RISK FACTORS PREDISPOSING ADULT PATIENTS TO POSTOPERATIVE INFECTION AT A RURAL DISTRICT HOSPITAL IN SOUTHERN PROVINCE/RWANDA

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DECLARATION AND AUTHORITY TO SUBMIT THE DISSERTATION

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a. *Declaration by the Student*

I do hereby declare that this *dissertation* submitted in partial fulfillment of the requirements for the degree of **MASTERS OF SCIENCE** in **NURSING**, at the University of Rwanda/College of Medicine and Health Sciences, is my original work and has not previously been submitted elsewhere. Also, I do declare that a complete list of references is provided indicating all the sources of information quoted or cited.

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b. *Authority to Submit the dissertation*

Surname and First Name of the Supervisor

Dr Amanda Kalisa

In my capacity as a Supervisor, I do hereby authorize the student to submit his/her **dissertation**.

Date and Signature of the Supervisor/Co-Supervisor

12th June 2017 .....

DEDICATION

I dedicate this work to:

God almighty,

My beloved husband UWAYEZU Casteur for his encouragement during my studies

My beloved children UHIRIWE Aimee Lois and INEZA IGANZE HIRWA Graziella

My beloved father Pastor NGWABIJE Enoch for his support in my undergraduate studies (source of continuity in Master's level)

My beloved father in Jesus MUSHINZIMANA Simeon for his support in my studies

My beloved brothers in low and their wives for their unyielding support and, unforgettable love and courage

To my friends,

To my classmates,

God bless you all

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ABSTRACT

Background: Postoperative surgical site infection is frequently nosocomial infection and it continue to be a main cause of morbidity and mortality in patients undergoing surgery globally and cause of worry for patients, health care providers, hospitals and the public as a whole. The prevalence of surgical site infections (SSI) in a tertiary hospital in sub Saharan Africa was 15.5%. In surgical patient, SSI is still a challenge compared to other health care associated infections. In worldwide a considerable number of patients undergone surgery developed surgical site infection; moreover, surgical site infection increases mortality related to surgery.

Aim: this study aimed to assess the risk factors predisposing adult patients to postoperative infections at Kabgayi district hospital.

Method: This study took place at Kabgayi District hospital in southern Province/Rwanda, this was quantitative; Cross-sectional design and purposive sampling strategy were used. Questionnaire, interview and patients records from their file were used to collect data from 122 patients' undergone surgery. Data were analysed by using SPSS, descriptive statistics, Chi-square test and logistic regression; to identify the relationship between variables. IRB clearance and approval letter from the hospital were given before to collect data, and data were recorded to the computer and protected with password.

Results: In this study among 122 participants; SSI was 10 (8.2%), the most participants were female 105 (86.1%) and mean age was 32 years old, among patients' factors only HIV positive (p value=0.014) was found to increase the risk for developing SSI but in various surgical factors none was found to be associated with SSI.

Conclusion and recommendation in this study HIV positive was found to be a risk factor associated with SSI among patient's related factors. Further research was needed regarding surgical site infection at rural district hospitals especially among women who undergone cesarean delivery as main procedure performed at this level.

Key words: risk factors and surgical site infections

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LIST OF SYMBOLS AND ABBREVIATIONS/ACRONYMS

ASA: American Society of Anesthesiologists.

BMI: Body mass Index

CABG: Coronary Artery Bypass Grafting.

CDC: Center of Diseases Control and Prevention

CHU: Yaounde University Teaching Hospital

CMHS: College of Medicine and Health sciences

CVICU: Cardio-Vascular Intensive Care Unit.

ECDC: Europe center for diseases control

HAI: Health associated infections

HCY : Yaounde Central Hospital

HDBA : Biyem Assi District Hospital.

IHI: Institute for Healthcare Improvement

IRB: Institutional Research Board

NCCWCH: National Collaborative Center for Women's and Children's Health

NCI: National Cancer Institute

NHSN: National Healthcare Safety Network

NICE: National Institute for health and Care Excellent.

NIMH: National Institute for Mental Health

NRI: Nutrition Risk Index

SSI: Surgical Site Infection

SSISS: Surgical Site Infection Surveillance Service

SSIRS: Surgical Site Infection Risk Score

WHO: World health organization

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CHAPTER I: INTRODUCTION

1.1 DEFINITION OF KEY WORDS

Surgical site infection or Postoperative infection is an infection that occurs after surgery especially in the operation area. The infection can be seen from the first day to years after surgery but frequently occurs between 5 to 10 days post operation (Medical Disability Advisor, 2016)**.**

Risk factors: Something or exposure that increases the chance of developing a disease or injury (NCI, 2017)

1.2 BACKGROUND

Surgical site infections continue to be a cause of morbidity and mortality to patients who have undergone surgical procedures, SSI contributes to the burden on providers of healthcare services by prolonging the duration of hospital stay and increasing costs (Jenks et al, 2014). A surgical site infection is an infection that appears after surgery in the operation area. Superficial SSI involves the skin only and may be serious when involves subcutaneous tissues, internal organs, or inserted material (CDC, 2012b). In surgical patients more than 20% of hospital acquired infections are surgical site infections. Moreover, surgical site infection increases mortality related to surgery among those with superficial incisions. In worldwide, postoperative deaths related to SSI occur in more than one-third of postoperative patients (Fan et al., 2014).

There are various risk factors of postoperative infections like diabetes mellitus, obesity, preexisting infection, low serum albumin, older age, smoking, ischemia due to vascular disease or irradiation, prolonged procedure and inappropriate surgical scrub or the antiseptic preparation of the skin. Other factors related to surgeon skill such as inadequate operation procedures, improper hemostasis, and the presence of dead space, influence to highest incidence of postoperative wound infection (Bizimana et al., 2016)

About 157,500 of infections related to surgery were reported in prevalence survey done by CDC healthcare-associated infection (HAI) in 2013 and SSI rate of 1.9%between 2006-2008 was reported by National Healthcare Safety Network (NHSN) (CDC, 2016).

Based on WHO findings, in low and middle-income countries, particularly in sub-Saharan countries a risk of postoperative infections are higher than in high-income countries (Allegranzi et al., 2011). Incidence rate of surgical site infections in mainland China was 4.5% (Fan et al. 2014). Differents studies done in some countries in Africa showed that: In Algeria the incidence of SSI was 11.9% in 2001, in Tanzanian 19.4% of patients developed SSI after surgery and in Tertiary Care Center in South-Western Nigeria in 2012 the incidence rate of wound infection among the surgical patients was 13.0%. Study done on cesarean section SSI in Sub-Saharan Africa particularly in Burundi, Democratic Republic of Congo (DRC), and Sierra Leone found that Lubutu in D RC had SSI rate of 1.7 %, and Kabezi, Burundi site had SSI (10.4 %) (Amoran et al. 2013 and Chu et al., 2014). The prevalence of SSI in this was 15.5% in a tertiary hospital in sub-Saharan Africa(Osakwe et al., 2014).

In Rwanda, reported postoperative infection rates from 40 district hospitals were 0.8%, 0.4% and 0.2% for 2008, 2009 and 2010 respectively (Petroze et al., 2014).
Prospective cross-sectional study done at teaching hospital of Butare from 1st January to 31st July 2015 found that the prevalence of surgical site infection at university teaching hospital of Butare (CHUB) was 4.9% and prolonged labor was the predominant risk of developing postoperative wound infection among women undergoing Cesarean delivery (Bizimana et al. 2016).

Different measures to anticipate SSIs are kept in place: doctors, nurses, and other healthcare providers must do surgical hands washing with an antiseptic agent before starting operation; before and after caring for each patient; hand washing must be done by using soap, water and alcohol for decontamination. If presence of hair in the site of operation electric clippers must be used to remove it than using a razor; wear operation cap, protective gloves, and masks when performing surgery, to maintain the proper surgery area. Antibiotics administration before starting surgery and to be given within a hour before starting operation. The antibiotics should be discontinued within a day following operation and the client skin of surgery must be cleaned by using recommended soap that kills germs (CDC, 2012a)

1.3 PROBLEM STATEMENT

The occurrence of SSI is not only a serious threat to the patient's health and life,

but also imposes a substantial economic burden on the patient's family and society (Boltz et al. 2011).

The effects of postoperative infections on the patient include long time hospitalization, discomfort, gas gangrene, splitting open wound, and tetanus. Therefore, surgical site infections can lead to long stay at hospital; patient/family economical capacity is affected and may impress considerable healthcare resources demand. The patients with self-payment of medical services can result to serious lack of money to their families and many families lose a significant part of their lands by selling them for hospital bills (Osakwe et al., 2014)

Periodic studies must be done to determine surgical site infection risk factors. Identification of surgical site infections risk factors should enhance the national measures for prevention (Amoran et al. 2013).

Postoperative infection rates were of 0.8%, 0.4% and 0.2% for 2008, 2009 and 2010 according to the reports done from 40 Rwanda Districts hospitals (Petroze et al., 2014).

The study done at CHUB among women undergoing Cesarean delivery found that prolonged labor was significantly associated risk factor of developing surgical site infection (Bizimana et al., 2016). In Rwanda district hospitals offer care to a considerable number of population, few researches were conducted in those hospitals but except the reports done, no retrievable study found on risk factors of postoperative infections that why this study is aimed to assess risk factors predisposing adult patients to postoperative infections at Kabgayi District Hospital.

1.4 OBJECTIVES

Main objective

To assess the risk factors predisposing to postoperative infections among adult patients undergone surgery at Kabgayi hospital.

Specific objectives

1. To identify patients factors predisposing to postoperative infections among adult patients undergone surgery at Kabgayi hospital
2. To identify surgical factors predisposing to postoperative infections among adult patients undergone surgery at Kabgayi hospital
3. To determine the correlation between patients' factors, surgical factors and postoperative infections among adult patients undergone surgery at Kabgayi hospital.

