



**KNOWLEDGE AND PRACTICE ON PREVENTIVE MEASURES OF NOSOCOMIAL  
INFECTIONS AMONG NURSES WORKING IN INTENSIVE CARE UNIT OF  
REFERRAL HOSPITALS.**

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**A dissertation submitted in partial fulfilment of the requirements for the**

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**In the College of Medicine and Health Sciences**

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PREVENTIVE MEASURES OF NOSOCOMIAL  
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a. Declaration by the Student

I do hereby declare that this *dissertation* submitted in partial fulfilment 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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In my capacity as a Supervisor, I do hereby authorise the student to submit his/her **dissertation**.

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## **DECLARATION**

I, NYIRANTIBIBAZA Marianne, do hereby declare that this dissertation report submitted in partial fulfillment of requirement for the Degree of Master of Science in Critical Care and Trauma Nursing, School of Nursing and Midwifery, College of Medicine and Health Sciences University of Rwanda, is my own original work. It has not been submitted elsewhere and will not be presented to any other university for a similar or any other degree award.

Also, I do declare that a complete list of references is provided indicating all the sources of information quoted or cited.

Signature .....

## **DEDICATION**

This work is dedicated to the Almighty God for his guidance and protection, to my family and to all who contributed to the success of this work.

## **ACKNOWLEDGEMENTS**

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*May God bless every one!*

## **ABSTRACT**

**Background:** The burden of nosocomial infections all over the world is still causing problems including high morbidity resulting in many cases of death. As nosocomial infections are preventable through the use of appropriate preventive strategies, up to date knowledge and skills of nurses in ICU is highly needed because it is very important for the prevention of nosocomial infections as the nurses spend most of their working hours with critically ill patients.

**Aim of the study:** The aim of this study was to assess knowledge and practice of preventive measures of nosocomial infections among nurses working in ICU in referral hospitals

**Materials and methods:** A non-experimental quantitative cross-sectional study was conducted among nurses working in Intensive Care Unit (ICU) of referral hospitals at Kigali University Teaching Hospital (CHUK) and Rwanda Military Hospital (RMH), to identify knowledge and practice of nurses on preventive measures of nosocomial infections. A non-probability convenience sampling method was used, and a sample of 51 nurses working in ICU in both referral hospitals was used in the study. A self-administered questionnaire with closed-ended questions was used to assess knowledge and observational checklist was used to assess the practice.

### **Results:**

The study found that 22 (43.1%) of nurses working in ICU have adequate knowledge, 24 (47.1%) and 5 (9.8%) have poor knowledge towards prevention of nosocomial infections. Most of nurses working in ICU 31 (60.78%) have good practice and 20 (39.22%) have poor practice towards the preventive measures of nosocomial infections. Nearly three quarter (74.5%) did not wash hands before entering ICU. The Fisher's Exact test and the Chi-squared test revealed an association between level of nursing education and knowledge ( $p=0.049$ , Fisher exact test) as well as practice ( $X^2= 5.031$ ,  $df=1$ ,  $p=0.025$ ).

**Conclusion:** The knowledge and practice of nurses working in ICU towards the prevention of nosocomial infections need to be improved through refresher workshop and trainings to recall and reinforce acquired knowledge and skills of nursing care procedures in intensive care unit

## KEY WORDS

**1. Knowledge:** Understanding of information about a subject which a person gets by experience or study, and which is either in a person's mind or known by people generally. (Cambridge Advanced Learner's Dictionary, 2016). In this study knowledge refers to level of understanding of measures to prevent nosocomial infections.

**2. Practice:** Action rather than thought or ideas.

In this study practice refers to an implementation of preventive measures of nosocomial infections, during patient's care.

**3. Nurse:** The Merriam-Webster (2016) defines a Nurse as a licensed health-care professional who practices independently or in collaboration with a physician, surgeon, or dentist and who is skilled in promoting and maintaining health. In this study, a nurse is a health care provider who is licensed by National Council for Nurses and Midwives as a registered nurse.

**4. Nosocomial infections:** Are infections acquired in hospitals and other healthcare facilities when the patient has been admitted for reasons other than the infection and the patient must also have shown no signs of active or incubating infection at the time of admission. The infection should develop 48 hours or more after patient admission (CDC, 2014). Nosocomial infections are also including the infections acquired by a health care provider at the health facility or hospital (WHO, 2011). In this study nosocomial infection will be limited to infection acquired by the patient.

