COLLEGE OF MEDICINE AND HEALTH SCIENCES
SCHOOL OF HEALTH SCIENCES

HIGH RATE OF SURGICAL SITE INFECTIONS IN MATERNITY AND SURGICAL WARDS OF KIGEME DISTRICT HOSPITAL

A dissertation submitted in partial fulfillment of the requirements for the Degree of Master of Hospital and Healthcare Administration (MHA)

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Kigali, 02nd June, 2017

DECLARATION

I, UMUHOZA Hyacinthe, hereby declare that this capstone thesis project entitled "**High rate of surgical site infections in Maternity and surgical wards of Kigeme District Hospital"** is my original work. I have not copied from any other students' work or from any other sources except where due reference or acknowledgement is made explicitly in the text, nor has any part been written for me by another person.

Candidate _____ Date _02nd June, 2017__

DEDICATION

This capstone thesis is dedicated to:

My lovely husband NSANZIMANA Jerome

My daughters: IHOZA Ornella and FEZA Orlene

ACKNOWLEDGEMENT

I would like to express our deep gratitude to all who in one way or another have contributed to the completion of this Project. My thanks go first to the Almighty God.

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ABSTRACT

Surgical site infection is a type of healthcare-associated infection in which a wound infection occurs after an invasive (surgical) procedure. SSIs are associated with increased duration of hospital stay, increased cost of care and increased mortality. The majority of surgical site infections are preventable..

A quality improvement project was established by using strategic problem solving approach to reduce SSI in Maternity and surgical wards of Kigeme district hospital, Rwanda. The aim of this study was to reduce the rate of surgical site infections in Maternity and Surgical wards of Kigeme District Hospital from 6.7% to 3% from January 2017 to March 2017. A pre post intervention study design was utilized in this project to evaluate the effect of the intervention. An intervention was designed and implemented and the collected data were tabulated using Microsoft Excel. Chi Square tests were used to compare the pre- and post-intervention SSI rate. All data analysis was completed using SPSS v.20 statistical software at a significance level of $P \leq 0.05$.

Results: The intervention (physically separation of five areas in CSSD, Training of CSSD staff) reduced the incidence rate of SSI from 6.7% to 2.3% (<0.001) with a percentage difference of 4.4% (P<0.001). The study was demonstrated elegantly as success due to many factors including the collaboration of the hospital senior management team and concerned departments.

In summary, reducing cross contamination in CSSD by separating areas is a crucial intervention and based on the results, it is feasible in a low-resource setting to establish a successful SSI surveillance using strategic problem solving approach. Longer term follow up of the intervention and team approach are needed to understand the sustainability.

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LIST OF ACRONYMS AND ABBREVIATIONS

ASA	American Society of anesthesia
APIC	Association for Professionals in Infection Control and epidemiology
BPH	Benign Prostatic Hyperplasia
C/S	Caesarian Section
CDC	Centers for Disease Control and prevention
CSSD	Central Sterile Supply Department
DH	District Hospital
HAI	Hospital acquired infection
HFES	International Symposium on Human Factors and Ergonomics in Health Care
HIV	Human Immunodeficient Virus
HMIS	Hospital Management Information System
IPC	Infection and Prevention Control
LMICs	Low middle income countries
NICE	National Institute for Clinical Excellence
NCDs	Non Communicable Diseases
OPD	Outpatient Department
OR	Operating Room
PBF	Performance Based Financing
PIDAC	Provincial Infectious Diseases Advisory Committee
PPEs	Personal Protective Equipments
SMT	Senior Management Team
SPSS	Statistical Package for the Social Sciences

SSI	Surgical Site Infection
WBC	White Blood Cells
WHO	World Health Organization
USA	United States of America

DEFINITION OF KEY TERMS

Infection:

Invasion and multiplication of microorganisms in the body tissue.

Post-operative:

Connected with the period after a surgical operation.

Nosocomial infections:

Also called "hospital-acquired infections", are infections acquired during hospital care, which are not present or incubating at admission. Infections occurring more than 48 hours after admission are usually considered nosocomial.

Surgical site infection:

Any purulent discharge, abscess, or spreading cellulitis at the surgical site during the month after the operation or up to one year after surgery in patients receiving implants

Sterilization (microbiology):

Referring to any process that eliminates, removes, kills, or deactivates all forms of life and other biological agents (such as fungi, bacteria, viruses, spore forms, prions, unicellular eukaryotic organisms such as Plasmodium, etc.) present in a specified region, such as a surface, a volume of fluid, medication, or in a compound such as biological culture media

Central sterile supply department: also called "Central sterile services department "or "central sterile department" is a centralized area within the health care setting for cleaning, disinfection and/or sterilization of medical equipment/devices.

Medical devices:

Any instrument, apparatus, implement, machine, appliance, implant, reagent for in vitro use, software, material or other similar or related article, intended by the manufacturer to be used, alone or in combination, for human beings, for specific medical purpose(s).

Reprocessing:

The HFES (2015) defines Reprocessing as "a multistep process including the cleaning, disinfection, sterilization and repackaging of a used medical device so that it can be put back in service again". Goal of reprocessing is to remove contaminants such as microorganisms by different steps so that when the device is reused the risk of infection is eliminated.

Cross contamination:

The process by which a substance that is harmful or dirty spreads from one area to another

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Kigeme District hospital is located in the Southern Province of Rwanda, Nyamagabe District, at 18km from Nyungwe National Park near the main road to Republic Democratic of Congo; it has a catchment area of 198173 populations and covers 10 Health centers, 1 dispensary and 5 health posts scattered over 8 sectors. The hospital has 32 clinical, Para clinical, administrative and technical services. Clinical services include outpatient departments (OPD for MD, dentistry, mental health, NCDs, ophthalmology and HIV/AIDS unit), internal medicine, paediatrics, nutrition, maternity, neonatology, surgery, physiotherapy , emergency unit, Central sterile supply department (CSSD) and three operating theatre with three rooms (two for maternity and one for general surgery).

Table 1: Summary of Kigeme hospital operating theatre & CSSD information

Number of surgeons	1
Number of physicians	11
Number of midwives in Maternity	13
Number of nurses in Surgical wards	5
Operating rooms	3
Recovery rooms	3
Major surgeries in 2015	1075
Minor surgeries in 2015	464

Source: HMIS/Kigeme DH

Para clinical services include pharmacy, laboratory, medical imaging and social services. Technical services include monitoring and evaluation, performance based finance (PBF) and accreditation, community health, environmental health, information technology, maintenance and ambulance.

Administrative services include direction and secretariat, administration management, public relations and customer care, human resources management and chaplaincy.

Currently the hospital has 134 employees, including 50 nurses, 10 medical doctors, one temporary surgeon, 15midwives, 23 paramedicals including 3 anaesthetists and 35 others including administrators and supporting staff. The motto of Kigeme hospital is " We work for the Lord who comforts and heals"[1,2]

Table 2: Data on patient in Maternity and Surgical wards /2015

Indicators	**Surgical ward**	**Maternity ward**
Number of beds	33	48
Average bed occupancy rate	43.3%	72.1%
Average length of stay	4 days	3.8 days
Major surgeries n=1075	133 (12.4%)	942 (87.6%)
Top five cause of morbidity	1. Physical traumatisms	1. Spontaneous abortion
	2. Closed fractures	2. Threat of premature delivery
	3. Open fractures	3. Post natal haemorrhage
	4. Head injuries	4. Urinary tract infection
	5. Hernia	5. Puerperal infections
Top five cause of mortality	1. Head injuries	1. Internal hemorrhage
	2. Bed sores	2. Post-partum hemorrhage
	3. Brain tumor	3. hypovolemia
	4. Strangulated hernia	
	5. BPH	

Source: HMIS/Kigeme DH

According to the world health organization, Surgery is often the only therapy that can alleviate disabilities and reduce the risk of death from common conditions; surgical procedures are intended to save lives. However, unsafe surgical care can cause substantial harm including infections known as surgical site infections (SSI), disabilities and death.[3]

Between 5th and 15th centuries, illness was considered as a punishment from God and all wounds were observed infected and after this epidemic, SSIs were main cause of death.[4]

Hippocrates (Greek physician and surgeon, 460-375 BC), known as the father of medicine, used vinegar to irrigate open wounds and wrapped dressings around wounds to prevent further injury. His teachings remained unchallenged for centuries.[4]

As late as the 19th century, aseptic surgery was not routine practice. Sterilization of instruments began in the 1880s as did the wearing of gowns, masks, and gloves.

In Africa, wound infection rates were high and in some hospitals almost every wound would become infected; the commonest reason advanced was poverty which caused malnutrition, poor facilities, shortage of equipment and the management of the infected wound was based on diverse practices such as the use of herbal medicine, divination and other physical interventions.[5,6] but now there are many international organizations such as CDC and WHO, many studies involved in infection control and worldwide improvement is observable.

In Rwanda, we still have few studies showing the incidence of SSI, However through accreditation program, the Ministry of health introduced IPC program in all hospitals including Kigeme district hospital and committees of IPC are functional.[7]

1.2 PROBLEM STATEMENT

There is a high rate of surgical site infections in Maternity and surgical wards of Kigeme District Hospital.

Surgical site infection is not only a concern for Kigeme District Hospital, but also other hospitals across Rwanda provinces are facing similar SSIs. For instance, Mibilizi District Hospital reported 5.1%, Kibungo hospital 3.6%, CHUB 4.9%.[8],[41][9] However, a similar challenge of SSI is also a health concern in developing countries where the average SSI rates are twice or three times higher than developed countries. In other similar settings from Africa the rate of SSI is considered high, in this case in 2011, Ethiopia reported 21%, Uganda 10%, Kenya 19%, Tanzania 24% and Nigeria with the rate ranged between 16 to 31%.[8,10] As results, Patients who develop SSIs are up to 60% more likely to spend time in an intensive care unit, 5 times more likely to be readmitted to hospital, and 2 times more likely to die compared with patients without SSIs. It account for 3.7 million excess hospital stay days, more than $1.6 billion excess costs annually and 3.57 extra drug use.[5]

1.2 OBJECTIVE OF THE STUDY

To reduce the rate of surgical site infections in Maternity and Surgical wards of Kigeme District Hospital from 6.7% to 3% from January to March 2017.