1. 5 RESEARCH QUESTIONS

1. What are patients factors predisposing to postoperative infections among adult patients undergone surgery at Kabgayi hospital?
2. What are surgical factors predisposing to postoperative infections among adult patients undergone surgery at Kabgayi hospital?
3. What is correlation between patients' factors, surgical factors and postoperative infections among adult patients undergone surgery at Kabgayi hospital?

1.6 SIGNIFICANCE OF THE STUDY

Surgical site infections continue to be a cause of morbidity and mortality to patients who have undergone surgical procedures, SSI contributes to the burden on providers of healthcare services by prolonging the duration of hospital stay and increasing costs (Jenks et al, 2014).

By knowing the factors associated with postoperative infections will help to take measures for minimizing postoperative infections. This study will help patients and health care providers to be knowledgeable about risk factors predisposing to postoperative infections; that knowledge may strengthen preventive measures of SSI.

This study will help in research because from the findings other researchers can conduct further research on postoperative infections.

1.7 SUBDIVISION OF THE STUDY

This study will be divided into 6 chapters: Chapte1 **Introduction**: this chapter contained Definition of key words, background of the study, problem statement, objectives of the study, research questions significant of the study and subdivision of the study; Chapter2 **Literature review**: in this chapter there were theoretical literature, empirical literature, critical review and research gap identification, and conceptual framework of the study; Chapter 3 **Methodology**: this chapter described study design, study approach, study area, sample size, sampling strategy, data collection method, instrument used, constraints and limitation of the study, and ethical consideration; Chapter 4 **Results presentation**: this chapter described the research findings, Chapter 5 **Discussion**: this chapter discussed the research findings by comparing them with other researches findings, Chapter 6 **conclusion and recommendation**.

CHAPTER II: LITERATURE REVIEW

2.1 INTRODUCTION

Surgical site infections (SSIs) new appellation of post-operative wound infection consist of surgical wound contamination by bacteria through surgery or after a surgery (Ahir et al. 2013). About 20% of all hospital acquired infections are surgical site infections. In wide world more than 5% of patients undergone surgery are surgical site infections (Leaper, 2008)

2.2 THEORETICAL LITERATURE

2.2.1 Patients related risk factors with postoperative infections

Patient characteristics that put him/her at an high risk for a surgical site infection consist of, HIV, steroid use, obesity, nicotine use, malnutrition and diabetes (Jaafar et al. 2017).

Age

Patient age is found to be a significant independent predictor of SSI risk factor generally and can cause development of SSI early (National Collaborating Centre for Women's and Children's Health, 2008). The older patients are usually characterized by impaired immune response to infectious agents (Triantafyllopoulos et al., 2015)

Prolonged preoperative hospital stay

Prolonged hospital stay was found to be independent patients characteristics associated with SSI. Pre-surgical admission could increase the risk of post-operative SSI. Hospitalized patients are more likely to be colonized by antibiotic resistant, virulent bacteria, such as methicillin-resistant Staphylococcus aureus (MRSA), which can predispose patients to infections (Sanford et al., 2015).

Days post-operation

The majority of SSIs become apparent within 30 days of an operative procedure and most often between the 5th and 10th postoperative days (Leaper, 2008).

Malnutrition

Malnutrition has been found as risk factor for SSI among patients undergoing surgery regardless type of surgery done. Malnutrition affects normal immune function and often results in poor wound healing, placing the patient at risk for SSI's and poor postoperative outcomes. Nutritional status is classified by Serum albumin level and normal nutrition range is varied from3.4 to 5.4 g/dl (Alfargieny et al. 2015).

Obesity

Obesity is defined as person with a body mass index (BMI) > 30 kg/m^2; person with overweight (BMI 25–30 kg/m^2); underweight is a person with (BMI < 18.5 kg/m^2) and normal weight (BMI 18.5–25 kg/m2), and (Huttunen et al., 2013)

Obesity is considered a strong independent risk factor for SSI and it is desirable for obese patients to lose as much weight as possible preoperatively (Ethicon, 2014). Poor vascularisation of Adipose tissues lead to inadequate oxygen supply of the tissues and impairment of immune response function is noted to raise the risk for developing SSI; this can lead to complex and prolonged operations on patients who are obese (Sangle & Chate, 2015).

Diabetes

Wound healing is impaired by weakened immune system caused by pathophysiological effect of diabetes. Studies showed that wound healing in patients with diabetes is characterized by decreased collagen production and deposition, diminished wound breaking strength, and impaired leukocyte function. Diabetic patients also experience impaired leukocyte chemotaxis, and phagocytosis, number of macrophages decreased in the wound matrix, and impaired perfusion and tissue oxygenation as a result of the microvascular changes associated with diabetes. Many of the adverse effects of diabetes may be related to the patient's level of glycemic control (Ethicon. 2014). Poor glycemic control in the immediate postoperative period, as measured by increased glucose levels (> 200 mg/dL), has been associated with an increased risk of SSI. In perioperative period adequate control of glucose of diabetes patients is required as recommended by CDC (Martin, 2016).

Patients with diabetes may have co mobility conditions that put them at high risk of postoperative infections when the disease is not well controlled. Complications of Surgical site infection (SSI) among patients with diabetes lead to raised morbidity, mortality, long time of hospital stay, and health care expenses (Wukich et al., 2010).

Based on the type of surgery; patients without diabetes have a low risk for developing SSI compared to patients with diabetes (Martin, 2016) .

Smoking

Smoking causes poor tissue oxygenation and aerobic metabolism these lead to decreased inflammatory mechanism of wound healing because chemotactic response, migratory action and mechanism of oxidative bactericide have been reduced. In other hand proteolytic enzymes are released while inhibitors are imbalanced. Smoking affects proliferation reaction by a decrease of fibroblast movement and uncontrolled collagen production and deposition (Sorensen, 2012)

HIV infection

Postoperative infections incidence among patients with HIV positive is increased by decline in CD4 counts if HIV is not well managed (Muchuweti, 2015). A cross-sectional study on Surgical Site Infection Risk Factors at Muhimbili National Hospital, Dar es Salaam Tanzania shown that; the occurrence of SSI rate was 35.6% in 118 patients; where 21.4% of them are HIV positive. The rate of infection is high in HIV patients compared with others where SSI among them was 45% (Akoko et al., 2012).

A.S.A Physical Status Classification System

American Society of Anesthesiologists classifies the health status as follow: 1.A normally healthy patient this category may include but not limited to Healthy, non-smoking, no or minimal alcohol use patients. 2. A patient with mild systemic disease 3.A patient with severe systemic disease. 4. A patient with life threatening systemic disease. 5.A declining patient who is not expected to survive without operation.6 A declared brain-dead patient whose organs are being removed for donor purposes (Lacivita et al., 2014).

Types of wound

A wound is skin injury and or tissue damage, wounds can be open or closed, the open wound is the wound characterized by broken and can bleed this bleeding may increase the risk of infections. Closed wounds are dangerous because the skin is intact but the tissues are damaged (Chandler, 2015).

2.2.2 Surgical factors associated with postoperative infection

The Study done by CDC on Nosocomial Infection Control Efficacy (SENIC); found that the surgical risk factors for developing infections include: abdomen operation, a surgical procedures lasting more than 2 h, an operation categorized as contaminated or dirty, and a patient at discharge having three or more underlying diagnoses (Korol et al. , 2013)

Abdominal site

At Muhimbili hospital abdominal surgeries has been found to have highest proportion of SSI (36.8%) and the second was breast surgery with 15.8% (Akoko et al., 2012)

Duration of operation

The duration of operation is defined as the duration of operation in minutes from opening of the skin to closure of the skin. Total duration of operation must be considered, despite of whether the procedures belong to different surgical categories if more than one surgical procedure take place in the same incision during the same operation (Khairy et al., 2011)

Anesthesia

Study done by Patel et al, (2011) in civil hospital Ahmedabal from 2007 to 2008 showed that the infection is higher in patients given general anesthesia (19.7%) than the patients given spinal anesthesia (10.2%).

Prophylactic antibiotics

In clinical trials antibiotics prophylaxis has been found to be efficacy in minimizing SSI for main surgical procedures. However, the Surgical Care Improvement Project and Prevention (SCIP) mentions standard time for administration of antibiotic prophylaxis as regard to reduce SSI. Antibiotic prophylactic should be given within one hour before to start operation or within 2 hours if vancomycin or fluoroquinolones should be given. Appropriate prophylactic antibiotics should be given to the patient based on specific category of procedure; after procedure antibictics should be stopped within 24 hours or 48 hour if cardiothoracic surgery. Prophylactic antibiotic goal is to make successful serum and tissue levels of the drug through the time of surgery (Stulberg et al., 2010).

Type of surgery

The surgical procedure can be either elective or emergency; emergency procedures can be increase the for developing SSI because they are not accompanied by the usual pre-operative preparation (Harrington et al., 2013).

Wound classification

According to CDC (2016) surgical wounds are classified into 4 categories:

1. Clean: is no infected operative wound and without appearance of inflammation. Usually clean wound are closed; non penetrating traumatic wound should be counted in this class if they meet criteria (No infection or inflammation).

2. Clean-Contaminated: wound from airway line, digestive, genital organs, or urinary tracts without unusual contamination are included in this category. This category also includes operations involving the track of bile and appendix even if there is no evidence of infection.

3. Contaminated: is operation very hard to optimize sterile technique like open, fresh and accidental wounds or gastrointestinal tract wound, non discharge (pus) inflammation is considered including damaged tissue with no confirmation of purulent discharge are integrated in this category.

4. Dirty or Infected: previous wounds resulting from trauma with damaged tissue, perforated viscera or existing clinical infection are included in this category. Based on this definition the postoperative infection is caused by the microorganism already live the area of operation.