**5. Prevention:** Prevention is the act or practice of stopping something bad from happening (Merriam-Webster, 2016). Disease prevention is a specific, population-based and individual-based intervention for primary and secondary prevention, aiming to minimize the burden of diseases and associated risk factors (WHO, 2016). In this study, prevention means the practice of appropriate strategies to stopping nosocomial infection from happening.

**6. Intensive care unit:** A hospital unit in which is concentrated special equipment and specially trained personnel for the care of seriously ill patients requiring immediate and continuous attention, also called critical care unit (Farlex Partner Medical Dictionary, 2012).

## **LIST OF SYMBOLS AND ACCRONYMS**

**CAUTI:** Catheter Urinary Tract Infection

**CDC:** Centres for Disease Control

**CHUB:** Centre Hospitalier Universitaire de Butare

**CHUK:** Centre Hospitalier Universitaire de Kigali

**CPD:** Continuous Professional Development

**ETT:** Endo-Tracheal Tube

**HAI:** Healthcare Associated Infection

**HDU:** High Dependent Unit

**HRH:** Human Resource for Health

**IC:** Infection Control

**ICU:** Intensive Care Unit

**IRB:** Institutional Review Board

**KUTH:** Kigali University Teaching Hospital

**NCI:** Nosocomial Infection

**RMH:** Rwanda Military Hospital

**R-MPM:** Rwanda Mortality Probability Model

**SPSS:** Statistical Package for Social Studies

**TPN:** Total Parenteral Nutrition

**USAID:** U.S. Agency for International Development

**VAP:** Ventilator Associated Pneumonia

**WHO:** World Health Organization

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# **CHAPTER 1: INTRODUCTION**

## **1.1. INTRODUCTION**

Nosocomial infection is a global problem of health which affects around 1.4 million worldwide, and is like an endemic in Sub Saharan Africa (Mbim, Mbotto and Agbo, 2016). One in ten patients are estimated by the World Health Organization to be affected by nosocomial infections globally (WHO, 2016, p.6), 7% of patients in developed countries and 15 % of patients in developing countries acquire infections at the health facility; and Intensive care Unit (ICU) account for an increase of cases of nosocomial infections up to 30% in high-income countries which triples in number in developing countries.

## **1.2. BACKGROUND OF THE STUDY**

The World Health Organization (WHO, 2016, p.4), defined a nosocomial infection (NI) as an infection that a patient acquires during admission period in the health facility and during the process of care, and was not manifested or incubating at the time of admission. It also consists of infections acquired in the hospitals which appear after discharge. The occupational infections among staff of the facility are also included. In other words nosocomial infections are also called hospital-acquired infections (HAI) or healthcare associated infections (WHO, 2016, p.1). From that definition, the World Health Organization further specified that infections are called nosocomial, when they occur up to 48 hours after hospital admission, up to 3 days after discharge, or may appear even up to 30 days after an operation (WHO, 2016, p.4)

The prevalence of nosocomial infections in high income countries varied between 3.5% to 12% with low rate in Germany (3.5%), high rate in Canada (11.6%), New Zealand (12%) compared to the rate of 5.7% -19.1% in low resource settings (Mbim, Mbotto and Agbo, 2016, p. 5)

The Intensive Care Unit (ICU) is often called “epicenter” of infections due to vulnerability of patients hospitalized in the Unit and multiple procedures and invasive devices used such as intubation, peripheral and central vascular access which invade the normal protective barriers of lining epithelium (Brusselsaers, Vogelaers and Blot, 2011).

Pneumonias, urinary tract infections, blood stream infections and surgical site infections were found to be most common nosocomial infections in ICUs in numerous studies (Assar,Akhoundzadeh et al., 2012, p.455; Mohammed et al., 2014, p.8; Dasgupta, Das and Hazra, 2015, p.13; Khan,Kundra et al., 2015, p.4).In US, the most common nosocomial infections in 2011 were central catheter associated blood stream infections (84.0%),catheter associated urinary tract infection (67.7%),pneumonia (21.8%),infection at surgical site(21.8%),ventilator associated pneumonia at a rate of 39.1%% (Centers for Disease Control and Prevention, 2014, p.1).