1.4 HYPOTHESIS

H_0: Establishing a separate sterilization room from other areas of CSSD will not improve SSIs.

H_1: Establishing a separate sterilization room from other areas of CSSD will improve SSIs.

1.5 JUSTIFICATION OF THE PROJECT

According to the WHO, in many district hospitals from developing countries, the quality of surgical and acute care is often further constrained by poor facilities, inadequate low technology apparatus and limited supplies of drugs, materials and other essentials and all these factors contribute to unacceptable rates of mortality.

A surgical site infection is a post-operative complication that brings about embarrassment to the surgeon, discomfort along with prolonged hospitalization and sometimes death for the patients and considerable financial burden on the society. [(12)]

In Kigeme hospital, the problem of post-operative infection was identified during data surveillance of Hospital Acquired Infection (HAI) by Infection Prevention Control (IPC) committee and this quality improvement project aims at reducing the SSI by improving sterilization process in order to minimize risks of cross contamination in CSSD and to fight against the consequences which can be experienced by the patient, staff and hospital.

1.6 ORGANIZATION OF THE THESIS

This dissertation contains six main chapters. Chapter one of this study introduced the setting and the background of Kigeme hospital, highlights data related to Surgical site infections in Maternity and surgical wards at the hospital, describes the specific problem addressed in the study as well as the hypothesis, objectives and justification of the study. Chapter two presents a review of literature and relevant research associated with the surgical site infections. Chapter three describes the design of the study. A detailed root cause analysis is described, explains how the intervention was selected, implemented and evaluated and presents the methodology and procedures used for data collection and analysis. Chapter four contains an analysis of the data and presentation of the results.

Chapter five offers a summary and discussion of the study findings, implications for practice and challenges during implementation.

Chapter six offers the conclusion and recommendations of the future work and the last points are references and appendix which contains in details tools used in data collection and other documents related to the study.

CHAPTER TWO: LITERATURE REVIEW

Surgical site infection is a type of healthcare-associated infection in which a wound infection occurs after an invasive (surgical) procedure. SSIs are associated with increased duration of hospital stay, increased cost of care and increased mortality. The majority of surgical site infections are preventable. Measures can be taken in the pre-, intra- and postoperative phases of care to reduce risk of infection.[13] This chapter aims to offer the current situation of SSI in world and different countries, describes in details the central sterile supply department as well as risk factors and prevention measures of SSI in the hospital.

II.1. Surgical site infections

United States Centers for Disease Control and Prevention (CDC) has developed criteria that define surgical site infection (SSI) as infection related to an operative procedure that occurs at or near the surgical incision within 30 days of the procedure or within 90 days if prosthetic material is implanted at surgery.[14]

According to NICE 2013 and Byung Wook Min 2015, surgical site infections have been shown to compose up to 20% of all of healthcare-associated infections; at least 5% of patients undergoing a surgical procedure develop a surgical site infection, this one is a worldwide problem; is the one of the most interesting issues among surgeons and is the second most frequent nosocomial infection (20%) after urinary tract infection (36%).[14,15]

As stated in global guidelines for the prevention of SSI by WHO 2016, the annual rate of SSI in worldwide is between 2 and 5% the same range in USA and the estimation of attributable patient hospital cost for SSI is between US$ 3.2–8.6 billion in USA while in Europe the economic cost of SSI is between € 1.47 – 19.1 billion and the rate of C/S is 1.4%. [12]

In the study done by Osakwe et al in 2014 in sub-Saharan Africa especially in hospitals from Tanzania, Uganda and Benin, by comparing the Incidence of SSI of 26%, 58.5%, 11.8% respectively with the worldwide and USA where the range is between 2-5%, the rate of sub-Saharan Africa appears to be higher than that obtained by the USA and worldwide. The reason for the high rate of surgical site infection in the study of Osakwe et al 2014 is due to poor application of aseptic techniques such as inadequate sterilization of surgical operative equipment, inadequate environmental hygiene and lack of running tap water which sometimes may not be available in the hospital. [16] However, in the study done in Rwanda by J.Kalibushi Bizimana et al at Butare university teaching hospital (CHUB) in 2016, the prevalence of surgical site infection (c/s) in this study was 4.9%, in the study done by Augustin Bahufite et al 2016 at Mibirizi hospital the C/S SSI rate was 5.1% and those rates are lower than those found in other developing countries, in CHUB the lower rate is due to the introduction and implementation of IPC program [8], however the baseline rate (6.7%) of SSI in Kigeme hospital is higher than that obtained in many hospitals of Rwanda.

The CDC describes three main types of SSIs which follow:

a) **Superficial incisional SSI**: involves only skin and subcutaneous tissue of the incision
b) **Deep incisional SSI**: involves deep soft tissues of the incision (eg: fascial)
c) **Organ/ space SSI**: infection involves any part of the body deeper than the fascial /muscle layers which is opened or manipulated during the operative procedure.

The management of SSI depends on its type by surgical intervention, antibiotherapy and local care of the infected wound.[14,17–19]

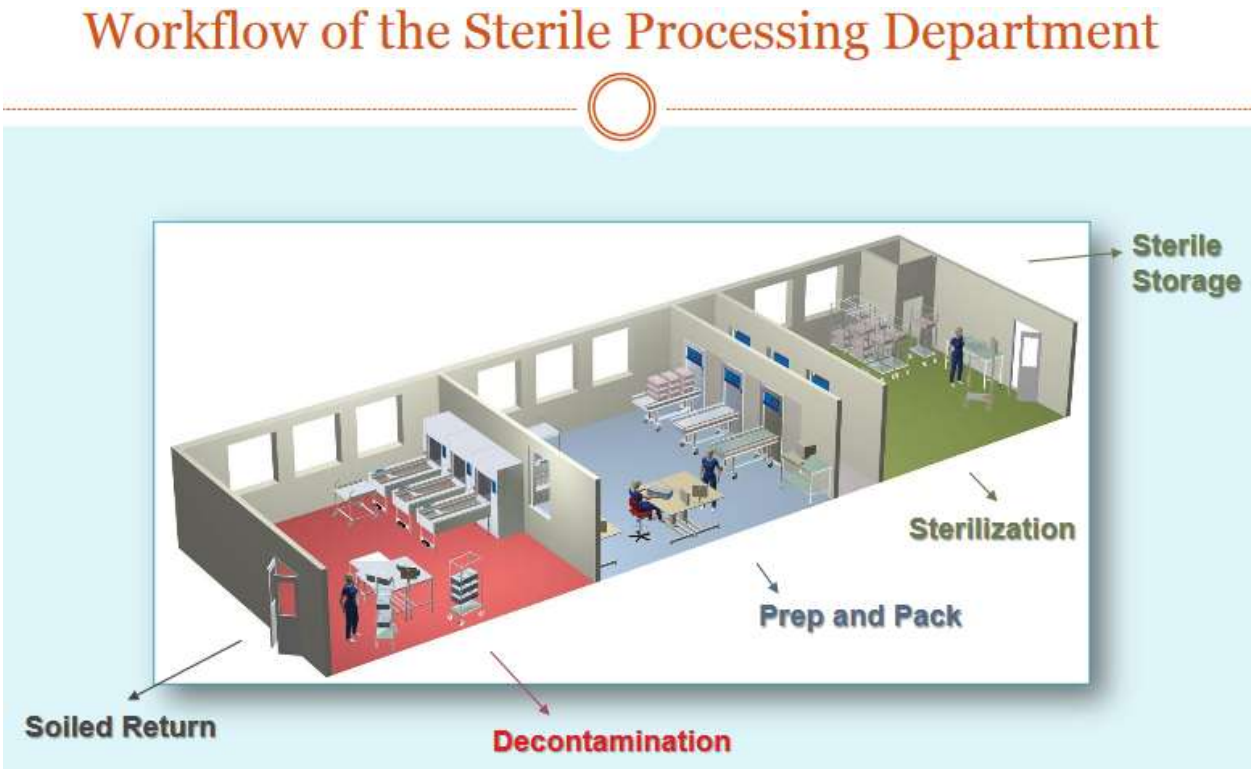
II.2. Central sterile supply department (CSSD)

As stated by many studies, all reprocessing of medical devices must take place in the sterile services department, which should be a separate demarcated department or in a designated decontamination area. Many countries have centralized decontamination areas (central sterile services department) and provide services to the OR, wards and clinical areas. [12,20,21]

According to the WHO guidelines 2016, Centralized decontamination processes make the decontamination process cheaper, increase the process safety and enhance its quality. A structured transportation system for clean and used equipment must also be in place. Of note, when the decontamination area space is very limited (usually just one room) and reprocessing is expected to take place in the smallest and least appropriate space with old equipment and overcrowded surfaces, the risk of contamination of clean trays is highly likely. Decontamination of medical devices in clinical areas is not recommended. [12,17]

The work flow of CSSD must follow the following way: from dirty area to cleaned area, the dirty area where the items are received and cleaned, the inspection-assembly-packaging and the sterilization or high-level disinfection areas, and finally those dedicated to the storage of sterile packs and their transportation.

The World health organization (WHO) recommended that these areas must be physically demarcated to avoid cross-contamination from dirty to clean. The workflow is shown in the figure no 1 below and this example was introduced in USA and it has become standard in Europe. (21) However every health care facility must design the CSSD according to its capacity and also to WHO guidelines.