SSI rates in clean and clean contaminated cases are influenced by ASA score and Charlson comorbidity index (CCI). Patients undergone clean and clean contaminated general surgical procedures but with co-morbidities have high SSI rates compared with those without any co-morbidity (Khan et al., 2010)

2.2.3 Surgical Site Infection Criteria

According to CDC (2016), there three surgical site infection criteria; superficial incisional SSI Deep incisional SSI and Organ/Space SSI.

Superficial Incisional Surgical Site Infection

This type of SSI occurs within 30 days after operation, involves the skin and subcutaneous tissue and has one or more in the following criteria:

The presence of purulent drainage from incision with or without laboratory testing (culture) diagnosis; isolated organisms from aseptically obtained fluid or tissue culture in incision, At least one sign or symptom of clinical infection: localized pain, edema, erythema, warmth *and* the superficial incision is deliberately opened by a surgeon (unless culture of incision is negative), diagnosis of a superficial incisional SSI by a surgeon or attending physician (Kuplicki, 2016)

Deep Incisional Surgical Site Infection

Deep soft tissues are involved like fascia or muscle within incision, and occur within 30 days after operation without implant or within a year with implant in place and the infection are directly related to surgical procedure with one of the following additional criteria.

Purulent drainage from incision but not from the organ/space of the site; dehiscence or deliberate opening by the surgeon from the deep incision when the patient has at least one of the following signs or symptoms of clinical infection (fever greater than 100.4°F, localized pain or edema, unless culture is negative); abscess or other evidence of infection involving the deep incision is found during examination of incision, reoperation, or pathologic or radiologic exam, diagnosis of a deep incisional SSI by a surgeon or attending physician (Kuplicki, 2016)

Organ/Space Surgical Site Infection

Involves any part of the anatomy other than the incision, occurs within 30 days postoperatively without implant, occurs within 1 year if implant is in place and infection appears to be directly related to surgical procedure, and must fulfill one of the following:

Purulence from a drain that was placed via stab incision into the organ/space (infection of drain site is not an SSI); isolated organisms from aseptically obtained fluid or tissue from the organ/space; abscess or other evidence of infection involving the deep incision is found during examination of incision, reoperation, or pathologic or radiologic exam, diagnosis of an organ/space SSI by a surgeon or attending physician; (Kuplicki, 2016)

2.3 EMPIRICAL LITERATURE

The prevalence of SSI was 2.55% among patients who underwent orthopedic surgery at King Fahd Hospital of the University in Soudi Arabia (Al-mulhim et al., 2014). Study conducted at three public hospitals in Cameroon shown that the prevalence of SSI was 9.16% among patients who underwent surgery and the predominant SSI type was Superficial (Ntsama et al., 2013). The rate of surgical site infections was 11.4% among obstetrics cases at Jimma university specialized hospital, southwest Ethiopia(Amenu and Belachew, 2011)

Prolonged preoperative hospital stay was found to be associated with higher rate of infection. Prolonged preoperative hospital stay leads to colonization with antimicrobial resistant micro organisms and itself directly affects patient’s susceptibility to infection either by lowering host resistance or by providing increased opportunity for ultimate bacterial colonization (Patelet al., 2012).

According to the study conducted at Mymensingh Medical College and Hospital in Bangladesh. it was observed that most of the infections were started between 4th and 8th post operative days (PODs) and it was highest (33.33%) on 5th POD (Karim, 2011).

The study done in France count part of the considerable clinical and economic burden of SSI on the French healthcare system; where infection including surgical procedure rate about 3%; based on patients' age increasing of Health associated infection incidence following surgery varied according the surgical procedure performed (Lamarsalle et al., 2013). Study done by Neumayer et al. (2007) in 142 medical centers among patients undergone general and vascular surgery; found that age is predictor of postoperative infection; where patients with 40years old and above have been develop surgical site infections compared with those patients less than 40.

Study done in England among patients undergone total hip replacement has found that age more than 75 was significant risk factors compared with a baseline of under 65 years old (Ridgeway et al. 2005).

Study done in Japan on surgical site infection independent risk factor like age shown that for Appendicectomy the risk for developing SSI increased with age, with the proportion of 75% for the patients of 70-79 year-olds compared with those with 20-29 year-old with proportion of 33%.For cholecystectomy; the SSI proportion increased with age from 15% (40-49 years old)where to 35% among patients with 80 years old and above (Talbot & Schaffner, 2005).

The study done by Shinkawa et al. (2013) in the Department of Hepato-Biliary-Pancreatic Surgery, Osaka City University Hospital, among patients undergone pancreaticoduodenectomy the nutrition risk index (NRI) has been found to be predicting factor of SSI with the prevalence of 43.3%.

The study done at University Hospital of Ioannina in Cardio-Vascular Intensive Care Unit (CVICU) among the patients underwent on-pump coronary artery bypass grafting

(CABG) shown that the risk of developing postoperative infection is 5.9 times more in diabetes mellitus patients (Lola et al., 2011).

ASA class has been found to be related to the rate of complications occurring in postoperative patients. The studies shown that the rate of ASA score I is 0.41/1000 while those with ASA score IV and V is 9.6/1000; in emergency surgeries ASA score rate is 1/1000 while those with score IV and V is 26.5/1000 (Daabiss, 2011). According to study done by Elbur et al. (2012) Patients with ASA score 2 had almost twice the odds of developing wound infection compared with patients who had ASA score 1.

The study conducted in a General Surgical Unit of Khyber Teaching Hospital, Peshawar found that the SSI rate was 6.1% among them, 4.23% are the patients with clean wound and 7.29% in patients with clean contaminated wound. There were significantly higher surgical site infection rates among patients with ASA II-III than those with ASA-I in clean contaminated surgeries (Khan et al., 2010). Contaminated wound, clean contaminated wound and emergency surgical procedures were been found to increase risk for developing SSI according to the study conducted at Muhilimbili national hospital in Tanzania(Akoko et al., 2012)

The study done in 3 public hospitals of Cameroon on surgical site infections prevalence and risk factors evaluation after surgery shown that; the prevalence of was 9.16%. Where 90% of infected patients their wounds are open with 68.18% of superficial infections and 31.82% of deep infections. (Ntsama, et al., 2013)

A prospective study done by Patel et al. (2011) in civil hospital Ahmedabal from 2007 to 2008 showed that a longer duration of surgery is associated with higher infection rate; with 40% of infections for those operation lasting more than 60 minutes compared to 0% for those with operation lasting less than 60 minutes in Appendicectomy

According to the class of the wound, dirty wounds have highest SSI rate (75%) ; contaminated (30.4%), clean contaminated (25%) and lowest rate is clean wounds (4.7%) (Akoko et al. 2012).

Incidence rate of SSI was 38.1% in tertiary hospital in Nigeria among patients underwent abdominal surgery where superficial SSI was74.1% while 25.9% was deep SSI. The rate of SSI on 3rd day post surgery were 63.5% , other 36.5% appear on day 5after operation (Adejumo et al., 2015)..

Study done at Thika Hospital in Kenya showed that among various operations like hernia repairs, laparotomies, hysterectomies, amputation and appendicectomies; C-section was the predominant surgical procedure done with 75% of all procedures. SSI rate is high among orthopedics and neurosurgery (14%), and greater incidence was seen in contaminated road accident trauma. According to surgeon skills, SSI rate is increased in patients operated by vocationally trained clinicians with rate of 15% (Aiken et al., 2013)

The retrospective observational study done in tertiary care centre Rajarajeshwari medical college hospital in the Department of General Surgery and gyneco-obstetrics found that which Appendicectomy, caesarean section, abdominal hysterectomy and herniorraphy were more performed with 61.2% of total types of abdominal procedures performed. The rate of surgical site infection was 13.7%. Appendicectomy, caesarean section, abdominal hysterectomy and small bowel surgeries themselves accounted 78.1% out of all wound infections. According to wound class the infection is more predominant among patients with dirty wound (56.7%) compared to those with clean wound (3.9%). This study found clear relationship between the wound infection rate and the contamination of the wound. According to type of surgery SSI rate was more with emergency surgery (25.2%)} when compared to elective surgery 7.6%

SSI was more with early operative and post-operative prophylaxis compared to preoperative prophylaxis (Satyanarayana et al., 2011).

According to study done in Minas Gerais, Brazil, between 2005 and 2007, the incidence of surgical site infection was 1.8%. The clean contaminated wound, contaminated wound, infected wound, emergency surgery and ASA SSI risk tended to increase with the patient's clinical severity) were found to be statistically associated with infection (Ercole et al., 2011).

The study done in Department of Infection Control, Zhongda Hospital in China shown that risk factors associated with SSI were, cancer, diabetes, ASA scores, wound classification, white blood cells count before procedure, type of surgery, amount of blood loss during operation, blood transfusion, operative duration, risk index, postoperative drainage and use of a gastrointestinal or urinary catheter (Cheng et al., 2015)

Study done in India, Increase in pre-operative hospital stay, ASA (American Society of Anesthesiology) score > 2, increase in surgical wound class, emergency surgeries, longer duration of surgery were associated with increased SSI rates (Sachin, 2012).

2.4. CRITICAL REVIEW AND RESEARCH GAP IDENTIFICATION

The various read articles, main of them looked to risk factors predisposing to SSI by focusing on unique procedure like heart surgery, total hip replacement, cesarean sections etc, and other articles studded only one or 2 factors that can increase the risk for developing SSI (e. g; age, diabetes, malnutrition etc). In Rwanda few studies were conducted on SSI but no retrievable study found on SSI risk factors among adult patients in district hospital; some of these studies looked to infection outcome, other for surgical site infection risk factors among women underwent cesarean section (Bizimana et al., 2016), etc. however this study was identifying various risk factors predispose adults patients to postoperative infections.

2.5. CONCEPTUAL FRAMEWORK

According to the study done by Kabau (2014) the bellow figure is describing the relationship among variables and the consequences**.**

This figure is describing how independents variables (risk factors of SSI) lead to postoperative infections and the consequences for nation, health care providers and community in general.