In Eastern India, nosocomial infection rate was 11.98% and pneumonia was the most common infection found (62.07%) followed by infections affecting urinary tract also called UTI and bloodstream infections associated with central venous catheter (Dasgupta, Das and Hazra, 2015, p.13). At contrary, a high rate (29.5%) of nosocomial infections in ICU has been reported in a study done in Southern India (Khan *et al.*, 2015, p.2)

The study conducted in Iran by Assar Shideh *et al.*, (2012, p.456) demonstrated that patients admitted in Intensive Care Unit were particularly at high risk of acquiring nosocomial infections: 12% compared to 1% in patients admitted in other wards. This was similarly reported by Mohammed *et al.*,2014, p.8who stipulated that the rate of nosocomial infections in ICUs was almost three times higher than any other departments of the hospital, where the prevalence was 9.6%. Device-acquired infections in ICUs was found at an overall rate of 9.8% in Lebanon and Escherichia coli was the most common causative microorganism (Kanj, Kanafani and Rosenthal, 2012, p. 12)

The use of indwelling urinary catheter, the length of ICU stay and prior antimicrobial therapy was found to be significant factors predisposing to nosocomial infections in ICU patients and nosocomial infections cause increased hospital stay in ICU patients (Dasgupta, Das and Hazra, 2015, p.14). Similarly, increased hospital stay has been found to be a consequence of nosocomial infection in ICU in Gaza, where 81% of patients who stayed for more than one week in ICUs had nosocomial infections with double risk of mortality in patients who were affected by nosocomial infections compared to patients without nosocomial infections: 42% versus 21% mortality rate respectively (Ashour and El-Nakhal, 2012, p. 33).

A high mortality rate has also been reported in India with three times higher mortality rate in patients who acquired infections in ICU (25.8%) compared to those who did not acquire infection (7.2%) showing a high risk of mortality in ICU due to nosocomial infections (Khan *et al.*, 2015, p. 4). Mortality rate of 33% has been reported in ICU patients who had nosocomial infection in Oceania Country Suva (Naidu *et al.*, 2014, p. 3).

In the other hand, total parenteral nutrition, patients with diabetes mellitus, emergency surgery and tracheostomy use were the significant risk factors predisposing to high nosocomial infections in ICUs (Khan *et al.*, 2015, p. 4). In addition, the consequences of nosocomial infections include rise of antimicrobial resistance in ICUs which include methicillin-resistant staphylococcus aureus and vancomycin-resistant enterococci as the most important microorganism in Intensive Care Unit (Brusselsaers, Vogelaers and Blot, 2011, p. 2), this was argued by (Khan *et al.*, 2015, p.4) that multidrug resistance microbes in ICUs makes nosocomial infections more challenging and serious issue.

A recent review of nosocomial infections in Sub-Saharan Africa (Mbim, Mbotto and Agbo, 2016, p.3) revealed that nosocomial infections range from 2-49% in hospitalized patients in general and the patients hospitalized in intensive care units have the highest rate (21.2- 35.6%). The surgical site infections in Sub-Saharan Africa were found to be the most common nosocomial infections (Mbim, Mbotto and Agbo, 2016, p.3). A high rate of nosocomial infections (19.1%) has been reported in Benin (Ahoyo *et al.*, 2014, p.1)

In Rwanda, recently available data for nosocomial infection (Rwabizi *et al.*, 2016, p.1-2), includes the presence of postpartum infections among 117 women and the infections were namely peritonitis (56%), deep surgical site infections and fasciitis (17%) and endometritis (15%). Study done in trauma patients in Rwanda by (Petroze *et al.*, 2014, p. 385), revealed that 7.4% of admitted trauma patients developed nosocomial infections including surgical site infections, urinary tract infections and pneumonia which increase the hospital stay in trauma patients who acquired nosocomial infection.

In addition Infection Control (IC) in Rwanda is currently an inadequately addressed area, which the government is seeking to develop through a long-term capacity building partnership with USAID and other partners, known as the Human Resources for Health initiative. International practices of IC are largely inapplicable in a developing country setting, thus innovative and contextually relevant approaches are required in order to address this crucial aspect of healthcare management (Fath, 2016, p.1 ).

Considering morbidity, mortality, increased length of stay and the costs caused by nosocomial infections, it could be classified as a major safety concern for both healthcare providers and the patients, in which efforts should be made to make the healthcare facilities as safe as possible by preventing such infections (Mehta, Gupta and Ramasubban, 2014, p. 149)

Nosocomial infections are preventable when appropriate strategies are used; these strategies include hand hygiene, use of aseptic technique and presence of functioning infection control committee (Mohammed *et al.*, 2014, p.8). Preventive measures of nosocomial infections also include strict follow-up of WHO five moments of hand hygiene, use of standard precautions including gloves, gowns, mask, source isolation and protective isolation, use of specific strategies to prevent nosocomial infections in critically ill patients (Mehta,Gupta and Ramasubban, 2014, p. 150),and the authors further clarified the specific preventive measures of ventilator-associated pneumonia including avoiding intubation when possible, preferring noninvasive ventilation when possible, preferring oral intubations to nasal unless contraindicated and preferring closed endotracheal suction systems.