Source: Getinge USA Inc.: Principles & Design considerations for sterile processes /2008

Figure 1: The workflow of sterile processing department

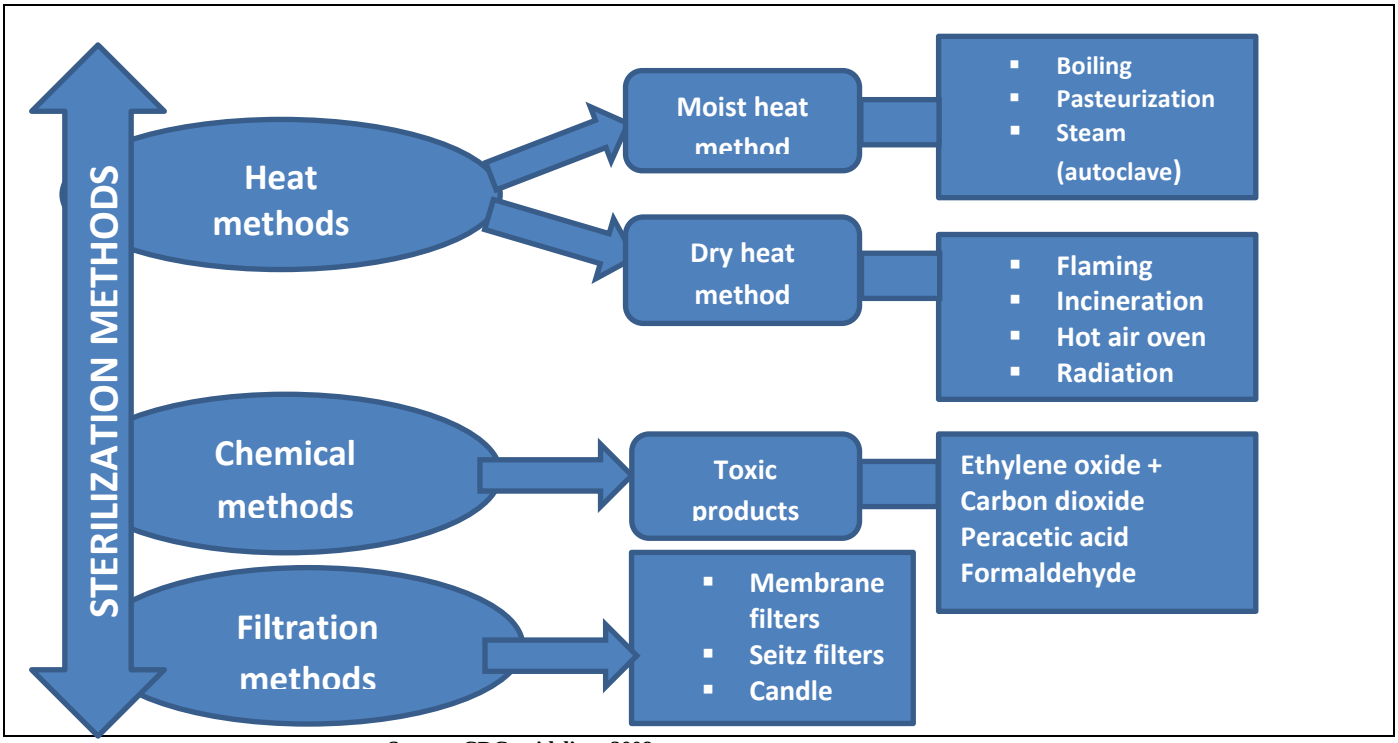
Decontamination area: Space where dirty items are brought for cleaning after use on patients in the OR or procedural room. Reusable equipment, instruments, and supplies are cleaned and decontaminated by means of manual or mechanical cleaning processes and chemical disinfection. Due to the nature of work performed in decontamination, there is great potential for contamination of the environment. It is prohibited to perform the decontamination without wearing the personal protective equipments (gloves, masks, head covering, face shield, gown and shoe covers) and this is shown by many studies done like PIDAC-IPC, Daniel Jirkovský et al.[22,23]

Drying area: Space where performs the removal of relatively small amounts of water or other liquid from a solid material. After a visual inspection, items may be air-dried or dried by hand with a clean,

lint-free towel. Dry the instruments with a soft cloth; this minimizes the risk of corrosion and the formation of water spots. The space between instruments or other material is needed

- **Packing area:** Area where packs are made according to type of item or intervention. Packs are labelled indicating date of sterilization and date of expiry.
- **Sterilization area**

Sterilisation is therefore an essential step in preventing the spread of infection. Sterilization area is where the elimination of all disease-producing microorganisms, including spores (e.g. Clostridium and Bacillus species) and prions is performed by using different methods of sterilization that follow in the figure below:



Source: CDC guidelines 2008

Figure 2: Sterilization methods

Notice: Ethylene oxide and formaldehyde for sterilization, boiling, radiation are being phased out in many countries because of safety and some of them have been shown to inactivate microorganisms.[22]

- **Sterile store**

The area reserved in storing the sterile item. Any item that has been sterilized should not be used after the expiration date has been exceeded or if the sterilized package is wet, torn, or punctured.

II. 3. Risk factors of SSI

The risk of developing an SSI is multifactorial; according to the CDC report and WHO, risk factors for SSIs fall into three main categories including ***Patient, surgery/surgeon*** and ***environment*** characteristics and those are common factors related to them: age, sex, obesity, malnutrition, ASA score, diabetes, cancer, smoking, physical hygiene and beddings, the wound classification, length of procedure and hospital stay, skill of the surgeon, appropriate use of antibiotic prophylaxis and maintenance of normothermia throughout the perioperative experience, OR rules, cleanliness, temperature and humidity levels and ventilation, infrastructure, hand hygiene, aseptic techniques and proper use of surgical safety checklist, pre-operative skin preparation, wound dressing, foreign object, post discharge surveillance and many studies reported similar findings. [2,8,16,24,25]

However in a study done by Cheng et al 2015 in Zhongda hospital in China, a prospective study was initiated to investigate risk factors for SSI and those reported above were found in addition of pre-procedural white blood cell count (WBC), volume of blood loss, blood transfusion, risk index, use of a gastrointestinal or urinary catheter and postoperative drainage. Different studies showed that risk factors determined not to be significantly associated with SSI were sex, age, use of a trachea cannula and type of anesthesia. [18,25–27]

In Maternity: Many researchers reported other specifics risk factors like emergency obstetric condition, chorioamnionitis, presence of meconium and duration of labor.[13,24,27,28]

II.4. Prevention measures of SSI

Following the work of the British nurse Florence Nightingale (1820-1910) in making fresh linen, controlling the pest and scrubbing brushed floors, the rate of SSI was reduced from 40% to 2% in six months.[23] From 1843 to 1910, Koch found that Bacteria lead to known infection and aseptic techniques, steam sterilization, local antisepsis and PPEs were introduced in order to prevent infection.

According to Anderson et al 2014, recommended strategies for SSI prevention were the administration of antimicrobial prophylaxis according to evidence-based standards and guidelines, the hair removal when is only indicated, the control of blood glucose in post-operative period, the maintenance of normothermia during the peri operative period, supplemental oxygen, use of surgical safety checklist, perform surveillance of SSI and patient education.[29]

The WHO presented the evidence based for focusing on hand hygiene (five moments) and surgical scrubbing improvement as part of an integrated approach to the reduction of hospital acquired infection including SSI. The same recommendation was given by many studies. [30–32]

The processing of items involves a series of sequential steps aimed at maintaining those cleaned and sterilized items in an aseptic state until they are reused. Therefore, to separate areas in CSSD has an important role in preventing cross contamination of items.[12,33]

In summary, a surgical site infection is a post-operative complication that brings about embarrassment to the surgeon, discomfort along with prolonged hospitalization and sometimes death for the patients and considerable financial burden on the society. Participation in preventing SSI is a crucial contribution in health and safety of patient and society.

CHAPTER THREE: METHODOLOGY

3.1 STUDY DESIGN

A pre and post intervention study design was utilized in this project to evaluate the effect of the intervention. The pre-intervention period from October 2015 to December 2015, consisted in collecting SSI in Maternity and Surgical wards of the hospital, a root cause analysis to identify the cause of infection was conducted. Based on the root cause, an intervention was designed and implemented. The implementation of the intervention began in December 2016 and continues to become part of the hospital daily routine. Post intervention evaluation was conducted during 3 months from January 2017 to March 2017.

3.2 BASELINE DATA COLLECTION PROCEDURE

Written permission was obtained prior to data collection of SSI from Kigeme Hospital Director. Data were retrospectively collected over a period of three months from October 2015 to December 2015 in Maternity and surgical wards (major surgeries) using the tool developed for data collection (appendix A) and registers of concerned services.

The objective was to find out the magnitude of surgical site infections in that hospital and the following formula for calculating the rate of SSI was used:

$$\text{SSI rate} = \frac{\text{Number of SSI}}{\text{Number of major surgical interventions}} \times 100 \quad \text{(in three months)}$$

Out of 239 patients who underwent major surgeries, 16 developed surgical site infection. The incidence of surgical site infections is 6.7% among those who underwent major surgery in Maternity and Surgical wards.

Sample

The study population comprised all patients who underwent major surgeries in Maternity and surgical wards at the time of the study. This population was targeted because of all Surgical site infections found in previous reports were from major surgeries none have been found in minor surgery. We combined two departments because even if the great number of SSI was observable in caesarian section, we couldn't ignore a few numbers of infections in surgical wards in order to make an overview of surgical site infection status in Kigeme District Hospital.

3.3 ROOT CAUSE ANALYSIS

Participants in identifying the root cause of SSI were all staff of Maternity ward including 15 midwives, 1 physician responsible of Maternity and 3cleaners**,** 3 anesthetists and 3 cleaners of operating theatre room**,** Staff of Surgical ward including 1 surgeon, 6 nurses and 1cleaner**,** 3 Members of Infection Prevention control (IPC) and 1 Data manager.