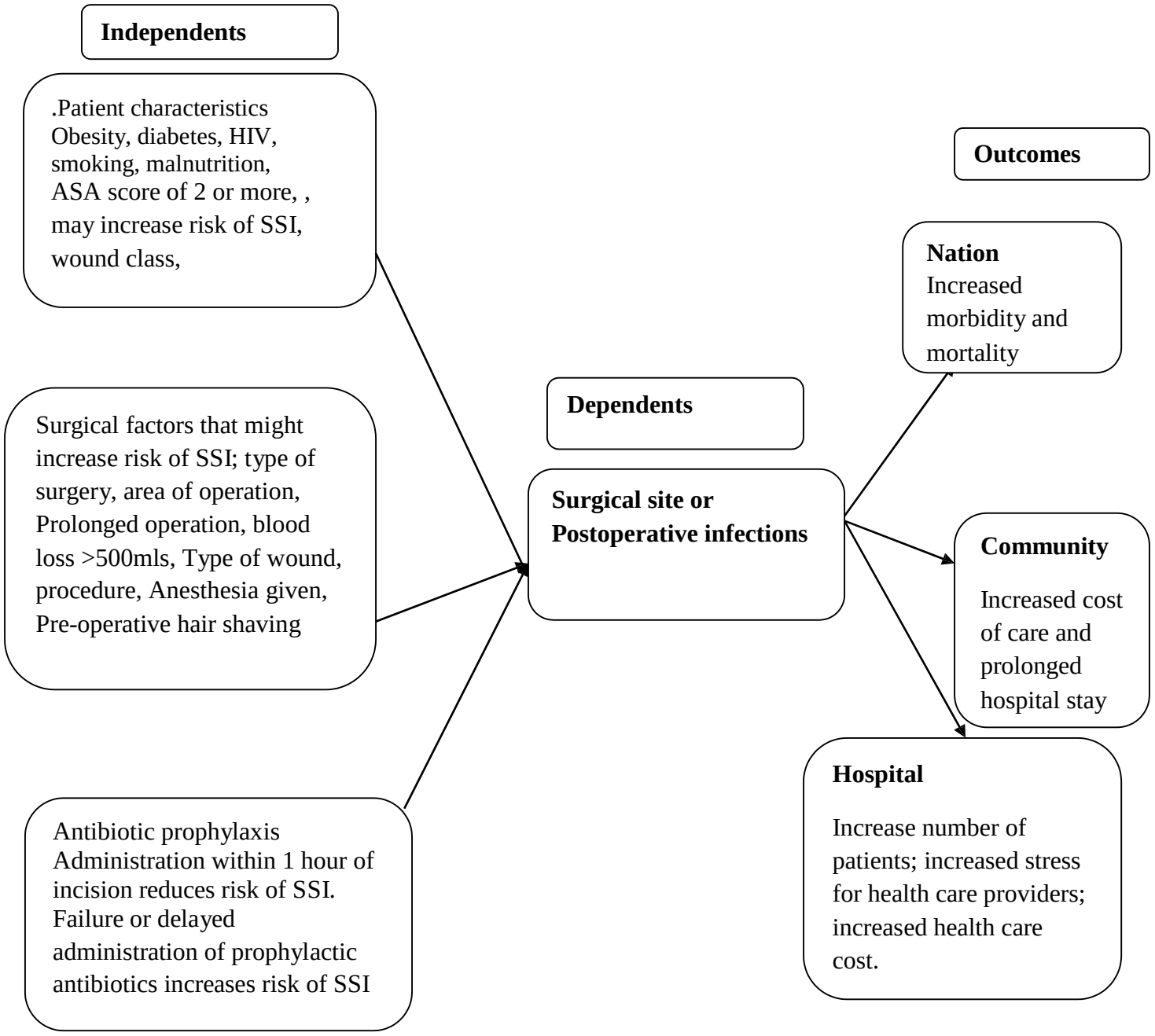

Figure 2. 1: Conceptual framework

CHAPTER III. RESEARCH METHODOLOGY

3.0 INTRODUCTION

This chapter was describing the techniques used to identify and to analyze information applied to understanding the research problem. This chapter is also shown how the data were collected and analysed.

3.1 STUDY APPROACH

This study was quantitative study because this study was looking for quantifiable information about SSI and the data were presented in numerical form and analysed by use of statistics.

3.2 STUDY DESIGN

A descriptive cross-sectional design was used to identify the risk factors of postoperative infections among adult patients who undergone surgery at Kabgayi hospital

3.3 STUDY AREA

This study was take place in gyneco-obstetrical and surgical units at Kabgayi district hospital located in Rwanda country, southern Province, Muhanga District, Nyamabuye sector and Gahogo cell. This is referral hospital for 16 health centers and has 305 of staffs. Actually Kabgayi hospital is made with the following wards and services: For outpatient consultation there is consultation for surgery, maternity, dentistry, mental health, ophthalmology and other pathologies; for Hospitalization there are surgery wards, pediatric ward, emergency ward, maternity ward, neonate ward and internal medicine wards; for paraclinical services there are GBV, physiotherapy, medical imagery, and laboratory. Other services are administration, social service, hygiene and nutrition services.

3.4 STUDY POPULATION

The study population was adult patients underwent surgery at Kabgayi hospital with 18 years old and above consulting gyneco-obstetrics and surgery units.

The study was conducted within 2 months from 13rd February to 12thApril. According to the report done by Kabgayi hospital, from July 2015 to June 2016 shown that 556 patients undergone surgery in surgery unit and 1965 surgeries in Gyneco-obsterics (Kabgayi hospital annual report 2015-2016). Based on this report the total of estimation population from both units was 2521 in one year. Referred to the population size of 1 year estimation population of 420 was considered; as the study was done within 2 months.

3.5 STUDY SAMPLE

To determine the sample size, this formula was used; $N=Z^2 x\ p\ x\ q/d^2$ (Charan and Biswas, 2013). Where, N = wanted sample size, Z = standard deviation 1.96 at 5% level, this equivalent to 95% level of confidence, p= Expected proportion in population based in previous studies here P= the prevalence of surgical site infection in 3 countries of sub-Saharan Africa by (Osakwe et al. 2014) =15.5% (0.155); q = 1- p= 1-0.155=0.845, d = Absolute error in this study will be 5%, which assumes 0.05. Estimated sample size will be: $N=(1.96)^2x0.155x0.845/(0.05)^2=201$.

As my study population is fewer than 10,000 to adjust sample size the following formula was used $n_{f=}n/1+(n)/(N)$ (Zubair, 2012)

Where,

n_f = wanted sample size, if size of population N < 10,000

n = wanted sample size, when size of population, N > 10,000

N = estimated size of population.

In my study estimation population will be 420 and the sample size will be

$n_f=420/[1+(420/201)]=135$.

In this study estimation sample size was 135 patients underwent surgeries with 18 years old and above, but in this study obtained participant was 122.

Based on Kabgayi annual report of 2521 population in 2015-2016 where 1965 were operated in gyneco- obstetrics ward and 556 were operated in surgery unit, estimation population within 2 months of the study was 420. Based on this population and sample size; sample size from surgery unit was 122*556/2521=26.9=27 sample size from gyneco-obstetrics was 122*1965/2521=95.01= 95

3.5.1 Sampling strategy

Purposive sampling strategy was used where the researcher picked population who met the criteria until reaching 122 participants.

A purposive sample is a non-probability sample that is selected based on characteristics of a population and the objective of the study. Purposive sampling is also known as judgmental, selective sampling (Crossman, 2017).

Inclusion criteria

Patients 18 years old or above, who undergone surgery at Kabgayi hospital,
Client who underwent surgery and hospitalised in surgical or gyneco-obstetrics wards
Patients who signed informed consent.

Exclusion criteria

Patients under 18 years old
The patients operated in eye unit.
The patients who declined to give consent
Patients severely ill who were not able to take decision for participate

3.6 DATA COLLECTION METHOD AND PROCEDURE

Data were collected directly from the client through interview and surgical patients file by using a structured questionnaire.

3.6.1 Data Collection instrument

The questionnaire was designed in such way that the patients' data can be easily recorded from patients and his or her file. The tool was developed by Surgical Site Infection Surveillance Service in England (Harrington et al., 2013) and validated by ECDC in 2012. This tool contained several sections; the first section contained the general information regarding the patient's demographic data and health condition (comobilities). The second section deal with the ASA score and CDC wound class in which the patient falls into.

Third sections was concerned to collect data related to surgery like type of surgery duration of surgery, type of anesthesia given, amount of blood loss or bleeding, etc. and the last section was describing SSI.

3.6.2 Data collection procedure

The researcher approached the client individually; if the client met inclusion criteria, explanation regarding the research objectives and consent form were given; data was filled by the researcher on questionnaire, the researcher was in gyneco-obstetric unit or in surgery unit, the patients were interviewed about the demographic data and comobilities, the researcher measured client weight and height before operation, after operation by using client file the researcher recorded other information related to surgery. Emergency cases for operation and those clients require cesarean section, all needed information was taken after operation if they met the inclusion criteria.

3.7 DATA ANALYSIS

Data collected was summarized and analyzed by using SPSS version 20 with descriptive statistics. Associations and relationships between risk factors and SSI were analyzed by using Chi-square test and binary logistic regression. The percentages (frequencies) were considered in description of risk factors associated to postoperative infections among adult patients at Kabgayi hospital.

3.8 LIMITATIONS OF THE STUDY

The researcher encountered some constraints and limitation that might influence the research results. This study was limited only to patient related and surgical related risk factors associated with SSI. Cultural aspect of the client was addressed because the Rwandan culture orients the population to reserve disclosure about personal life termed “vuga uziga” in Kinyarwanda. This translates to “say something and keep the other”; for this raison some patients decline to give consent for participation in this study.