These strategies are also applicable in Rwanda in prevention of nosocomial infection in ICU. Unsatisfactory knowledge level (63.6%) regarding infection control standard precautions has been found in Egyptian intensive care nurses (Eskander, Morsy and Elfeky, 2013, p.160), and only 40.7% of nurses in Ethiopia were found to have adequate knowledge about prevention of surgical site infection (Teshager, Engeda and Worku, 2015, p.3); therefore updated knowledge and skills of nurses regarding infection control may show a significant role in preventing nosocomial infection in ICU (Eskander *et al.*,2013, p.167).

Training of newly joined ICU nurses and retraining of nurses in terms of continuing in-service educational training about infection control, observation of strict utilization of infection preventive measures and correction of poor practice by the infection control team and incorporation of infection control principles in student nurses' curriculum are the recommended actions to improve knowledge and practice of infection prevention among ICU nurses (Samuel *et al.*, 2010, p. 108; Eskander, Morsy and Elfeky, 2013, p.160; Mbim, Mbotto and Agbo, 2016, p.5).

The Rwandan nurses practicing in healthcare system are trained at different levels:

Level A2, or enrolled nurses, have a high-school diploma with some basic nursing training (A2-level nurses are being phased out) A1, or registered nurses with an advanced diploma have completed 3 years of nursing post-secondary education, and A0 or registered nurses with a bachelor's degree, have completed 4 years of nursing post-secondary education, and are mostly trained to work as general nurses in primary healthcare settings. There are a few nurses with master's and PhD degrees in the country, and are generally working in educational institutions or administration settings (P Munyiginya, 2016, p. 56)

Currently in ICU of the two hospitals (CHUK and RMH) where the study was done, the large proportion of the staff delivering nursing care for critically ill patients is constituted by those nurses mostly trained to work as general nurses in primary healthcare settings, as there are no qualified critical care nurses specialists yet available in those ICUs settings. The two hospitals count 37 and 14 nurses respectively with A1 and A0 level of nursing education.

### **1.3. PROBLEM STATEMENT**

Nosocomial infection is a common problem all over the world. As stated in many studies, despite the efforts put by hospitals on infection control and preventive measures, the burden of nosocomial infections all over the world is still causing problems including high morbidity resulting in many cases of death (high mortality); in addition nosocomial infections cause the prolonged period of hospitalization with subsequent increase in health care cost to patients, families and unnecessary deaths without ignoring the problem of antimicrobial resistance; all of those problems are considerably higher in low income countries such as in Sub-Saharan Africa where Rwanda is located. (Mbim *et al.* 2016, P.3; Mohammed *et al.*, 2014, P.8; Custodio, (2014).

Patients admitted in intensive care unit have high risk of getting nosocomial infection compared to other wards in a hospital (Assar *et al.*, 2012, P.455; Mohammed *et al.*, 2014, P.8) with high morbidity rate ranging from 21.1% to 35.6% in Sub-Saharan Africa (Mbim, Mbotto and Agbo, 2016). Moreover, a high mortality rate due to nosocomial infection has been reported in different countries: 42% in Gaza (Ashour and El-Nakhal, 2012, P.33), 40% in Fiji (Naidu *et al.*, 2014, P.3), and 25.8% in India. In other hand, the mortality rate in ICUs in two referral hospitals in Rwanda was 48.7% which means that approximately 1 in 2 hospitalized patients in ICUs died in 2014 ( Riviello *et al.*, 2016, P.5).

Recently, available data for nosocomial infection in Rwanda (Rwabizi *et al.*, 2016, P. 1-2), includes the presence of postpartum infections among 117 women and the infections were namely peritonitis (56%), deep surgical site infections and fasciitis (17%) and endometritis (15%). Another study done in trauma patients in Rwanda revealed that 7.4% of admitted trauma patients developed nosocomial infections including surgical site infections, urinary tract infections and pneumonia which increase the hospital stay in trauma patients who acquired nosocomial infection (Petroze *et al.*, 2014, p. 385).

Furthermore Mbabazi (2007, p. 45) found 4.3%,5.8% in medical wards of CHUK during period of February and March respectively with UTI, and again (Mbabazi, 2007, p. 44) revealed that in surgical ward, patients with UTI were 3.9%,2.7% in February and March respectively. Pneumonia was found among 6.8%,5.8% in medical ward during February and March respectively, no case of pneumonia was found as nosocomial infection in surgical ward (Mbabazi, 2007, p. 47). All the above studies showed the picture of nosocomial infections in Rwanda.

