHO SSI recommendations
There is visible commitment from management to ensure monitoring and feedback is conducted in timely manner with an open culture in providing and receiving feedback for action and not blame.
Budget is available to ensure the right materials and human resources are available for monitoring.
An identified, dedicated and competent team who will undertake consistent, valid and reliable monitoring exists, including members with analytical skills.
A reliable protocol has been identified or developed and a list of indicators is defined and used to monitor advancement and accounting for critical issues.
An action plan for conducting specific monitoring and feedback of process indicators and SSI surveillance in the context of the overall local improvement plans has been developed, reviewed and approved by all relevant staff.
Training of observers has been conducted, if necessary.
The task of analysing the data has been assigned and there is a plan for interim and final analysis of the data and their use in the context of the improvement plan.
The team in charge of monitoring and feedback meet on a timely base to brief and debrief the activity carried out.
An approach for ongoing checks on action against monitoring feedback/defects is in place.
The WHO Surgical Safety Checklist is in use with management of any defects in adherence.
All facility documentation, for example, policies, standard operating procedures, procurement plans, are concurrent with monitoring indicators.

WHO already provides a number of tools that can help with monitoring aspects of the guidelines.

D. Reminders and communications for awareness-raising

WHAT DO YOU NEED TO KNOW?

Reminders and communications in the workplace are key to prompting and reminding health workers about the importance and relevance of practices to prevent SSI and are particularly important at the point of care. They are also 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.

Reminders and prompts are key to remind all those involved in surgical care how to take the right evidence-based actions when needed and should be used as part of a multimodal strategy. Dedicated teams should position reminders appropriately in order to trigger staff attention on the most critical and relevant action to be taken in order to prevent SSI. Most of the WHO recommendations lend themselves to this approach. Communication is key to construct the organizational culture and attitude regarding the key recommendations for preventing SSI. It should be oriented both internally and to a wider audience to create problem-awareness and point to the identified solution and local action to reduce the burden of SSI.

WHAT ACTION NEEDS TO HAPPEN?

A number of steps will likely be required to ensure that reminders are coherent and aligned with the comprehensive multimodal strategies and objectives defined by the health-care facility regarding the key recommendations and concepts promoted through training and education, as well as other dimensions. This will support the goal that staff accept reminders and progressively embed them in current behavior and practices for SSI prevention. The local situation and culture and available expertise should be taken into account in order to construct sound and effective communication strategies regarding the implementation of key recommendations.

EXAMPLE

In the SUSP project described in section II, the content for a reminder summarizing all SSI prevention measures included in the intervention was designed by local staff. They considered it helpful to categorize the measures to be improved according to the pre- peri- and intraoperative periods and to use the term 'wound' infection rather than SSI. The same designed content was used in different supports, such as a poster, a folded leaflet and banners to suit different audiences and uses. Have you included clinical staff in your communication exercises to be sure that the language and format will be acceptable?

The facility needs to ask itself some key questions:

– *Do we know what are the best places where reminders on key recommendations should be placed and which recommendation should be targeted?*

– *Do we know which staff members would benefit from reminders?*

– *Do we know what are the key messages to communicate with simple language understandable locally?*

– *Do we have the right expertise and resources to develop impactful communications?*

– *Have we asked staff members how they could contribute to communication exercises and what practices would benefit from tailored reminders?*

– *Do we know the objectives of a communication strategy to support SSI prevention at the local level and how to design it according to diverse audiences and media?*

A sample action plan, as well as identification of barriers and solutions for monitoring and feedback of IPC practices, is included in Part III of the *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*" (23) and can be easily applied to SSI prevention programmes.

WHO NEEDS TO BE INVOLVED?

Each staff discipline most relevant to the change you want to see should be engaged in reminders and communication plans and activities. To address the risk factors associated with SSI prevention, all those working in or associated with surgery will be important at different stages of communication plans in order to assure that the scientific content of the message is coherent and aligned with care activities. The following are suggestions for developing communications and targeting key staff.

- If you decide that certain/all SSI recommendations need communications to ensure that they attract the attention they deserve to encourage implementation, engage all relevant staff groups in preparing and disseminating these messages. For example, you can ask ward or OR staff to create posters describing the evidence-based recommendations that require change.

- If you have financial resources, engage communication experts to work alongside local staff.

- If you suppose or know that a recommendation is still not being adhered to even after communications or reminders have been posted, continue to involve a range of hospital staff including clinical and management as well as communication experts, where possible, to review materials and adjust the strategy.

Consistency of communications and the content of reminders with training and education materials should be ensured and trainers should be also involved in their development.

Table 5.7
Summary checklist of actions for reminders and communications for awareness raising to be achieved in relation to any of the WHO SSI recommendations
There is commitment from management to support communications as part of a multimodal strategy.
Budget is available to ensure that the right communications can be created and issued.
An identified, dedicated and competent team who will be able to develop or support the development of communications exists.
Communications are consistent with all other facility documentation, for example, policies, standard operating procedures, procurement plans, and with the facility communication style and local culture

WHO already provides a number of examples that can help with communications, reminders and prompts (WHO tools as a reminder in the workplace [hand hygiene] http://www.who.int/infection-prevention/tools/hand-hygiene/workplace_reminders/en/; WHO tools for communications for awareness-raising [injection safety] http://www.who.int/infection-prevention/tools/injections/communications/en/).