The initial steps of root cause analysis included a literature review on knowledge about SSI, Team organization, Discussion by brainstorming, development of data collection tools, data collection and data presentation.

Three meetings were conducted including SMT meeting, Maternity and surgical ward staff meeting and IPC meeting to discuss the possible causes of SSI and those are possible root causes identified by concerned staff:

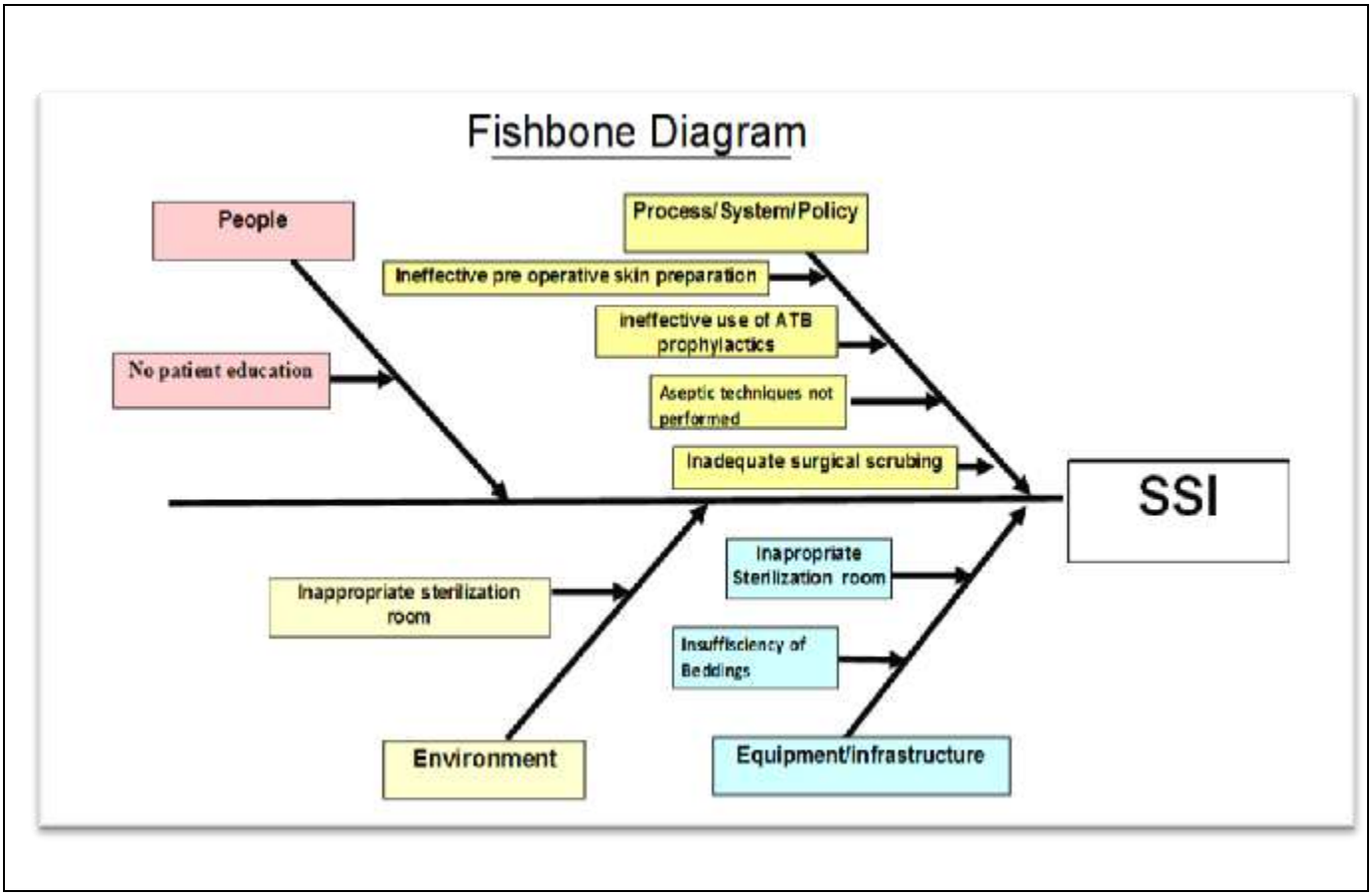


Figure 3: Fishbone diagram summarizing the possible root causes of SSI in Kigeme DH

After discussion on fishbone diagram, the following are possible root causes of SSI in Kigeme hospital which have been measured from 1st to 31st July, 2016 using different tools.

3.3.1. Aseptic techniques

We collected data from three operating rooms. We designed an observation sheet to collect data related to sterile field, sterile equipment and intra operative rules. According to data collected, all techniques observed (9) in Surgery (OR 1) were performed 100% with no case of SSI while in Maternity (OR 2 and 3), 11over 26 aseptic techniques observed were not performed (42%) with 7 cases of SSI. Based on findings, the ineffective aseptic techniques was a root cause of SSI in Maternity ward of Kigeme District hospital.

3.3.2 Pre-operative skin preparation

The tally sheet was used in collecting data where it included three questions: (1) Is the Shower done in the night before surgery? (2) Is Chlorexidine used as antiseptic during shower? (3) Is hair removal indicated and performed? According to data collected, among 26 women who underwent caesarian section, they performed preoperative skin preparation on 17 women with a rate of 65% while in Surgery, they never performed pre-operative skin preparation (0%), however, those who never received pre-operative skin preparation, they didn't have any wound infection.

3.3.3 Surgical scrubbing

The team also conducted a 1-month observation study to see if proper surgical scrubbing were used before surgical intervention. A tool for collecting data which was designed by Davis Company 2007 has been used and all steps were respected by surgical team in gynecology obstetrics operating room as well as in surgical operating room by 100%.

3.3.4. Patient education

According to World Health Organization 2014, Specific SSI education to the patient and family is a major priority for any hospital focused on preventing SSIs. A retrospective data collection was used in 35 patient files, 9 for surgery and 26 for Maternity using a designed tool. According to data collected, we found that in both services, there is no record (0%) related to patient education on the surgical intervention done especially preventive measures for SSI, only oral report was given to the patient and family.

3.3.5 Antibiotics prophylaxis

It was also suggested that the non-respect of administration of antibiotics in pre and post-operative according to guidelines was causing SSI. Before data collection we set five criteria to be evaluated including respect of criteria of antibiotics selection, respect of time (within 60min before surgery), respect of dose, respect of frequency and checking if there is any antibiotics resistance to the patient. According to the records in the patient files and observation, there was a rational use of antibiotics and this is recorded in all patient files.

3.3.6 Quantity and hygiene of beddings

According to data collected, the beddings are neither enough nor cleaned, out of 26 women hospitalized in Maternity ward, 20 (87%) had cleaned beddings while in surgical ward the percentage of cleaned was 83.3% and we found that sometimes the patient do not want to give them to the cleaners to wash them because there are not another to replace them in beddings store.

3.3.7. Sterilization room

The responsibilities of the central sterilization service are to clean, decontaminate, test, prepare for use, sterilize, and store aseptically all sterile hospital equipment. The World Health Organization (WHO) recommends the minimum of 3 areas which are separated each other in central sterilization service including receiving and Decontamination area, drying and packing area, sterilizing and sterile store area.[12] The team in charge collected data using designed tool and observation then after we drew a map of sterilization room in order to verify if the room had a problem of space. According to the data collected, in this service all areas are in the same room which is not appropriated according to WHO guideline. [12] The service has a one door for entry and exit of sterile materials and those are risk factors of surgical site infection. The figure below show in details the sterilization room.

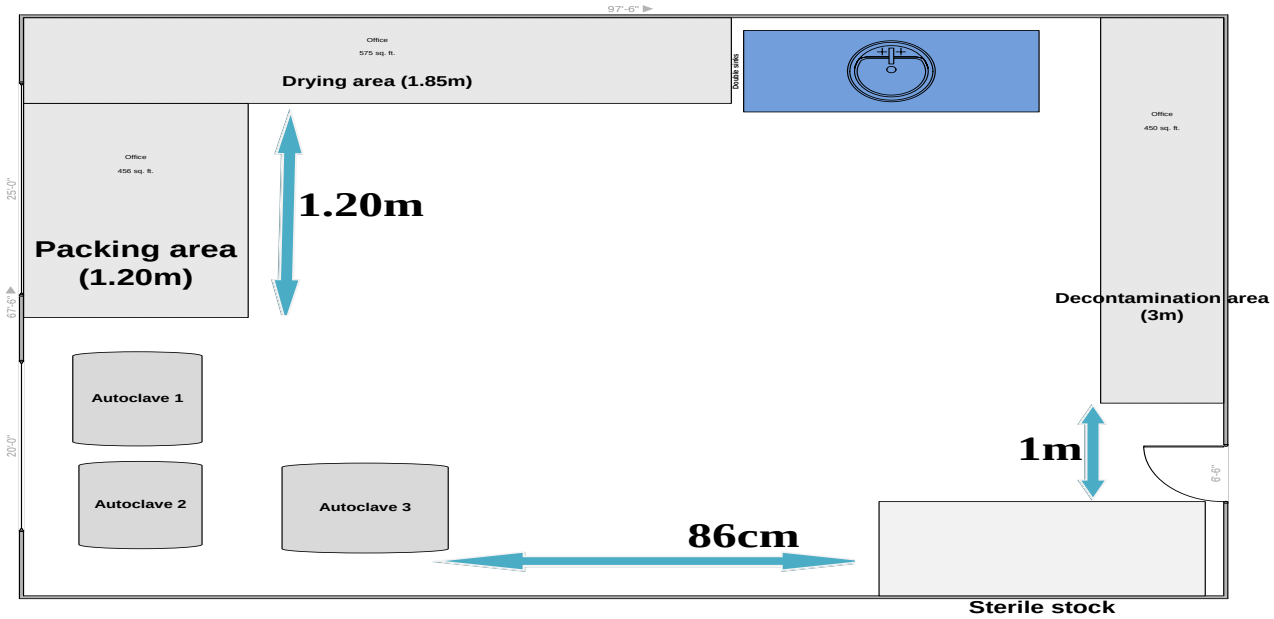


Figure 4: Map of CSSD of Kigeme hospital

Table 3: Root cause decision matrix

No	POSSIBLE ROOT CAUSE n = 35	M=Mat S= Surg	number of subjects meeting standards	%	Decision
1	Pre-operative skin preparation	M	17	65%	rejected
		S	0	0%	confirmed
2	Rational use of ATB prophylaxis	M	26	100%	rejected
		S	9	100%	rejected
3	Aseptic techniques	M	11	58%	rejected
		S	9	100%	rejected
4	Surgical scrubbing	M	26	100%	rejected
		S	9	100%	rejected
5	Patient education	M	0	0%	confirmed
		S	0	%	confirmed
6	Quantity and hygiene of beddings	M	20	77%	rejected
		S	6	83%	rejected
7	Sterilization room n = 1	M & S	0	0%	confirmed

Based on the results of root cause data analysis, the final root causes of SSI are Ineffective pre-operative skin preparation in Surgical ward, No patient education and inappropriate sterilization room in Maternity and surgical wards.