As nosocomial infections are preventable through the use of appropriate preventive strategies (Mohammed *et al.*, 2014, P.8), the need of up to date nurse's skills and knowledge in ICU is very important for the prevention of nosocomial infections as they spend most of their working hours with critically ill patients. Therefore, knowledge and practices of nurses working in ICU regarding nosocomial infections prevention should be evaluated to ensure that nurses have sufficient knowledge or otherwise plan for training or other interventions to improve their knowledge and practice of nosocomial infection prevention in ICU.

Knowledge level and practice of nosocomial infection prevention among nurses have been determined in many studies across Africa (Eskander, Morsy and Elfeky, 2013, P.160), however no study has been conducted to assess knowledge, and practice of ICU nurses towards preventive measures of nosocomial infection in Rwanda.

#### **1.4. AIM OF THE STUDY**

The aim of this study was to assess knowledge and practice of preventive measures of nosocomial infections among nurses working in ICU in referral hospitals.

#### **1.5. OBJECTIVES OF THE STUDY**

1. To identify the level of knowledge in prevention of nosocomial infection among nurses working in ICU of referral hospitals
2. To assess the practice in preventive measures of nosocomial infections among nurses working in ICU in referral hospitals.
3. To identify socio-demographic characteristics of nurses working in ICU in referral hospitals.
4. To address the association between socio-demographic characteristics and knowledge as well as practice of preventive measures of nosocomial infection among nurses working in ICU in referral hospitals

#### **1.6. RESEARCH QUESTIONS**

1. What is the level of knowledge of nurses working in ICU towards preventive measures of nosocomial infections?
2. What is the practice towards nosocomial infection preventive measures among nurses working in ICU?
3. What are socio-demographic characteristics of nurses working in ICU in referral hospitals?
4. What is the association between socio-demographic characteristics and knowledge and practice of preventive measures of nosocomial infections among nurses working in ICU in referral hospitals?

## **1.7. SIGNIFICANCE OF THE STUDY**

The finding of this study will inform the hospitals about the level of knowledge and practice of prevention of nosocomial infection that nurses working in ICU possess, and this will enable the hospital infection control committee to engage the needed change like to plan training, and/or retraining of nurses about updated infection control measures in Intensive care unit to improve the level of knowledge and practice. The findings of this study will also indicate the quality of care in ICU, because infection control practice is one indicator of quality. The study will also inform different researchers in the field of infection control to do further research using different research designs and finally the study findings will inform nursing education to know the area of emphasis to incorporate in curriculum of student nurses.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1. INTRODUCTION**

A literature review is a part of research paper which contains an evaluation of previous studies showing a summary of what studies have been done in a particular area and scrutinises their methods and findings in-depth (Shuttleworth, 2009, p. 1). Literature review is used to identify various previous studies done related to the study and identify similar and different findings across the world, discover the gap existing in literature and hence helps to formulate a research question (Polit and Beck, 2010, p. 4). This chapter will talk about the theoretical literature, empirical literature, critical review and research gap identification and the conceptual framework used to guide this study.

#### **Research strategies**

Literature was retrieved using various databases including Pub Med, Biomedical central and the internationally recognized website such as World health Organization website and Centre for Disease Control and Prevention website and the searching key words included nosocomial infections, hospital acquired infections, intensive care unit, knowledge, practice and nurse. The searched literature sources were dated up to 6 years from now.

### **2.2. THEORETICAL LITERATURE**

#### **2.2.1. Definition and cause of nosocomial infections**

Nosocomial infections are infections which the patients present when admitted in healthcare and the infections were not present at the time of admission and were not in incubation period during the time of admission (WHO, 2016a). Healthcare associated infections is the term used to mean nosocomial infections, hospital-acquired infections or hospital-onset infections, and they also include infections appearing after 48 hours of hospital stay and the infections occurring after discharge when the organisms in cause have been acquired during hospitalization (Custodio, 2014, P. 1; WHO, 2016, P. 6).

Healthcare-associated infections include main types such as central line-associated bloodstream, surgical site, catheter-associated urinary tract infections and ventilator-associated pneumonia (Centers for Disease Control and Prevention, 2014, p. 1). They are also classified as localized infections or systemic infections, medical devices-associated infections, blood product associated infections among others (Custodio, 2014, P. 1). Various microbes are responsible for nosocomial infections including *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus* and *Klebsiella pneumonia* among others, are the causative agents of nosocomial infection in intensive care unit (Brusselaers, Vogelaers and Blot, 2011, P.47; Naidu *et al.*, 2014, P. 3; Mbim, Mbotto and Agbo, 2016, P. 3).