There were some days when there were no surgical operations performed hindering the ability to achieve 100% calculated sample size. Even though the postoperative days assessed in the study in relation to SSI showed significant deference, extrapolation of the findings was limited due to the precision of the exact day of SSI. \

This was because information about SSI was obtained from the patients' files rather than prospective lab results initiated from the study. In addition, the sampling strategy; used was purposive limiting generalization of results to the other hospitals in Rwanda.

3.9 ETHICAL CONSIDERATIONS

The written permission from college of medicine and health sciences (CMHS) institutional research board (IRB) commit for caring out the research was given to the researcher, and authorization from the hospital to conduct the research was received by the researcher before to start data collection. The researcher disclosed to the client the benefits (like awareness of SSI risk factors) and risks (like time consuming during data correction, use of his or her file for data correction) for participating in the study. Participation in this study was voluntary and informed consent form was given to client; data collection from selected client started after receiving signed informed consent from the client. Confidentiality was observed and participants were anonymous. The participants have right to refuse to participate without repercussions. Participants were given contact of supervisor and IRB in case of concerns arising from the study but no problem arising from participants during my data collection. This study will be disseminated through the school, publication and the feedback will be given to the hospital administrative staff.

CHAPTER IV. RESULTS PRESENTATION

4.0 INTRODUCTION

This study was carried out to determine factors predisposing to postoperative infections among adult patients at Kabgayi hospital. This chapter is describing the risks factors associate with SSI among 122 participants who undergone surgery at Kabgayi hospital. In this study 95 participants were obtained from Gyneco-obstetrics ward while 37 participants were obtained from Surgery ward.

4.1: BIO-DEMOGRAPHICS CHARACTERISTICS AMONG PATIENTS UNDERGONE SURGERY AT A DISTRICT HOSPITAL /SOUTHERN PROVINCE/ RWANDA.

Most patients were aged between 28-37 years old 59 (48.4% Mean age: 32; SD=16) out of 122, 105 (86.1%) were female. The maximum days of hospital stay before surgery was less than 5 days with 111 (91% Mean days: 2.3; SD=2.1) and after surgery was 1-5 days 108 (88.5% Mean:3.8, SD=2.4) . More patients were coming with reference 113(92.6%), the most participants were HIV negative 118 (96.7%); the smokers were few 3(2.5%) compared to those who did not smoke 119 (97.5%), patients with normal nutritional status were more predominant with 92 (75.4%) compared to those with obesity or overweight 28 (23%) and malnutrition or underweight 2 (1.6%). Based on ASA score the most patients were in normal health status (ASA score 1) 112 (91.8%) compared to other ASA scores, clean contaminated wound was the predominant characteristics of wound with 94 (77%),

Table 4. 1: Bio-demographics characteristics among patients who underwent surgery at Kabgayi Hospital.

Patients characteristics	Frequency	Percentage	Mean	Std. deviation
Age			32	16
18-27	39	32.0		
28-37	59	48.4		
38-47	16	13.1		
48-57	7	5.7		
>57	1	0.8		
Total	122	100.0		
Sex				
Male	17	13.9		
Female	105	86.1		
Total	122	100.0		
Hosp stay before operation			2.3	2.1
<1 day	55	45.1		
1-5 days	56	45.9		
> 5 days	11	9.0		
Total	122	100.0		
Days post-operation			3.8	2.4
1-5 days	108	88.5		
6-10 days	6	4.9		
> 10 days	8	6.6		
Total	122	100.0		
Referred				
Yes	113	92.6		
No	9	7.4		
Total	122	100.0		
Patient HIV status				
Positive	4	3.3		
Negative	118	96.7		
Total	122	100.0		
Patient nicotine use				
Yes	3	2.5		
No	119	97.5		
Total	122	100.0		
Patient nutritional status				
Normal	92	75.4		
Obesity or overweight	28	23.0		
malnutrition or underweight	2	1.6		
Total	122	100.0		
ASA Score				
ASA 1	112	91.8		
ASA 2	9	7.4		

ASA 3	1	.8
Total	122	100.0
Class of wound		
Clean	17	13.9
Clean – contaminated	94	77.0
Contaminated	4	3.3
dirty or infected	7	5.7
Total	122	100.0

Patients characteristics, among patients found with surgical site infection at Kabgayi hospital.

Table 4.1: Among 10 patients with SSI, 6(60%) aged 18-27 (Mean=26.5 SD:5.5), female were the most patients with SSI 9(90%), hospital stay before operation was in less than 5 days 9(90%) (Mean: 2.25, SD: 2.3) the most people of SSI last more than 10 days 8(80%) after operation (Mean13.5, SD: 4.3); HIV negative were 8 (80%) of all patients with SSI, no patients who use nicotine out of 10 patients with SSI; based on nutrition status 5(50%) were normal and 5(50%) were obese or overweight, according to ASA score 80% were patients with ASA score 1. Based on wound class 9 (90%) were the patients with clean contaminated.

Table 4. 2: Patients characteristics among patients found with surgical site infection at Kabgayi hospital

Patients factors	Frequency	Parentage	Mean	Std. Deviation
Age			**26.5**	**5.5**
18-27	6	60		
28-37	4	40		
Total	10	100.0		
Sex				
Male	1	10		
Female	9	90		
Total	10	100		
Hosp stay before operation			**2.25**	**2.3**
<1 day	5	50		
1-5 days	4	40		
> 5 days	1	10		
Total	10	100.0		
Days postoperation			**13.5**	**4.3**
1-5 days	1	10		
6-10 days	1	10		
> 10 days	8	80		
Total	10	100.0		
Patient HIV status				
Positive	2	20		
Negative	8	80		
Total	10	100		
Patient nicotine use				
No	10	100		
Patient nutritional status				
Normal	5	50		
Obesity or overweight	5	50		
Total	10	100		
ASA Score				
ASA 1	8	80		
ASA 2	2	20		
Total	10	100		
Class of wound				
Clean – contaminated	9	90		
dirty or infected	1	10		
Total	10	100		

4.2. PREVALENCE OF SURGICAL SITE INFECTION AMONG ADULT PATIENTS WHO UNDERWENT SURGERY AT KABGAYI HOSPITAL

Among 122 participants SSI cases were 10(8.2%) and 112(91.8%) were cases without infections,

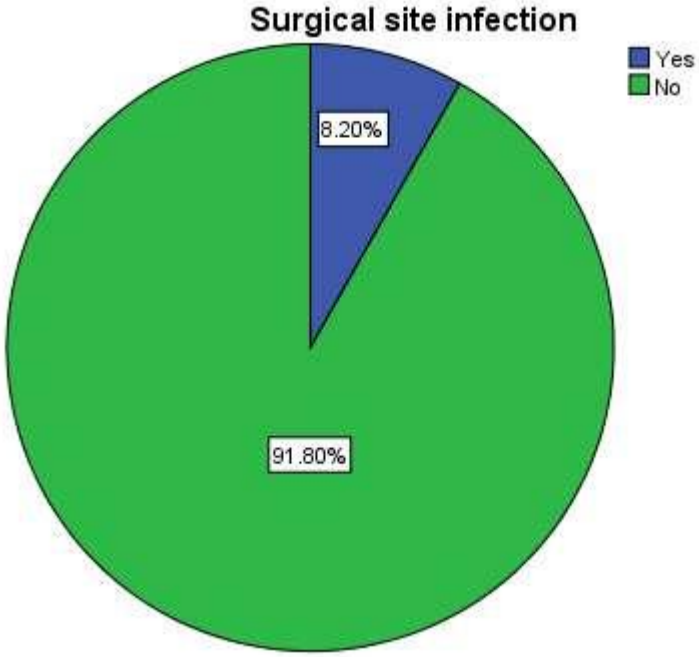

Figure 4. 1: Prevalence of surgical site infection among adult patients who undergone surgery at Kabgayi hospital.

Among the 10 cases with SSI 5 (50%) of them SSI were identified within the first 5 days after operation. Majority 8(80%) of patients with SSI had deep SSI as described in table 4.3.

Table 4. 3: Description of surgical site infection among adults patients who undergone surgery at Kabgayi hospital

	Frequency	Percentage %
Time infections identified		
1-5 days	5	50
6-10 days	4	40
> 10 days to 30days	1	10
SSI type		
Superficial	2	20
Deep	8	80

4.3: SURGICAL CHARACTERISTICS AMONG PATIENTS WHO UNDERGONE SURGERY AT KABGAYI HOSPITAL

The most patients were emergency cases 78 (63.9%) and more operation have been done on the abdomen 107 (87.7%), the predominant operation were non traumatic 111 (91%), antibiotics prophylaxis has been given to all cases within 60 minutes before operation, caesarean section was the predominant procedure with 93 (76.2%), and blood loss was within normal range in 104 (85.2%) cases, most patients were operated under local anesthesia 119 (97.5%), in among 73 (59.8 mean: 1, SD: 0.6) operation last less than 1hour.