Considering the fact that within the scope of this project it cannot be possible to address all root causes contributing to the high rate of surgical site infection in Maternity and Surgical wards of Kigeme DH, therefore, the team decided to evaluate those three root causes in one dimension (Degree of severity) for potential risks in order to have one final root cause. The team used the model of *Sten Westgard, MS* January 2012 to rank root causes, and the final root cause of SSI was selected as shown on the table below.

Table 4: Degree of severity matrix:

Final root causes	**Degree of severity**					**Rank**	**RC selected**
	Minor 1/5	**Significant** 2/5	**Serious** 3/5	**Critical** 4/5	**Catastrophic** 5/5		
Ineffective pre-operative skin preparation		**X**				2	✗
No patient education		**X**				2	✗
Inappropriate sterilization room				**X**		4	✓

Based on the degree of severity ranking, the inappropriate central sterilization room has been selected by involved team as root cause of surgical site infection to get involved in intervention and the world health organization revealed that the sterilization process when performed, it is the first way to provide the adequate barrier to the infection. [(3)]

3.4. INTERVENTION

Based on the root cause analysis which is inappropriate sterilization room, the team proposed the following alternative solutions:

1) Reorganization of Central Sterilization areas: the reorganization of CSSD includes the logical way from receiving area to sterile store, in order to prevent cross contamination; however, the WHO recommends at least two or three rooms of CSSD. [12]
2) Find the space of decontamination, drying and packing areas out of the sterilization room: the possible option to find three zones for CSSD is to combine decontamination, drying and packing areas in the same room but physically separated by partition, the second is sterilization room in the existing room and the third one is the store room which can be in the existing anaesthetists' room; for continuing the normal activities the shifted rooms will have other places.
3) Staff training on Sterilization process: concerned staff training includes sterilization process, use of different sterilization registers and aseptic techniques in CSSD.
4) Build a new central sterilization supply department: to build a new central sterilization supply unit this met the standards of world health organization

A comparative analysis was conducted on the alternative solutions based on the following criteria: cost, impact, time and feasibility for each intervention (appendix B). After scoring the above mentioned alternatives interventions, "find the space of decontamination, drying and packing areas out of the central sterilization room" was found to be the best option as shown on the below figure.

Find the space of decontamination, drying and packing areas out of the sterilization room:

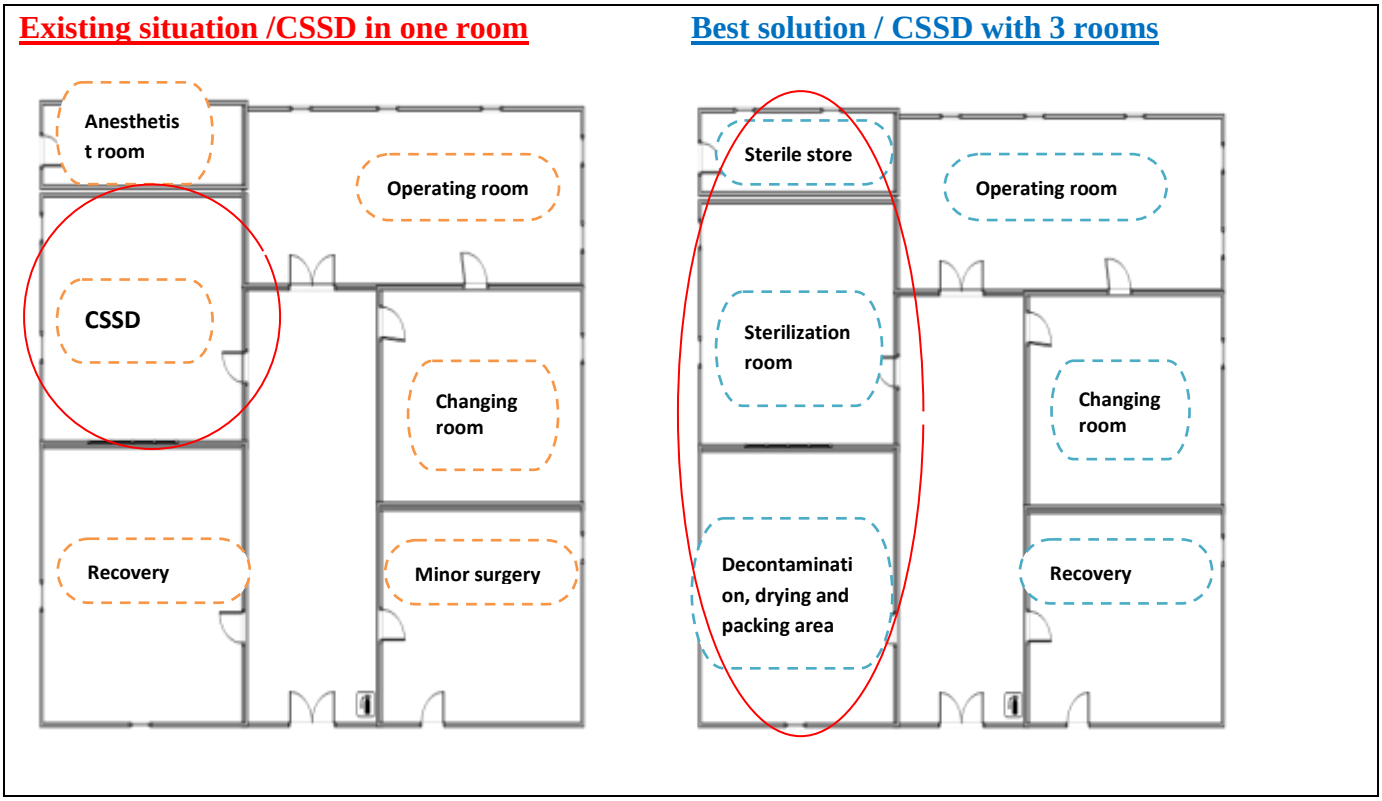


Figure 5: The existing CSSD and proposed solution

We worked in close collaboration with SMT because the intervention was involving the money for making transformations in a room reserved to receive, decontaminate, dry and pack all items to be sterilized; also operating theatre room staff and IPC team were involved in order to make agreement on transformations, Therefore three meetings were done to communicate the implementation plan (Appendix C) to the concerned staff. After holding all meetings, the transformations in CSSD began from the second week of December 2016 for ending in two weeks, and they were done as planned. After making transformations in CSSD, we did the orientation of CSSD staff on protocol and guidelines for each area of CSSD. All activities/tasks planed in finding the space of decontamination, drying and packing out of CSSD were all implemented.

3.5. MEASURES

In order to know the impact of the intervention, three measures were used in our study to evaluate the results including SSI rate as an outcome indicator, percentage of areas in CSSD which are physically separated either by wall or partition and the level of knowledge of CSSD staff on medical devices reprocessing as process indicators.

- % of areas in CSSD which are physically separated either by wall or partition: the observation method and tally sheet were used to count the number of areas which meet standards in CSSD.
- The level of knowledge of CSSD staff: training was done on medical devices reprocessing for CSSD staff in two afternoons; training was evaluated by using pre and post-test.
- SSI rate: In the same way used for calculating the baseline of SSI, the post intervention period from January to March 2017 helped us to determine the number of SSI out of the total number of major surgical interventions in this period.

3.6. DATA ANALYSIS

The data collection was performed by the researcher with the health & safety focal person and the Quality Improvement focal person. The collected data were tabulated and presented in graphs using Microsoft Excel. Chi Square tests were used to compare the pre- and post-intervention SSI rate. Fisher's Exact test was used to compare the pre- and post-intervention CSSD areas due to small sample size. All data analysis was completed using SPSS v.20 statistical software at a significance level of $P \leq 0.05$.

3.7. ETHICAL CONSIDERATIONS

Confidentiality of patient information was respected; before reviewing patient files and collecting data, a written permission to collect data was obtained from the administration of the hospital (Appendix E). The ethic and quality improvement committees were consulted before data collection. All data collected involving patient name were coded to protect the identity and privacy of the patient.

CHAPTER FOUR: RESULTS

The results include data from Maternity and surgical wards especially for patients underwent major surgical interventions during three months from October 2015 to December 2015 for pre intervention and from January 2017 to March 2017 for post intervention. The data collected are divided into three groups including data related to CSSD, SSI and to training of CSSD staff.

4.1.Transformations in CSSD

Before intervention there was only one room which included 5 areas and one door for entrance and exit. The space between areas was small (mean= 75cm, SD=19) where the space between Decontamination area and sterile store was only one meter which is a high risk factor of cross contamination and the areas were not separated from others by either wall or partition; however the access from area to another was feasible for all areas. After intervention, all areas are separated each other in three rooms by wall and the space between each area was sufficient (mean= 3.9m, SD=1.7) as shown in table below.