### **2.2.2. Strategies to prevent and control infection**

The role of institutions in prevention and control of nosocomial infections is to avail the equipment facilities require for implementing standards precautions for infection control and availing the written guidelines, in addition, the in-service training in matter of infection control is also important (Adly, Amin and Aziz, 2014). The educational training of infection control is another strategy to control nosocomial infections through increased knowledge and attitude of nurses (Galal, Labib and Abouelhamd, 2014).

The strategies on preventing nosocomial infections for health care workers includes the use of aseptic procedures, proper management of the use of catheters, follow-up of protocols during bladder catheterization and special consideration of vulnerable patients when giving care and contribute to the prevention of 60% of healthcare-associated infections which are preventable (Corrales-Fernández *et al.*, 2011, P.267). One of the goals of “Healthy people 2020” is to prevent the healthcare-associated infections with special attention to central-line associated bloodstream infection and methicillin-resistant infections through cautious insertion, maintenance and removal of catheter and proper administration of antibiotics (U.S. Department of Health and Human Services.,2014).

Hand hygiene is the simple and most effective in reduction of health care associated infections with 50% reduction, followed by a safety culture and prevention program which reduced 44% of surgical site infections in African hospitals and effective infection prevention and control programs with more than 30% reduction of healthcare associated infections (WHO, 2016, P.4).

## **2.3. EMPIRICAL LITERATURE**

### **2.3.1 Magnitude of nosocomial infections**

Nosocomial infections are prevalent in different hospital wards in particular intensive care units. A descriptive study of nosocomial infections done in adult intensive care unit in Oceania region revealed that among 663 adult patients admitted in ICU, 114 of them had nosocomial sepsis confirmed with culture representing 17% and the most causal bacterial agents were *Klebsiella pneumoniae*, followed by *Acinetobacter* species and *Pseudomonas aeruginosa* respectively in all studied types of nosocomial infections namely respiratory tract infections, bloodstream infections, surgical site infections and urinary tract infections (Naidu *et al.*, 2014, p.3)

In Benin, a study conducted in 39 hospitals found the overall prevalence of nosocomial infections of 19.1% and the most common nosocomial infections were urinary tract infections (48.2%), vascular catheter related infections (34.7%) and surgical site infections (24.7%) with a noted resistance to antimicrobial agents (Ahoyo *et al.*, 2014, p.1). A retrospective assessment of nosocomial infections in ICU in Gaza (Ashour and El-Nakhal, 2012, P.33) revealed a prevalence rate of 24% and pneumonia was the top common nosocomial infection (56%), while *Pseudomonas* and *Klebsiella* were the top causative agents of nosocomial infections representing 30% and 16% respectively.

A national prevalence study done in Germany among 132 hospitals and 41,539 patients found the prevalence of nosocomial infections of 5% in different wards of the hospitals and a high prevalence rate (18.6%) has been found in Intensive care Units of different hospitals with more than three times higher rate compared to other wards (Behnke *et al.*, 2013, p. 629) . In Spain, the prevalence rate of 3.2% has been reported (Corrales-Fernández *et al.*, 2011, p. 267).

In a systematic review and meta-analysis on healthcare-associated infections in developing countries revealed a prevalence of 15.5% with infection density of 47.9/1000 patients-days in critically ill adults in intensive care units and the surgical site infections were the leading type of healthcare –associated infections in developing countries (Allegranzi *et al.*, 2011, p. ).

Similar findings have recently been reported by (Mbim, Mbotto and Agbo, 2016, p.3) in their systematic review on nosocomial infections in Africa, stating that surgical site infections are the commonest nosocomial infections in Africa. The incidence density rate of nosocomial infection in Indian ICU of one tertiary hospital was 70.3/1000 ICU days and lower respiratory infections represented 15.5% of nosocomial infections (Khan *et al.*, 2015, p.3).

### **2.3.2. Contributing factors to nosocomial infections**

Among the risk factors, the use of medical devices took part in development of nosocomial infections. The centres for disease control and prevention (2014) reported that 75% of urinary tract infections in the hospital are related to urinary catheter. (Naidu *et al.*, 2014, p.3), in their descriptive study found that 111 out of 114 (97%) infected patients in ICU had been ventilated using mechanical ventilation and 69% had been hospitalized from other wards prior to coming in ICU.

Khan *et al.* (2015, p.2) revealed that the patients suffering from diabetes mellitus, those who underwent emergency surgery and those who received total parental nutrition and those with tracheostomy were at more risk to nosocomial infections in ICU. In addition patients acquired infections in ICU spent many hours on mechanical ventilation compared to those without infection (136 hours versus 31 hours, with a significant p value (<0.0001).