System change may also be necessary to ensure that the recommendations being promoted can be achieved. For example, posters stating that hair removal should only be performed with clippers if clippers are not available, will make the communication strategy fail. This again implies the cyclical or stepwise nature of the multimodal strategy where some components will need to be addressed before others.

E. Institutional safety climate and culture change

WHAT DO YOU NEED TO KNOW?

*The **institutional safety climate and culture** refer to creating an environment and the perceptions that facilitate awareness-raising about SSI prevention at all levels. 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 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 risk factors.*

At your facility, and in some countries at national level, SSI reduction is seen as both critical and a priority. This means that a safety culture already exists and the problem of SSI is at least recognized. Implementation of all the guideline recommendations will be affected by the institutional safety climate and culture. The involvement of senior clinical leaders, as well as managerial back-up, was a key success factor in the CUSP and SUSP-Africa programmes. A culture for improvement is dependent on the local history and other characteristics and is often a pre-existing element. In some facilities, the culture of patient safety does not exist or has been raised in other areas, but is not yet applied to SSI prevention.

The use of pre-existing adaptive approaches, such as CUSP and SUSP, has already proven useful as previously described.

WHAT ACTION NEEDS TO HAPPEN?

The CUSP process includes five steps:

1. science of safety training;
2. identifying safety hazards – a continuous process;
3. senior executive partnership;
4. learning from defects;
5. implementation of improvement tools.

It is clear that while training, monitoring and feedback and subsequent improvement steps using a checklist and other tools have been covered throughout this section, the specific CUSP process is about engagement of the right people to ensure the right outcome. It has been demonstrated that this leads to culture change within surgical units in support of SSI reduction (34). Achieving an institutional safety climate also depends on broader training and learning from defects that refers to the institutional mission, which encompasses the training on the actual SSI recommendations.

The facility needs to ask itself some key questions:

– *Are senior management engaged and participating in the workings of surgical units?*
– *Are staff listened to when they have concerns about patient safety or defects?*
– *Are issues or disagreements in surgical units resolved appropriately with what is best for the patient as the focus?*
– *Are all staff, including senior management, able to attend training and other sessions that discuss hazards and defects, for example, grand rounds?*
– *Would staff say that they would feel safe being treated in the surgical unit as a patient?*
– *Are the staff part of teams that design targeted interventions to achieve improvement in surgical processes?*

EXAMPLE

Communication from hospital leadership has been shown to be effective in supporting infection prevention. Is there a process whereby your facility's leadership has committed to the SSI reduction programme? For example, have chief executives agreed to have meetings with clinical teams to address barriers (including resources)?

Overall, who should be involved in ensuring an institutional safety climate and culture?

Each staff discipline most relevant to the change you want to see should be targeted and roles and responsibilities clearly outlined from the outset.

• If your facility has not already recognised that SSI is a problem, the IPC team, senior management, the quality and safety team, and senior clinical staff must meet to discuss why addressing SSI is necessary to quality and safety.

• If your facility has started the journey of addressing SSI, these teams and individuals should continue to work together to address all actions required to build a safety climate around SSI prevention.

• If your facility appears to be successfully addressing the SSI burden, the goal should be to demonstrate achievements through assessments and to reward individual and team excellence until everyone is confident that culture change is embedded and teams are working to achieve quality and safety every day without defects.

Health care facilities may also choose to engage patients as part of efforts to enhance the institutional safety climate.

Examples of SSI recommendations and who needs to be involved to create the right culture to support implementation	
Recommendation	**Who should be involved**
Surgical hand preparation should be performed either by scrubbing with a suitable antimicrobial soap and water or using an appropriate alcohol-based handrub before donning sterile gloves	Senior management IPC teams Procurement staff Pharmacy staff (if local production of a product will be necessary) Consultant surgeons Surgical nurses and assistants
In patients undergoing any surgical procedure, hair should **NOT** be removed or, if absolutely necessary, only be removed with a clipper	Senior management IPC teams Procurement staff Pharmacy staff (if local production of a product will be necessary) Consultant surgeons Surgical nurses and assistants
SAP should be administered before surgical incision, when indicated	Senior management IPC teams Pharmacy staff Consultant surgeons Anaesthetists Surgical nurses and assistants

Table 5.8
Summary checklist of actions for an institutional safety climate and culture to be achieved in relation to any of the recommendations
There is visible commitment from senior management to support change in surgical units.
Leads and senior staff in the surgical unit(s) proactively show commitment and play role models to catalyse change among all staff.
Budget is available to support activities that facilitate change (for example, celebrations of success, awards to teams/units that have achieved results, etc.).
An identified, dedicated and competent team has been formed and empowered to take action with clearly defined roles.
Culture assessment surveys have been undertaken at baseline and are planned for follow-up and the results have been used to inform the subsequent plan.
An action plan for change is in place with agreed timelines for review.
Learning from defects and other safety tools are being used.
Training opportunities exist and are consistent with the culture shift being addressed.

A number of tools that can help with progressing an institutional safety climate and culture are available from WHO and CUSP (US Agency for Healthcare Research and Quality Tools to promote safe surgery; https://www.ahrq.gov/professionals/education/curriculum-tools/cusptoolkit/index.html; WHO tools for an institutional safety climate [hand hygiene]: http://www.who.int/infection-prevention/tools/hand-hygiene/safety_climate/en/; WHO tools for an institutional safety climate and culture [injection safety]: http://www.who.int/infection-prevention/tools/injections/safety-climate/en/).

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