Table 5: CSSD environment

AREAS	Pre intervention			Post intervention		
	Space between areas	Access from other area	Barrier between areas	Space between areas	Access from other area	Barrier between areas
Decontamination –Sterile store	1m	yes	No	6m	yes	yes
Drying - Packing area	65cm	yes	No	1,5m	yes	No
Packing - Sterilization area	50cm	yes	No	5m	yes	yes
Sterilization - Sterile store	86cm	yes	No	3m	yes	yes
Mean (SD)	75cm (19)			3.9m (1.7)		

4.2. Knowledge of CSSD staff

A total of 8 staff of CSSD completed questionnaire, the responded included 4 anesthetists, 2 nurses and 2 cleaners, 4 (50%) participants working in the hospital since the last 1–5 years. Only one respondent (12.5%) received training for sterilization and its management. The results of pretest showed that, as per the respondents, SSI (100%), AIDS (87.5%) and hepatitis B (25%) were the main infectious diseases transmitted due to inadequate sterilization. Only one (12.5%) participant listed five areas and their functions in CSSD. After training on the medical devices reprocessing, the results of pre and post-test showed that there is statistical significance in number of staff trained on medical devices reprocessing ($p<0.001$), Knowledge of Hepatitis as infectious disease related to inadequate sterilization ($p<0.001$), knowledge of sterilization methods and importance of medical devices reprocessing with p- value of ($p<0.001$), ($p=0.011$) respectively, Knowledge of five areas in CSSD with $p=0.003$ as shown in the table below.

Table 6: Results on knowledge of CSSD staff

Variables	Pretest(n=8)	Posttest (n=8)	P-value ($p\leq0.05$)
Number of staff trained on medical devices reprocessing	1 (12.5%)	8 (100%)	<0.001*
Number of respondents who know the importance of medical devices decontamination in CSSD.	3 (37.5%)	8 (100%)	0.011*
Number of respondents who know sterilization methods.	3 (37.5%)	8 (100%)	<0.001*
Number of respondents who know infectious diseases caused by ineffective medical devices reprocessing			
• SSI	7 (87.5%)	8 (100%)	0.351
• HIV	7 (87.5%)	8 (100%)	0.351
• Hepatitis	1 (12.5%)	8 (100%)	<0.001*
Number of respondents who know five areas of CSSD and the function by each area	1 (12.5%)	7 (87.5%)	0.003*

* Significant at $P\leq0.05$

4.3 Incidence of SSI

Out of 239 patients who underwent major surgeries, 16 developed surgical site infection; the incidence of surgical site infections was 6.7%. Concerning CDC type of SSI, Superficial incisional SSI represented 75% in our study while deep SSI and organ SSI representing 12.5% respectively. The mean age of the participants was 26years (SD-5.6) with a range of 26 to 35 years in both pre and post intervention. Of all infections, 4 improved after observation (25 %), 10 (62.5 %) resolved with antibiotics, 1 (6.25 %) required opening of the wound with antibiotics, and 1 (6.25 %) required re-operation. After organizing Central sterile department by physically separating areas and training of CSSD staff on how to reprocess medical devices and the role of each area, the results of post intervention showed that out of 214 patients who underwent major surgeries in Maternity and Surgical wards, 5 (2.3%) had SSI, all infections were superficial and were resolved with antibiotics. our analysis showed that all those infection cases were in Maternity ward and there were other risk factors associated like prolonged labor and emergency conditions. The obtained results are displayed in figure 7 and table 5.

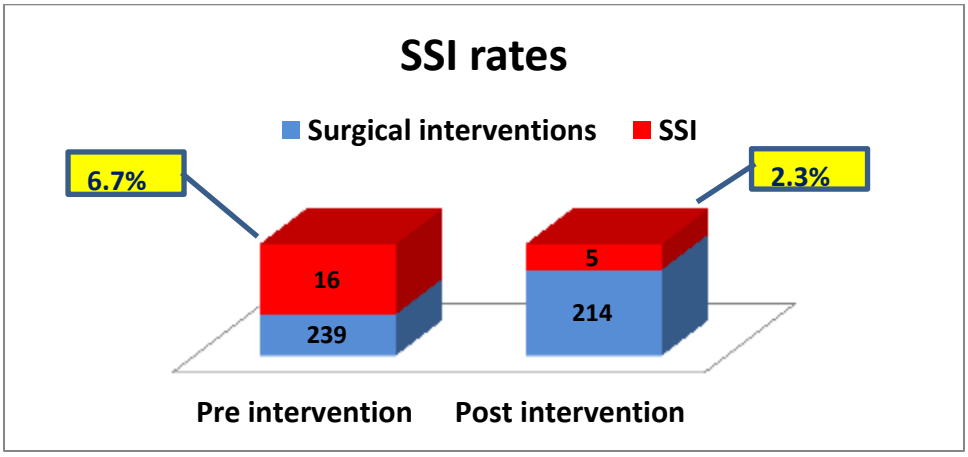


Figure 6: Pre and post intervention SSI rate

There is statistical significance when we compare the rate of SSI in pre and post intervention with a difference change of 4.4% and $p < 0.001$ at 95% of Confidence level.

Table 7: Comparison of pre and post intervention of SSI by types

Indicators	Pre intervention	Post intervention
SSI by type	n = 16	n = 5
1. Superficial incisional SSI	12 (75%)	5 (100%)
2. Deep incisional SSI	2 (12.5%)	0 (0%)
3. Organ/space SSI	2 (12.5%)	0 (0%)

The majority, 75% (n= 16), 100% (n=5) of SSIs were superficial SSIs in both periods; difference in pre and post intervention. The highest proportion of deep and organ incisional SSIs of 12.5% (n=16) respectively compared to 0% (n =5) in post intervention; this is due to small number of SSI in post intervention.

Table 8: Comparison of pre and post intervention of SSI by age

Indicators	Pre intervention	Post intervention	P-value (P≤0.05)
SSI by age	n = 16	n = 5	
1. <18 years	1 (0%)	1 (20%)	<0.001*
2. 18- 25 years	3(25%)	0 (0%)	0.004*
3. 26- 35 years	10(62.5%)	3 (60%)	0.113
4. 36 and more	2(12.5%)	1(20%)	0.010*
Mean age (SD)	26 (3.7)	26 (5.1)	

The mean age of the participants in pre intervention was 26years (SD-3.7) with a range of 26 to 35 years whereas in post intervention the mean was 26years (SD – 5.1)with the same range of 26 to 35 years and the majority of SSI cases were in this range.

Table 9: Comparison of pre and post intervention of SSI by services

Indicators	Pre intervention	Post intervention	P-value (P≤0.05)
SSI by services	n = 16	n = 5	
Surgery	2(12.5%)	0(0%)	0.025*
Maternity	14(87.5%)	5(100%)	0.308
SSI by type of intervention	**n = 16**	**n = 5**	
Herniorraphy	2(12.5%)	0(0%)	0.025*
Caesarean section	14(87.5%)	5(100%)	0.308

A decrease was noted in the proportion of patients who had SSI in Surgical ward from 12.5% in the pre intervention period to 0% in the post intervention period (p=0.025) and the high number of C/S still noted in the post intervention period.

Table 10: Comparison of pre and post intervention of SSI management

Indicators	Pre intervention	Post intervention	P-value (P≤0.05)
Management of SSI	n = 16	n = 5	
Antibiotics only	10(62.5%)	4(80%)	0.059
Opening of wound	3(18.75%)	1(20%)	0.002*
Surgery	1(6.25%)	0(0%)	0.126
Observation	2(12.5%)	0(0%)	0.025*

Of all infections, 2 improved after observation (12.5 %), 10 (62.5 %) resolved with antibiotics, 3 (18.75 %) required opening of the wound with antibiotics, and 1 (6.25 %) required re-operation.

CHAPTER FIVE: DISCUSSION

According to the global guidelines for the prevention of SSI (WHO 2016), in LMICs, decontamination science is in its infancy and few structured decontamination programs exist, as was evident during the recent Ebola outbreak. They found that in these countries, some factors like the lack of sterile instruments and/or the availability of a properly designed OR and sterile services department (CSSD) have a considerable impact on SSI.(12) This is similar of our results from the root cause analysis where the results showed that in Kigeme hospital there was inappropriate central sterile department and the intervention of this study was concerning to redesign a CSSD met standards with areas for 1) receiving, cleaning, and decontamination; 2) preparation and packaging; 3) sterilization; and 4) storage reusable medical devices according to CDC 2008 guidelines in order to avoid cross-contamination and promote efficiency in CSSD.[34]

The intervention reduced the incidence rate of SSI from 6.7% to 2.3% (<0.001) with a percentage difference of 4.4%; which is similar to Augustin Bahufite findings in Mibirizi hospital. [41] The null hypothesis is therefore rejected. The mean age of the participants was 26years (SD=5.6) with a range of 25 to 32 years in both pre and post intervention. The findings are similar to those published by Demisew A. et al.(24) The post intervention SSI rate (2.3%) exceeded our objective of 3%; we found that the study was demonstrated elegantly as success due to many factors including the collaboration of the hospital senior management team and concerned departments, especially the commitment of surgical team after understanding that SSI is a problem and a burden of patients, hospital and society, they made a great effort in improving all activities related to SSI prevention and also the selection of the achievable solution in redesigning a central sterile supply department and training of all concerned staff succeeded. (8), (40)

The goal of CSSD transformations was to prevent the spread of microorganisms, the flow of both the staff and the equipment should allow no cross-over of soiled and clean materials; this is similar to WHO 2016, PIDAC 2013 and CDC guidelines where they recommended separating physically the areas of CSSD by wall or partition. [12,22,34]