Using a logistic regression analysis Khan *et al.* (2015, p.3) found that having endotracheal tube expose the patients to nosocomial infection 20 times (AOR: 20.98, p=0.0004) compared to non-users and patients with tracheostomy tube have 11 times risk of getting infection (AOR: 11.32, p<0.0001). Total parenteral nutrition (TPN) exposes the patients nearly 3 times compared to those without TPN (AOR: 2.98, p=0.0004), showing the contribution of medical invasive devices in the occurrence of nosocomial infections. In Spain, the medical devices have also been noted to be associated with nosocomial infections as reported by (Corrales-Fernández *et al.*, 2011, p. 267) in their retrospective cohort study. These authors found that urinary catheter, nasogastric tube and central venous catheter were the significant factors contributing to nosocomial infections with respective odds ratio (2.4, 1.9, and 1.8) and long-time of hospitalization for more than one week (OR: 7.5).

The World Health Organization (2016) reported the common determinants of healthcare-associated infections (nosocomial infections) including improper use of invasive devices, inappropriate use of antibiotics, immune-suppression and severe underlying illnesses, including the substandard implementation of infection prevention and control precautions.

In addition to that, the health facility with limited resources can have other determinants including poor water and sanitation, poor waste management and poor environment hygiene, not enough equipment, insufficient staff, overcrowding of patients, poor knowledge of all infection prevention and control measures and absence of guidelines, policy and programmes related to infection prevention (WHO,2016, p.4).

### **2.3.3. Consequences of nosocomial infections**

A recent predicting mortality model by Riviello *et al.* (2016, P. 3) has been conducted in two Public referral hospitals in Rwanda in 2013-2014 included 11 ICU beds in both Kigali Teaching University Hospital (known as CHUK) and Butare Teaching University Hospital (known as CHUB) and adult patients admitted in ICU during the period of study. (Riviello *et al.*, 2016, p. 5) established a Rwanda Mortality Probability Model (R-MPM) and revealed a high mortality rate (48.7%) in ICU patients, and most of the patients who died had mechanical ventilation (96.1%) and had undergone surgery (68.1%).

Even though, no notion of nosocomial infection has been mentioned in this predictive mortality model, it is known that ventilator-acquired pneumonia and surgical site infections are among the common cause of nosocomial infection as reported in various literatures (Assar *et al.*, 2012, p.455; Mohammed *et al.*, 2014, p.8; Dasgupta, Das and Hazra, 2015, p.13; Khan *et al.*, 2015, p.4) A high mortality rate (22%) also was noted in the study done by (Ahoyo *et al.*, 2014, p.1) in patients with nosocomial infections during the seven days following detection compared to 7.4 % of mortality among non-infected patients. Similarly, (Naidu *et al.*, 2014, p.3) found a high mortality rate of 33% in patients suffering from nosocomial infections in ICU. In addition, a high risk of mortality among ICU patients suffering from nosocomial infection compared to non-infected patients with a significant p value (0.013) has been found at al-ashifa Hospital in Gaza (Ashour and El-Nakhal, 2012, p.33).

As the patients hospitalized in ICU are critically ill, and their immunity is significantly low, they are prone to high mortality caused by nosocomial infections. (Khan *et al.*, 2015, p.2) in the study conducted in India involving 315 patients hospitalized in ICU, found that patients who acquired infections in ICU had a mortality rate of 25.8%, and this was significantly higher compared to patients who did not acquire infection (7.2%) with a significant p value (0.0001). Nosocomial infections cause long stay in hospital and increase the health care cost to patients, cause long-term disability and unnecessary death.

#### **2.3.4. Knowledge and practice of nurses towards nosocomial infections**

The baseline knowledge of nurses working in Pediatric intensive care unit has been assessed before an infection control program and revealed that 91.2% of nurses knew the types of hand washing, 76.8% knew the types of nosocomial infections, 86.4% knew the groups which are at risk for nosocomial infection and only 68% of nurses had knowledge of control measures of nosocomial infections (Galal, Labib and Abouelhamd, 2014).

In Iran, a descriptive cross-sectional study conducted in 145 nurses in a teaching hospital found that the mean knowledge score was less than 50% categorized as poor knowledge ( $42.5 \pm 8$ ) and 43% had poor knowledge while only 22 % had good knowledge and the remaining 35% had average knowledge about prevention of nosocomial infections. The practice of nurses towards standard precautions to prevent healthcare-associated infection were found to be poor (24%), average (42%) and good practice was found in only 34% (Sarani *et al.*, 2016, p. 195).