Table 4. 4: Surgical characteristics among patients who underwent Surgery at Kabgayi hospital

Surgical factors	Frequency	Parentage	Mean	Std. Deviation
Type of surgery				
Elective	44	36.1		
Emergency	78	63.9		
Total	122	100.0		
Area of surgery				
Abdomen	107	87.7		
Limb	15	12.3		
Total	122	100.0		
Operation due to trauma				
Yes	11	9.0		
No	111	91.0		
Total	122	100.0		
Prophylaxis within 60'				
Yes	122	100.0		
Procedure				
Appendectomy	1	0.8		
Osteosyntheses	8	6.6		
Hernia	8	6.6		
Cesarean section	93	76.2		
Hysterectomy	1	0.8		
other lapalatomy	1	.8		
Other	10	8.2		
Total	122	100.0		
Bleeding				
Normal(< 500 ml)	104	85.2		
Abnormal (>500ml)	18	14.8		
Total	122	100.0		
Type of anesthesia				
General anesthesia	3	2.5		
Local anesthesia	119	97.5		
Total	122	100.0		
Duration of operation			1	0.6
Less than 1 Hour	73	59.8		
1-2 hours	46	37.7		
More than 2 Hours	3	2.5		
Total	122	100.0		

4.3.1: Surgical characteristics among patients found with surgical site infection at Kabgayi Hospital

Among 10 patients with SSI, there were 60% of patients with emergency surgery and 40% of patients with elective surgery, the abdomen as area of surgery were 90% of all cases and 10% for those with limb as area of surgery, all SI cases have been found among non traumatic surgery, according to procedure 90% of SSI cases were found among patients who undergone cesarean section and 10 % among patients with other procedures. All cases of SSI were found among patients with normal blood loss (<500ml), all cases have been operated under local anesthesia. According to duration of operation (mean 1.2 and std.0.422), SSI cases have been found among 80% patients whom the operation last less than 1 hour and 20% among patients whom the operation last over 2 hours, Table 4.5

Table 4. 5: Surgical characteristics among patients found with surgical site infection at Kabgayi Hospital

Surgical factors	Frequency	Parentage	Mean	Std. Deviation
Type of surgery				
Elective	4	40.0		
Emergency	6	60.0		
Total	10	100.0		
Area of surgery				
Abdomen	9	90.0		
Limb	1	10.0		
Total	10	100.0		
Operation due to trauma				
No	10	100		
Total	10	100		
Prophylaxis within 60'				
Yes	10	100.0		
Procedure				
Cesarean section	9	90		
Other	10	40		
Total	10	100.0		
Bleeding				
Normal(< 500 ml)	10	100		
Type of anesthesia				
Local anesthesia	10	100		
Duration of operation			1.9	0.8
1-2 hours	8	80		
More than 2 Hours	2	20		
Total	10	100.0		

4.4. THE CORRELATION BETWEEN PATIENTS' FACTORS, SURGICAL FACTORS AND SSI

4.4.1 The correlation between patients' factors and SSI

Factors associated to SSI were summarized in the table 4.6, HIV status was also found to be associated with SSI (Fisher's exact test: 9.604; P-value: 0.033) with P value less than 0.05.

Table 4. 6: Univariate analysis: Patients factors associated with SSI among adult patients who surgery

Patients factors	SSI			
	Yes (%)	No (%)	Chi-square	P-value
Age (df:4)			4.402**	0.325
18-27	6(15.54)	33(84.6)		
28-37	4(6.8%)	55(93.2)		
38-47	0(0.0)	16(100)		
48-57	0(0.0)	7(100)		
>57	0(0.0)	1(100)		
Hospitalization days before operation (df:2)			0.438**	0.896
< 1 day	5(9.1)	50(90.9)		
1-5 days	4(7.1)	52(92.9)		
> 5 days	1(9.1)	10(90.9)		
Patients HIV status (df:1)			9.604**	0.033*
Positive	2(50)	2(50)		
Negative	8(6.8)	110(93.2)		
Patient nicotine use (df:1)			0.275	1.000
Yes	0(0.0)	3(100)		
No	10(8.4)	109(91.6)		
Patient nutritional status (df:2)			4.456	0.116
Normal	5(5.4)	87(94.6)		
Overweight or obese	5(17.9)	23(83.1)		
Underweight or malnutrition	0	2(100)		
ASA Score (df:2)			3.558**	0.231
ASA 1	8(7.1)	104(92.9)		
ASA 2	2(22.2)	7(77.8)		
ASA 3	0(0.0)	1(100)		
Wound class (df:3)			2.179**	0.472
Clean	0(0.0)	17(100)		
Clean – contaminated	9(9.6)	85(90.4)		
Contaminated	0(0.0)	4(100)		
Dirty or infected	1(14.3)	6(85.7)		

N=122, *= P- value <0.05, **= Fisher's exact test df: degree of freedom

4.4.2 The correlation between surgical factors and SSI

In the below table; no statistical association found between surgical factors and surgical site infections because p value was >0.05

Table 4. 7: Surgical factors associated with SSI among adult patients undergone surgery

Surgical factors	SSI			
	Yes (%)	No (%)	Chi-square	P-value
Type of surgery (df :1)			0.073	0.787
elective	4(9.1)	40(90.9)		
emergency	6(7.7)	72(92.3)		
Area of surgery (df:1)			0.053	0.818
Abdomen	9(8.4)	98(91.6)		
limb	1(6.7)	14(93.3)		
Operation due to trauma (df:1)			1.079	0.299
Yes	0(0.0)	11(100)		
No	10(9)	101(91)		
Procedure (df:6)			3.629**	1.000
Appendectomy	0(0.0)	1(100)		
Osteosynthesess	0(0.0)	8(100)		
Hernia	0(0.0)	8(100)		
Caesarean section	9(9.7)	84(90.3)		
Hysterectomy	0(0.0)	1(100)		
other lapalatomy	0(0.0)	1(100)		
Other	1(10)	9(90)		
Blood loss (df:1)			1.885	0.17
Normal (.<500ml)	10(9.6)	94(90.4)		
Abnormal (>500 ml)	0(0.0)	18(100)		

Type of anesthesia (df:1)			**	1.00
General anesthesia	0(0.0)	3(100)		
Local anesthesia	10(8.4)	109(91.6)		
Duration of operation (df:2)			1.671**	0.47
< 1hour	8(11)	65(89)		
1-2 hours	2(4.3)	44(95.7)		
>2 hours	0	3(100)		
** = fisher's exact test **df**: degree of freedom				

4.4.3: The correlation between patients' factors and SSI

Multiple logistic regressions were conducted to test independent association between patients', factors and SSI; the results are as summarized in Table 4.8. The risk for developing SSI for the patients with HIV positive (OR: 13.7, P value: 0.014, CI: 1.7053; 19.8652) was found to be 14 times compare to those with HIV negative.

Table 4. 8: Multivariate Analysis for factors associated to SSI.

Variable	**OR**	**95% CI**	**p-Value**
HIV status			
negative	1		
Positive	13.7	[1.7053; 19.8652]	0.014*
N= 122, outcome : SSI , *p<0.05, OR: odd ratio			

CHAPTER V DISCUSSION

5.0 Introduction

Key findings in this study were regarding risk factors predisposing adult patients who undergone surgery at Kabgayi hospital in surgical and gyneco-obstetrics units. Among 122 participant, 112 (91.8%) were patients without infections and 10(8.2%) were patients with SSI. The present study shows SSI rate 8.2% which is comparable with rate (9.16%) of SSI reported by Ntsama et al (2013) in a study in Cameroon on Prevalence of surgical site infections and evaluation of risk factors after surgery, A lower rate of infection is reported by Al-mulhim et al. (2014) in their study coducted at King Abdulaziz Airbase Hospital, Dhahran in Saudi Arabia; on Prevalence of Surgical Site Infection in Orthopedic Surgery. The highest SSI were reported by Shinkawa et al. (2013) in their study conducted at Osaka City University Hospital in Japan on Nutritional risk index as an independent predictive factor for the development of surgical site infection after pancreaticoduodenectomy.

5.1 Demographic Data

The analysis of the demographic variables of the patients included in this study revealed that; the number of females operated were majority with 105 (86.1%) out of 122 participants. This may be partially explained by the fact that the number of patients recruited from the gyneco-obstetrics unit was more than those recruited from the surgery unit. These results were similar to Elbur et al. (2012) findings in their study conducted at Alshaab Teaching Hospital in Khartoum/ Sudan; they found that females were more than male with the rate of 82%.

Age of 122 patients ranged from 18-65 years. Most of the patients 59 (49 %) were in between 28-37years; with mean age 32years and standard deviation 16 years. In a similar study conducted in an Iranian teaching hospital on abdominal surgical site infections: incidence and risk factors; average age of the patients was 46.70 years (Razavi et al. 2005). Average age of the patients in the Iranian study was much higher than the present study. It was observed that rate of SSI in different age groups was higher 15.54% in the 18-27 years, and 6.8 % in the 28-37 years. This finding is inconsistent with the findings of an Iranian study where they showed the rate of SSI 3.70 % in < 25 years age. In this

study age was not associated with an increased risk of SSI (p=0.325), these results were similar to Ntsama et al (2013) findings in their study on Prevalence of surgical site infections and evaluation of risk factors after surgery, case of three public hospitals in Cameroon . This was contrary to Talbot & Schaffner (2005) findings in their study on Relationship between Age and the Risk of Surgical Site Infection; found that the relationship between age and the risk of surgical site infection was significant.

5.2. Patients factors predisposing to postoperative infection

In this study most of patients stay 1 day to 5 days before operation 56 (45.9%); and SSI was predominant in the patients hospitalized less than 1 day and those hospitalized over 5 days with 9.1% for each. Pre-operation hospital stay was not found to be associated with increased risk of SSI; this was different to Patel et al. (2012) findings in their study conducted in western India on surgical site infections: incidence and risk factors in a tertiary care hospital,

In relation to HIV, it was observed that 4 patients were HIV positive and 118 patients were HIV negative. Among the patients with HIV, 2 (50 %) developed surgical site infection (SSI), whereas, in the patients without HIV only 8 (6.8 %) developed SSI. It was clear that HIV played a vital role as a host related risk factor for SSI. In this study HIV positive was found to increase risk for SSI (p value: 0.014). These results were similar to Mawalla et al. (2011) in their study on Predictors of surgical site infections among patients undergoing major surgery at Bugando Medical Centre in Northwestern Tanzania Brian and Akoko (2012) in their studies on Risk Factors of Surgical Site Infection at Muhimbili National Hospital, Dar es Salaam, Tanzania; found that the rate of SSI was significantly higher in HIV positive patients than patients with HIV negative (p-value < 0.05).