The lack of experienced (50%) and trained (12.5%) staff in CSSD were observed as a deficiency in reprocessing medical devices (table 4) this is similar to the study done in Germany on evaluation of reprocessing medical devices in CSSD, among 25 medical practitioners 'offices, 24(96%) lacked experienced staff which was the most observable deficiency found in their results.[35]

Many studies found that the improper Decontamination process of medical devices causes infection in a surgical wound leading to more serious complications and when planning for effective sterilization the following points must be considered: infrastructure, equipments and capacity building plan.[20,21,36] According to WHO 2002 and CDC guidelines 2008, the deep and organ incisional SSI relate to the operation including aseptic techniques and materials reprocessing; in this study, the patient who experienced deep and organ SSI represent 25% in pre intervention and 0% in post intervention, this showed that the effective medical devices reprocessing reduced the deep and organ incisional SSI in Kigeme District hospital. However, the decontamination of medical devices in Kigeme hospital is performed by manual means which is similar in many developing countries; this is not recommended due to the high risk involved in causing injuries and it has also poor quality comparing with mechanical cleaning as shown in guidelines on sterilization and cross infection control in dental practices done by Dental Continuous Professional Development in Europe.[37] But we can't ignore good intervention done in improving workflow by separating the five areas of CSSD and using protocols and guidelines related to each area. Therefore the staff of CSSD can easily reprocess items to be sterile without having any risk of cross contamination. The commitment of all staff involved in surgical interventions in SSI prevention

is appreciable as well as infection related to surgical site which were statistical significant reducing from 6.7 to 2.3% ($p<0.001$), this one was the main strategy used to prevent SSI in Kigeme hospital.

In contrast, even if the CSSD staff were involved in decision making as well as the implementation, they showed behavior change resistance to adapt to change quickly and implement new practices (respect of protocols and guidelines reserved for each area of CSSD), therefore, we were obliged to increase communication with continuing education and this strategy helped CSSD staff to meet new technologies and overcome daily faced challenges. During implementation of this project, the lesson learnt is that team work spirit is very important to achieve best results. A decision made by different professionals with various skills and knowledge can be easily implemented particularly when the professionals are involved in implementation. Moreover, "it is easier said than done" It is therefore important to keep in mind that unplanned changes may occur at any stage of the implementation and it is very important to plan regular meetings, as a team, touring and collaborating on a regular basis when practices are involved .

V.3. Project limitations

The period of post-intervention in this project was short due to the academic time frame, therefore, the sustainability of the initial success is not clear but the close monitoring and surveillance of SSI will be maintained by the team. We missed some data for patients in post discharge surveillance who didn't give their information contacts and not came back for SSI. Finally this project did not determine the type of the bacteria causing the SSI, future research on this topic should be conducted.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

VI. 1. Conclusion

Understanding where and in what ways the risks and hazards associated with infections are embedded in the sterilization process is vital to the development of safe practices for SSI prevention. Reducing cross contamination in CSSD by separating areas is a crucial intervention and based on the results of pre and post intervention there is a good improvement in prevention of SSI which will increase the quality of the hospital especially in Maternity and surgical wards and it is feasible in a low-resource setting to establish a successful SSI surveillance using strategic problem solving approach. Efforts in preventing SSI may be prioritized in wards with higher SSI rates and closer attention may be focused on patients with key risk factors. It is the responsibility of each and every healthcare provider to work towards the prevention of SSI and a team work approach is needed.

VI.2. Recommendation

Longer term follow up of the intervention is needed to understand the sustainability. Surgical Site Infection Surveillance with feedback of surgical infection rates to surgeons is one of the successful strategies to help reducing surgical site infection; all services performing surgical interventions are recommended to undertake surveillance of surgical site infection and give feedback to surgical team. The hospital should adopt the strategic problem solving approach in conducting other quality improvement projects especially for those root causes found in this research but not be selected for intervention, other future researches recommended to be conducted are the determination of the type of the bacteria causing the SSI, to create a system of sending to the National laboratory the wound swabs for culture and sensitivity where discharge from the wound is present and the evaluation of medical devices reprocessing in CSSD.

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APPENDICES

APPENDIX A: Tools for SSI data Collection

A.1. Aseptic technique Tool

No:		
OR :		
Date:		
Hour:		
Type of intervention:		
Indicator:	**Yes**	**No**
Number of persons in theatre is limited (≤6) ?		
The sterile field is covered and not manipulated by unsterile staff?		
Is there a wide space between scrubbed staff and non scrubbed staff? (more than 30cm from sterile area)		
Any contaminated equipment is directly removed from the sterile field		
Are barriers available?		
Are barriers (PPEs) used correctly? sterile gloves, sterile gowns, sterile drapes and masks		
Doors are kept closed during operation?		
Operating Room is kept clean		
Washing hands and applying gloves when needed are respected?		
Total of YES and NO		
%		

A.2. Pre-operative skin preparation tool

Date:		
Department:		
Code:		
Indicator	**Yes**	**No**
Is the Shower done in the night before surgery?		
Is Chlorexidine used as antiseptic during shower?		
Is hair removal indicated and performed?		
Total of Yes and No		

A.3. beddings and cleaning assessment tool

Date / Indicator																				
# of patients																				
# of beds																				
cleaned																				
soiled																				
# of beds sheets																				
cleaned																				
soiled																				
# of bed covers																				
cleaned																				
soiled																				
# of mattress																				
cleaned																				
soiled																				

A.4. Surgical scrubbing tool (by Davis Company 2007)

Check (√) Yes or No Date: Code:

PROCEDURE STEPS	Yes	No	COMMENTS
1. Applies surgical shoe covers, cap, and face mask before the scrub.			
2. Ensures that sterile gloves, gown, and towel are set up for use after the scrub			

2. Follows agency policy for length of scrub and type of cleansing agent used (scrub typically takes 2 to 6 minutes)			
3. Follows agency policy regarding fingernail polish.			
4. Avoids chipped polish or artificial nails.			
Pre-wash			
5. Turns on water using knee or foot controls.			
6. Adjusts water temperature to warm.			
7. Wets hands and forearms from elbows to fingertips.			
8. Keeps hands above elbows and away from body.			
9. Applies liberal amount of soap.			
10. Lathers well to 2 inches above the elbow.			
11. Does not touch inside of sink.			
12. Removes debris from under nails, using nail file under running water.			
13. Rinses hands and arms, keeping hands above elbows.			
(Alternatively: Uses antibacterial gel, per agency policy; does not rinse gel.)			
Surgical Scrub Using Alcohol-Based Surgical Scrub Product			
14. Uses indicated amount.			
15. Rubs on all surfaces of hands, nails, and arms to 2 inches above the elbow.			
16. Allows hand-rub to dry completely before donning sterile gloves.			
17. Grasps sterile towel and backs away from sterile field.			
18. Leans forward slightly and allows towel to fall open, being careful not to let it touch the uniform.			
19. Uses one end of towel to dry one hand and arm; uses opposite end to dry other hand and arm.			
20. Makes certain skin is thoroughly dry before donning sterile gloves.			

Conclusion: Performed ☐ Needs more practices ☐

A.5. ATB prophylaxis

Rational use of ATB	**Never (1)**	**Rarely (2)**	**Sometimes (3)**	**Often (4)**	**Always (5)**
Respect of criteria of antibiotics selection					
Respect of time (within 60min before surgery)					
Respect of dose					
Respect of frequency					
Existence of antibiotics resistance					

A.6. Patient education

Date	**Patient ID**	**# of health education records**	**# of health education records related to surgical intervention done**
Total			

A. 7. Sterilization room tool

No	**Areas**	**Distance from area to another**	**Access from area to another**	**Type of barrier between areas: partition or wall**
1	Receiving area to Decontamination area			
2	Decontamination area to Parking area			
3	Parking /sorting area to sterilizing area			
4	Sterilizing/cooling area to sterile stock area			
5	Number of room			
6	Existence of entrance door and exit door			

A. 8. Table: Data collection tool on Magnitude

Date	**Patient ID**	**Services (M=Maternity, S=Surgery)**		**Type of Intervention**	**SSI (Yes or No)**

A.9.Table: Data related to SSI occurred

No	**Service**	**SSI code**	**Type**	**Age**	**risk factor before intervention**

A.10. Table showing the incidence rate of SSI by service/ Pre intervention (October-December 2015)

Month	Service	Number of surgeries	Number of SSI	Incidence rate
October	Maternity	73	5	6.8%
	Surgical ward	7	0	0.0%
November	Maternity	75	5	6.6%
	Surgical ward	3	0	0.0%
December	Maternity	78	5	6.4%
	Surgical ward	3	1	33.3%
TOTAL		239	16	6.7%

A.10. Table showing the incidence rate of SSI by service Post intervention

(January –March 2017)

Month	Service	Number of surgeries	Number of SSI	Incidence rate
January	Maternity	53	1	1.9%
	Surgical ward	4	0	0.0%
February	Maternity	68	2	2.9%
	Surgical ward	7	0	0.0%
March	Maternity	77	2	2.6%
	Surgical ward	5	0	0.0%
TOTAL		214	5	2.3%

Written test

Code of respondent: …….

Experience in CSSD: 1. <1year

2. 1-2 years

3. 3-4years

4. 5 years and more

Have you ever received any form of training on medical devices reprocessing?

Yes ☐ ☐

If yes, When (year) _____

Questions

Where does reprocessing happen? Choose one /**2pts**

-Clinical services ☐

-Sterilization room ☐

-Central sterile supply department ☐

Choose the sterilization methods used in our sterilization room. **/6pts**

Steam -Chemical

Boiling -Dry heat

List at least three infectious disease related to improper decontamination process. **/3pts**

List five areas of central sterile supply department and the main role by each area **/5pts**

Area	Role
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

APPENDIX B: Comparative analysis of alternative solution

This analysis was conducted with the following comparative criteria: impact, time to effect, feasibility, and cost. The highest score is **five** (5), while the lowest score is derived to **one** (1)

comparative analysis

CRITERIA / **STRATEGIES**	**Impact**	**Time to effect**	**Feasibility**	**Cost**	**Total**
Reorganization of Central Sterilization areas	3	5	2	5	15
Find the space of decontamination, drying and packing areas out of the sterilization room	4	4	5	3	**16**
Build a new central sterilization supply department	5	1	1	1	8
Staff training on sterilization process	2	3	4	4	13

After scoring the above mentioned alternatives interventions, “find the space of decontamination, drying and packing areas out of the central sterilization room” was found to be the best option.