Nutritional status (obesity or malnutrition) were not found to be associated with increased risk of SSI, these result were similar to Razavi et al. (2005) that found no significant correlations between obesity, malnutrition and SSI (p = 0.692) but the contrary results were found by Lola et al.(2011) in their study found that obesity and malnutrition increase the risk for SSI.

In this study among 3 patients actively smoking no case found with SSI and smoking was not found to be associated with increased risk to SSI (p=1.000); the different results were found by National Collaborative Center for Women's and children's Health (2008) for its guide on prevention and treatment of surgical site infection; they found that smoking is independent risk factor to SSI

Among 122 participants, according to ASA score, the most patients with SSI had ASA score 2, 2 (22.2%) out of 9 patients. This finding was similar to Cheng et al. (2015) findings; but the association between ASA score and SSI were statistically insignificant (p value> 0.05) the different results were found by Ntsama et al (2013) in their study on Prevalence of surgical site infections and evaluation of risk factors after surgery at three public hospitals in Cameroon; they found that there was a significant association between SSI rate and ASA score ≥ 3.

According to wound class clean contaminated wound was the most class of wound found in this study with 94 (77%) and among them, patients with SSI were 9 (9.6); In this study wound class was not found to be increased risk to SSI. The contrary results were found by Ntsama et al (2013).

5.3 Surgical factors predisposing to postoperative infection

In this study most patients underwent emergency surgery 78(63.9%); SSI were high among patients with elective surgery 4(9.1%) out of 44 cases, but the association between type of surgery and SSI was insignificant (P value >0.05); the similar results were found by Ntsama et al (2013).

The most operations were not due to trauma 111(91%) and SSI were observed among non traumatic surgery. The association between operation due to trauma and SSI was not significant. The different results were found by Ridgeway et al. (2005) in their study on Infection of the surgical site after arthroplasty of the hip conducted at 2 hospitals in England. All of participants received antibiotics prophylaxis within 60 minutes before operation; the similar results were found by Ishikawa et al. (2014)in their study conducted at Keiyukai Sapporo Hospita in Japan on incisional surgical site infection after elective open surgery for colorectal Cancer.

According to the procedure caesarean section was the most performed procedure 93(76.2%) of participants out of 122 underwent caesarean section. This findings were similar to(Petroze et al. (2011) findings in their study on Surgical Volumes at the District Hospital: A Retrospective Review of National Data in Rwanda. The association between surgical procedure and SSI was not significant with (p value>0.05). In this study all cases of SSI their blood loss during procedure were within normal range (<500ml) and the association between SSI and blood loss was not significant (p value>0.05).the different results were found by Cheng et al. (2015) in his study conducted at university- affiliated tertiary care centre in China on Risk factors for surgical site infection.

The most patients were operated under local anesthesia 119 (97.5%) and there was no association found between the type of anaesthesia used and SSI table 7. These results were similar to Cheng et al. (2015) findings. Likewise different results were found by Triantafyllopoulos et al. (2015) in their study on Patient, Surgery, and Hospital Related Risk Factors for Surgical Site Infections following Total Hip Arthroplasty in USA found that regional anaesthesia can reduce the risk of developing SSI.

The most operation were perform in less than an hour 73 (59.8%) the raison can be enhanced by the great number of patients undergone caesarean section compared to other procedure. Patients with SSI were 8 (11%) among patients with operation less than 1 hour but the association between duration of operation and SSI was not significant. These results were different to Jeong et al. (2013)in their study in 10 hospitals in Korea, on Incidence and Risk Factors for Surgical Site Infection after Gastric Surgery confirmed that prolonged operation time is a risk factor for SSI after gastric surgery.

CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

The patients in postoperative period are at risk for developing surgical site infections. SSI can lead to long hospital stay, patients' morbidity, increase the cost of health care services and can lead to mortality. In this study among patient's factors like age, hospital stay before operation, nicotine use, diabetes, HIV status, malnutrition, obesity and ASA score; only HIV was found to be statistically a risk factor associated with SSI. Among various surgical factors like type of wound, type of surgery, operation due to trauma, antibiotic prophylaxis, procedure, area of surgery, type of anesthesia, blood loss and duration of surgery; no factor found to be statistically associated with SSI. This study did not identify the environmental factors, gravida factors which also can increase the risk for developing SSI.

6.2 RECOMMENDATIONS

Through this study finding the following recommendation can be made:

1. Adequate pre-operative assessment should be done in order to recognize or to detect early as possible patients comobilities for better management of the patients before operation, during operation and after operation.

2. There is a need of maintain adequate prevention measures of surgical site infections as recommend by CDC

3. There is a need of adequate mentoring of students about SSI prevention during their clinical practice as future health care providers.

4. As cesarean section was the most performed procedure at district hospital in Rwanda, further researches are needed to be performed on risk factors associated with SSI among cesarean delivery women at district hospitals.

5. Further research is needed to be conducted in great level for direction regarding identifications of other risk factors not studied or for those studied in this research.

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APPENDIX

Appendix 1: INFORMED CONSENT FORM

This Informed Consent Form is for adult patients' undergone surgery at Kabgayi Hospital, and who we are willing to participate in research on **risk factors predisposing adult patients to postoperative infection.**

I am Deborah MUKAMUHIRWA student at university of Rwanda, college of medicine and health sciences in school of nursing sciences and midwifery medical surgical master's program. I' m conducting research on **risk factors predisposing adult patients to postoperative infection**.

I am inviting you to participate in this study because the postoperative infection is the commonest hospital acquired infection and remained a major cause of morbidity and mortality globally. This study will contribute to identify individual and surgical factors predisposing to postoperative infection. That knowledge may strengthen preventive measures to minimize postoperative infections. This study will involve all postoperative adult patients from 18 years old and above admitted at Kabgayi hospital in gyneco-obstetric ward and surgical units within 2 months from 13th February to 12nd April, 2017. Participation in this study is completely voluntary after an individual signed informed consent. Participants are allowed to ask any information about this study to the researcher and get answers and clear explanations. You will receive any payment for being a participant in this study. No intervention will be performed on you. A review of your file will be done and a series of questions will be asked to you and provided answers will be hand written by the researcher. It is not mandatory to sign it now, you are allowed to sign later if you need time to reflect on it**.** Refusal to participate will not affect quality of services you will be provided. All information is confidential; collected only for the study purpose. No individual feedback will be provided as only a general feedback and recommendations will be provided to Kabgayi hospital administration at the end of this study.

I have read the foregoing information, or it has been read to me. I have had the chance to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Print Name of Participant_____

Signature of Participant _____

Date _____

Day/month/year

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness_____ AND Thumb print of participant

Signature of witness _____

Date _____

Day/month/year

INYANDIKO YEMEZA UBUFASHA MUBUSHAKASHATSI

Iyi nyandiko irareba abantu cyangwa se abarwayi babazwe kandi barwariye ku ibitaro by' Akarere bya Kabgayi bafite nibura imyaka 18 y'amavuko kuzamura; bemera gukorerwaho ubushakashatsi kubijyanye n' **ibintu bishobora kuba intandaro yo kwanduzwa n'udukoko (microbes) ku igisebe gikomoka ku ibagwa**

Nitwa MUKAMUHIRWA Deborah umunyeshuri muri kaminuza y'u Rwanda mu ishuri ry'abaforomo n'ababyaza mugashami kigisha indwara zo mumubiri nizo kubagwa kubantu bakuru mukiciro cya gatatu cya kaminuza.

Ubu bushakashatsi burareba ku **ibintu bishobora kuba intandaro yo kwanduzwa n'udukoko (microbes) ku igisebe gikomoka ku ibagwa.**

Ngusabye kumfasha muri ub'ubushakashatsi; kuberako ubushakashatsi bwakozwe bwagaragjeko ko ku isi ubwandu bw'igisebe nyuma yo kubagwa ari imwe mumpamvu itera ubusembwa bwu'umubiri ndetse bikaba byanaviramo urupfu. Ubu bushakashatsi bugamije kureba ibintu bishobora kuba intandaro yo kwanduzwa n'udukoko (microbes) ku igisebe gikomoka ku ibagwa: ibihereye k'umurwayi ndetse nibihereye ku ibagwa nyirizina. Ubumenyi buzava muri ubu bushakashatsi buzafasha ari k'abarwayi cg se kubaganga mugufata ingamba zo kugabanya kwandura ku ibisebe nyuma yo kubagwa.Ubu bushakatsi burareba gusa abantu babazwe bari mu byumba by'imbagwa rusange no mubyumba by'imbagwa by'ababyeyi mu bitaro bya Kabgayi, bafite nibura imyaka 18 y'amavuko bemeye kubushake bwabo kandi bagasinya ku inyandiko yemeza gufasha mubushakashatsi. Ubu bushakashatsi buzamara amezi 2 kuva kuya 13 Gashyantare kugeza kuya 12 Mata umwaka wa 2017. Umurwayi yemerewe kubaza ibibabazo kandi ubusobanuro buhagije arabuhabwa. Uwemeye kujya mubushakashatsi ntacyo yishyurwa, muri ubu bushakashatsi ntagikorwa kizakorerwa kumuntu uzabujyamo keretse gusubiza ibibazo bijyanye nubushakashatsi no kwemerako ifishi ye avurirwaho yakurwamo amakuru yingenzi akenewe muri ubu bushakashatsi. Ntabgo ari ngombwa guhita usinya kuri iyi nyandiko; mugihe ushaka gufata umwanya wo kubitekerezaho urawuhabwa ukazasinya nyuma ubishatse. Kwanga kujya muri ububushakashatsi ntangaruka bifite kuri wowe cyangwa se kubuvuzi ugomba guhabwa. Amakuru uduha ni ibanga kandi azakoreshwa kubijyanye nubu bushakashatsi gusa.

Ntagisubizo kizahabwa umuntu kugiticye keretse umwanzuro rusange niwo uzahabwa ubuyobozi bw'ibitaro bya Kabgayi.