Justification of scoring:

Reorganization of central sterilization area: The problem of inappropriate CSSD would not be resolved because of sterilization room which is small; the space between areas can't change and the cross contamination of infection is not reduced in this case even if time and cost are saved.

Find the space of decontamination, drying and packing areas out of the sterilization room: The intervention is good and would be feasible because it met CDC and WHO standards, replacement place is available and the cross contamination will be totally reduced but it will require some money to make change in two rooms: Preparation, packing room and sterile store room(39)(40)(18)(12)

Build a new CSSD: It is the best option in terms of impact but it requires more time and high cost and it is not feasible according to available budget.

Staff training on sterilization process: the intervention is feasible because of availability of trainers and material but it also requires much money and more time, it doesn't resolve the real problem.

SELECTED SOLUTION

Based on the findings from the comparative analysis, the identified solution to reduce surgical site infection in Kigeme district Hospital is to find the space of decontamination, drying and packing out of sterilization room.

APPENDIX C: IMPLEMENTATION PLAN

GANTT'S CHART

No	Detailed list of tasks/activities	Person Responsible	2016				2017					
			December				February				March	
			w2	w3	w4	w5	w1	w2	w3	w4	w2	w3
1	Hold a meeting with hospital administration team, IPC committee and surgical team and avail approved minutes	Resercher Hyacinthe										
2	Expertise of a new change of building	Administrator Manager										
3	Procurement procedures for purchasing materials	Procurement officer										
4	Moving autoclave and other materials from CSSD to emergency department	Maintenance officer										
5	Make transformations in rooms reserved to decontamination and sterile store	Procurement officer										
6	Prepare signage in all areas of CSSD, post them and avail protocols and guidelines in each area	Head of CSSD										

7	CSSD staff training on five areas of CSSD and & start working in new areas	Researcher Hyacinthe											
8	Monitoring and evaluation in CSSD, data collection and analysis	Researcher Hyacinthe											
9	Data presentation	Researcher Hyacinthe											

APPENDIX D: EVALUATION PLAN

Monitoring and evaluation plan

Indicators	**Definition**	**How**	**When**	**Who**
Process indicator				
% of areas in CSSD which met standards	Sterilization room separated from other areas in CSSD and those areas must be also separated each other	The observation method and tally sheet will be used to count the number of areas which meet standards in Central sterilization supply department	December 2016	Researcher Hyacinthe
% of staff oriented on CSSD	Number of staff oriented out of the total number of staff in CSSD	Training will be done as an OJT in service in two afternoon	December 2016	Researcher Hyacinthe
Outcome indicator				
Surgical site infection rate	The number of SSI out of the total number of surgical interventions in specific period.	In calculating the rate of surgical site infection in Maternity and Surgical wards for patients underwent major surgical intervention in January,February and March 2017 using tally sheet	April 2017	Researcher Hyacinthe + 2 IPC members

APPENDIX E: GUIDELINES

E.1. GUIDELINES ON REPROCESSING MEDICAL DEVICES

NYAMAGABE DISTRICT

KIGEME HOSPITAL

IPC PROGRAM

- The cleaning of instruments should begin during the surgical procedure to prevent drying of blood, soil and debris on the surface and within lumens.

- The cleaning of instruments should continue at the point of use post-procedure, including sorting and disassembly of instruments, containment and transportation to the decontamination room.

- Cleaning/detergent agents should be selected that will not damage the cleaning equipment and effectively clean instruments.

- Cleaning may be performed manually, mechanically or a combination of both. The selection of the cleaning method should be based upon the type of device and manufacturer's recommendations. However, cleaning alone may not be sufficient to decontaminate items that present a high risk of disease transmission such as surgical instruments and therefore, should undergo a microbicidal process.

- New and repaired instruments should be inspected, decontaminated, and sterilized according to the manufacturer's written instructions prior to being placed in the surgery department's normal circulation of instrumentation.

- The decontamination room should be a room that is physically separate from areas where clean instruments, supplies and equipment are undergoing preparation for sterilization to prevent the risk of cross-contamination.

- Health Care Workers that handle contaminated instruments and devices are required to wear PPE to protect from soil and debris, blood and body fluids, and splashes from liquid chemical cleaning agents.

- Health Care Workers involved in the handling and reprocessing of contaminated instruments and devices should complete initial education and training and competency validation on the use of decontamination processes and procedures, use of machines, chemicals used and PPE. Education and training should be an ongoing process in order to promote a safe environment for patients and Health Care Workers.

- Prior to assembly and packaging for sterilization, the instruments should be visually inspected for damage, debris, detergent residue, and all parts are present if the instrument was disassembled.

E.2. GLOBAL GUIDELINES FOR THE PREVENTION OF SURGICAL SITE INFECTION

In 2016, the World Health Organization (WHO) published the following guidelines regarding surgical site infection (SSI)

- It is good clinical practice for patients to bathe or shower prior to surgery. Either plain soap or an antimicrobial soap may be used for this purpose.
- Patients undergoing cardiothoracic and orthopedic surgery with known nasal carriage of S. aureus should receive perioperative intranasal applications of mupirocin 2% ointment with or without a combination of chlorhexidine gluconate (CHG) body wash.
- Surgical antibiotic prophylaxis (SAP) should be administered prior to the surgical incision when indicated (depending on the type of operation). The panel recommends the administration of SAP within 120 min before incision, while considering the half-life of the antibiotic.

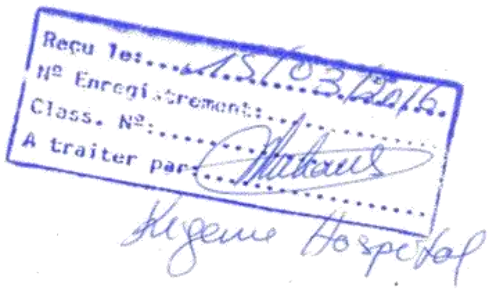
  Preoperative oral antibiotics should be combined with mechanical bowel preparation to reduce the risk of SSI in adult patients undergoing elective colorectal surgery. Mechanical bowel preparation alone (without administration of oral antibiotics) should not be used for the purpose of reducing SSI in adult patients undergoing elective colorectal surgery.
- In patients undergoing any surgical procedure, hair should either not be removed or, if absolutely necessary, should be removed only with a clipper. Shaving is strongly discouraged at all times, whether preoperatively or in the OR.
- Alcohol-based antiseptic solutions are recommended for surgical site skin preparation in patients undergoing surgical procedures.

- Surgical hand preparation should be performed by scrubbing with either a suitable antimicrobial soap and water or using a suitable alcohol-based hand rub before donning sterile gloves.
- Consider the administration of oral or enteral multiple nutrient-enhanced nutritional formulas for the purpose of preventing SSI in underweight patients who undergo major surgical operations.
- Do not discontinue immunosuppressive medication prior to surgery for the purpose of preventing SSI.
- Adult patients undergoing general anesthesia with endotracheal intubation for surgical procedures should receive an 80% fraction of inspired oxygen intra operatively and, if feasible, in the immediate postoperative period for 2-6 hr to reduce the risk of SSI.

- Preoperative antibiotic prophylaxis should not be continued in the presence of a wound drain for the purpose of preventing SSI.

APPENDIX F: a. Request for permission to conduct research

UMUHOZA Hyacinthe
Student at University of Rwanda
Phone number: +250788661943
Email: ukikhy@yahoo.fr



14th March, 2016

Dear Director of Kigeme District Hospital.

Subject: **REQUEST FOR PERMISSION TO CONDUCT RESEARCH**

I am a registered Master's student in the School of medicine and health sciences, in Masters of Health care and Administration (MHA) at the University of Rwanda. My supervisors are Professor Joseph NTAGANIRA and Jean d'Amour HABAGUSENGA.

The proposed topic of my research is related to: Surgical site infections in Maternity and Surgical ward
The objective of the study is:

To reduce the percentage of surgical site infections in Maternity and Surgical wards from 6.4% to 3% by the end of March 2017.

I am hereby seeking your consent to approach a number of patients who underwent major surgical interventions and staff working in Maternity and Surgical ward to provide participants for this Quality improvement project where the interview process, internal data and direct observation will be used.

Upon completion of the study, I undertake to provide you with a bound copy of the dissertation.

Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

UMUHOZA Hyacinthe

E. b. Authorization letter

REPUBLIC OF RWANDA

SOUTHERN PROVINCE
NYAMAGABE DISTRICT
KIGEME HOSPITAL
P.O.BOX. 43 NYAMAGABE
Tel. 0788823228(Director)
E-mail: hopkigeme@yahoo.fr

Kigeme, 21./03./2016
Ref No: 227../07.02.05/20/HOPKG/2016

Dear UMUHOZA Hyacinthe,

I have reviewed your request to conduct a research project involving Kigeme hospital in Maternity and surgical ward for patients who underwent major surgical interventions looking for SSI where interview process, internal data and observation will be used. I feel that this project will be beneficial to our hospital in infection control. You have the permission of Kigeme hospital to conduct interview, use internal data and observation for this project in concerned services.

The results must be shared with the administrative team of Kigeme hospital (Director, Administrator, clinical Director, Chief of nursing) and concerned departments.
Good Luck

Sincerely,

HOPITAL DE DISTRICT DE KIGEME

Dr NZABONIMANA Ephraim
Medical Director of Kigeme Hospital