Nasomye /nasomewe amakuru ajyanye n'iyi nyandiko. Nahawe umwanya wo kubaza ibibazo kandi ubusobanuro nahawe bwanyuze. Nemeye kubushake kujya mubushakashatsi.

Izina _____

Umukono _____

Itariki _____

Nasomeye neza umurwayi ushaka kujya mubushakashatsi kandi yabonye umwanya wo kubaza ibibazo. Ndemezako agiye mubushakashatsi kubushake ntagahato.

Izina ry'uwasomye_____ na Igikumwe cya nyirubwite

Umukono _____

Itariki _____

Appendix 2: DATA COLLECTION SHEET

Risk factors predisposing adult patients to postoperative infections at rural district hospital in southern province

PATIENT INFORMATION

Patient initial name: Patient ID number : Ward : _/__/__ Date of admission:……./…../…….. operation:			Date of birth: Date of operation: Days of post
Referral: Yes/ No			**Referral from:**
Age: Gender: Male/Female	Height (cm):_ __	Weight(Kg): _____	BMI:
General condition of patient	Diabetes Type I: Yes/No Diabetes Type II: Yes/No HIV: positive/negative or unknown	Smoking: Yes/No	Obesity: Yes/No Malnutrition: Yes/No Other----------

A SA	WOUND CLASS	TYPES OF WOUND
1. A normally healthy patient 2. A patient with mild systemic disease 3. A patient with severe systemic disease 4. A patient with severe systemic disease that is a constant threat to life 5. A moribund patient who is not expected to survive without the operation.	1. Clean 2. Clean-Contaminated 3. Contaminated 4. Dirty or Infected	1.Open wound 2.Closed wound

SURGICAL INFORMATION

Type of surgery Elective Emergency	**Operation due to trauma** Yes/No	**Pre op Hair shaving** Yes/No **If yes removed with**: razor/ electrical clip	**Antimicrobial prophylaxis** Yes /No /Unknown If **Yes**, was it given within 60 minutes? Yes/No
Area of surgery:…….			

Category of surgical procedure	**Bleeding**	**Anesthesia**	**Duration of operation**
Procedure ➢ **General surgery** Appendectomy Hernia Laparotomy Thyroidectomy Adenomectomy (BPH) Other:_____ **Orthopedic** Osteosyntheses Other:_____ **Gyneco/Obstetrics** Caesarian section Hysterectomy Dilation and Curettage Laparotomy (GEU) Other Laparotomies_____	Normal: < 500ml Abnormal: >500ml	☐GA ☐Regional: ☐epidural ☐spinal ☐ Local/Other	Time of incision_____ Time of closure_____ Minutes_____

POSTOPERATIVE INFECTIONS

Surgical site infections	**Type of surgical site infections**
Yes/No If Yes date of infection identified…….	Superficial Deep Organ/space

Completed by ----------

Date:---------- Signature…….

I knowledge for Surgical site infections surveillance service in England for their contribution for elaboration of the above tool;

URUPAPURO RW'IBAZWA: ibintu bishobora kuba intandaro yo kwanduzwa n'udukoko (microbes) ku igisebe gikomoka ku ibagwa

AMAKURU AHEREREYE K'UMURWAYI

Impine ry'izina ry'umurwayi: Nimero: Icymba : igihe ya vukiye: Igihe yaziye ku ibitaro:__/__/__ _/__/__ igihe yabagiwe:			
Imyaka: igitsina: Gore/Gabo	uburebure (cm):_ __	ibiro(Kg): _____	ikirango y' Ibiro kuburebure:
Ubuzima rusange	Indwara y'igisukari ubwoko bwa I Indwara y'igisukari ubwoko bwa II Abana n'ubwandu bwa gakoko gatera SIDA: Yego/Oya	Anywa itabi:Yego/Oya	Umubyibuho ukabije / Bwaki Ibindi----------

Ihuriro ry'abasinziriza ry'Amerika	**Ubwoko bw'igisebe**

1. umuntu muzima utarufite ibindi bibazo 2. Umurwayi ufite indwara zoroheje 3. umurwayi ufite indwara zikomeye 4. umurwayi ufite indwara zikomeye cyane kd zidakira 5. umurwayi udafite icyizere cyo kubaho mu h gihe atabazwe .	1cyiza cg se kitanduye 2. yanduye buhoro 3. cyanduye 4. cyanduye cyane

AMAKURU Y'IBAGWA

Ubwoko bw'ibagwa Yarategujwe Byihutirwa	**Yabazwe bitewe n'impanuka** yego/oya	**Yahawe Imiti irinda ubwandu bw'igisebe** Yego/Oya Ntibizwi

Igice ibagwa rihererereyemo	**Amaraso yatakaye abagwa**	**Ikinya**	**Igihe ibagwa ryamaze**
Ibagwa ➢ **Ibagwa rusange** Yabazwe uruhago rw'utubuye Yabazwe umusipa Yabazwe kunda Yabazwe umwingo Yabazwe (BPH) Ahandi:_____ **Amagufwa** Kuringaniza igufwa Ibindi :_____ **Imyanya y'imyibarukiro/kubyara** Bakuyemo Nyababyeyi Koza munda ibyara Gukuramo inda yari hanze y'umura Ibindi:_____	bizima: < 500ml Bibi: >500ml	Icy'uruhande Icy'umubiri wose	Igihe batangiriye_____ Igihe barangirije_____ Igihe cyose hamwe_____

AMAKURU YA NYUMA YO KUBAGWA

Igisebe cyaranduye	**Ubwoko bw'ubwandu bw'igisebe**
Yego oya	Hejuru (kuruhu) Munsi (Munyama)

Byujujwe na **----------** Itariki……. umukono

Appendix 3: Ethical clearance from IRB

UNIVERSITY OF RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 09/01/2017
Ref: CMHS/IRB/039/2017

Mukamuhirwa Deborah
School of Nursing and Midwifery, CMHS, UR

Dear Mukamuhirwa Deborah

RE: ETHICAL CLEARANCE

Reference is made to your application for ethical clearance for the study entitled ***"Risk Factors Predisposing Adult Patients To Postoperative Infections At Rural District Hospital In Southern Province".***

Having reviewed your protocol and found it satisfying the ethical requirements, your study is hereby granted ethical clearance. The ethical clearance is valid for one year starting from the date it is issued and shall be renewed on request. You will be required to submit the progress report and any major changes made in the proposal during the implementation stage. In addition, at the end, the IRB shall need to be given the final report of your study.

We wish you success in this important study.

Professor Kato J. NJUNWA
Chairperson Institutional Review Board,
College of Medicine and Health Sciences, UR

Cc:
- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate studies, UR

EMAIL: researchcenter@ur.ac.rw P.O. Box: 3286, Kigali, Rwanda WEBSITE: http://cmhs.ur.ac.rw/

Appendix 4: Recommendation letter

UNIVERSITY OF RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

Kigali, on 30 / 01 /2017

Ref. No: 38/ UR-CMHS/SoNM/17

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

Re: Request to collect data

Referring to the above subject, I am requesting for permission for **MUKAMUHIRWA Deborah**, a final year student in the Masters of Science in Nursing at the University of Rwanda/College of Medicine and Health Science to collect data for his/her research dissertation entitled **Risk factors predisposing adults patients to postoperative infections at rural district hospital in southern province**

This exercise that is going to take a period of 2 months starting from 13th February 2017 to 12th April 2017 will be done at **Kabgayi District Hospital**

We are looking forward for your usual cooperation.

Sincerely,

Dr. Donatilla MUKAMANA, RN, PhD
Dean, School of Nursing and Midwifery
College of Medicine and Health Sciences

Email: schoolofnursingandmidwifery@ur.ac.rw, P.O.Box: 3286 Kigali-Rwanda, Website: www.ur.ac.rw

Appendix 5: Letter for requesting to collect data

MUKAMUHIRWA Deborah
UNIVERSITY OF RWANDA
COLLEGE OF MEDECIN AND HEALTH SCIENCES
MASTER'S PROGRAM
MEDICAL-SURGICAL TRACK
E-MAIL:mukamuhirwad@yahoo.fr
25Th January, 2017

To Director of Kabgayi Hospital

Re: Request the permission for conducting research

Dear Sir,

I humbly request for the permission for conducting research in the hospital that you assume responsibility for completion of my studies.

In fact I'm student at university of Rwanda/college of medicine and health sciences, in master's program/ medical surgical track. After looking that postoperative infections remain a major cause of long hospital stay, morbidity and mortality among postoperative patients, I would like to conduct research in your institution on **risk factors predisposing adult patients to postoperative infections.** The attached document is the abstract of my study.

I' m looking for good response from you.

Your respectfully

MUKAMUHIRWA Deborah

Appendix 6: Approval letter from the hospital

KABGAYI DIOCESE

MUHANGA DISTRICT

KABGAYI HOSPITAL
B.P: 66 GITARAMA – RWANDA.
E– mail: kabgayihospital1@ gmail.com
Tel : 07 86 21 74 28

Kabgayi, 15th February 2017

N0...082.../HOP/K.E./ dm

Review Approval Notice

Dear Madam, MUKAMUHIRWA Deborah

Re: Response to your Request for conducting Research

I'm pleasure to inform your that your request for conducting Research for 2 months has been approved.

In fact after reviewing your letter requesting to conduct research on Risks Factors predisposing adult patients to postoperative infections, abstract of your study, recommendation letter from your school and ethical clearance from Institutional Review Board (IRB) of College of Medecine and Health Sciences (CMHS); your request has been granted and you are allowed to start your study.

If any change in progress of your study that requires ethical intervention, please notify Ethical committee of your school for resolution and inform us about feedback. In addition at the end, the hospital shall be given the final report of your study.

I wish all the best in your work, if any constraints regarding our Institution please contact us for clarification.

Your faithfully.

Dr Espoir KAJIBWAMI
Director of Kabgayi Hospital.