This is not far different from the finds of the cross-sectional study conducted in 135 nurses in Iran where only 29.9% had good knowledge about infection control, and knowledge of infection control and gender had been found to be significantly related in numerous studies (Ghadamgahi *et al.*, 2011, p.167). Excellent knowledge (>90% positive answers) about infection control practice has been found in 5% of 100 nurses working in Intensive care units in a tertiary hospital in India, good knowledge (80-90%) in 37% of 100 nurses, average knowledge (70-80%) in 40% and the below average knowledge (<70%) of infection control measures has been found in 18% showing that overall knowledge of nurses in intensive care unit in tertiary hospital in India was quite good (Sodhi *et al.*, 2013, p. 272 ).

Knowledge of prevention of ventilator-associated pneumonia in 133 critical care nurses in Taiwan was high in ICU-licensed nurse compared to nurses working in ICU without ICU license and the mean score of nurses was 65.5% (Lin, Lai and Yang, 2014, P. 5 ), another study conducted in Turkey revealed that nurse's knowledge in intensive care unit on prevention of VAP (ventilator-associated pneumonia) was poor (Korhan *et al.*, 2014, P. 28).

In Africa, a study done in Northwest Ethiopia, showed that only 40.7% of nurses had good knowledge and 48.7% had good practice of prevention of surgical site infection (Teshager, Engeda and Worku, 2015, p. 3 ). Poor knowledge of infection control standard precautions has also been reported in Nigeria (Ogoina *et al.*, 2015, P. 4), however, another study done in North

In Uganda, a study conducted at Mulago referral hospital found that nurses considered hand washing as method of self-protection rather than a way of prevention of infection transmission from patient-to-patient (Sethi *et al.*, 2012, p. 917) Western Nigeria (Iliyasu *et al.*, 2016, P. 38) found 76% of nurses washed hand in-between patients care and all nurses recognized that hand washing is important in prevention of hospital-acquired infections.

In Kenya, 75% of nurses used soap and water or antiseptic when performing hand hygiene (Gichuhi *et al.*, 2015, p. 41). Recently, (WHO, 2016, p. 5 ) reported that 61% of health workers are not compliant to the recommended practices of hand hygiene.

## **2.4. CRITICAL REVIEW AND RESEARCH GAP IDENTIFICATION**

The study done in Turkey by Korhan *et al.* (2014, p. 28 ) about knowledge of infection control standard precautions, did not show specific statistics of the results where the author said that the ICU nurse's knowledge on VAP was poor, which does not seem to be specific to show the level of knowledge for participants. The findings of the study done by (Bischoff *et al.*, 2000, p. 195) reported less than desirable levels of practice among healthcare personnel but the researcher did not show which was the desirable level of practice. Poor knowledge of infection control standard precautions has also been reported in Nigeria (Ogoina *et al.*, 2015, p. 4 )

Studies assessing the knowledge and practice of nurses towards infection control and/or prevention of nosocomial infection have been done around the World, even in East Africa including the study conducted in Kenya (Gichuhi *et al.*, 2015, p. 41) and the one conducted in neighboring country Uganda (Sethi *et al.*, 2012, p. 917), but no study was conducted in Rwanda to assess knowledge and practice of nurses working in ICU towards the preventive measures of nosocomial infection. Still there is a need to assess knowledge and practice of nurses working in ICU

## **2.5. CONCEPTUAL FRAMEWORK**

According to Polit and Hungler, (1999) a conceptual framework is a combination of inter related concepts that are assembled together in some rational scheme by virtue of their relevance to a common theme. This study was guided by Neuman system model (1995). Patients hospitalized in ICU are considered as open system and are interacting with internal stressors (i.e. critically ill status, low immunity) and external stressors (i.e. invasive medical devices, poor environmental hygiene and lack of aseptic procedure). The patient hospitalized in ICU reacts to stressors and acquires nosocomial infection.

The Neuman system model also mentions three types of prevention including primary prevention, secondary prevention and tertiary prevention. In this study, only the primary prevention will be used and consists of knowledge and practice of nurses working in ICU towards the preventive measures of nosocomial infection. Knowledge and practice of nurses can be influenced by some factors such as educational qualification, working experience and attendance to continuous in-service training courses.

# PRIMARY PREVENTION OF NOSOCOMIAL INFECTIONS

Educational qualification,  
Working experience Attendance  
of in-service training courses..

Adequate  
KNOWLEDGE of  
ICU nurses about  
Standard  
preventive  
measures of  
nosocomial  
infections

Adequate  
PRACTICE of  
ICU nurses of  
preventive  
measures of  
nosocomial  
infections

## ICU PATIENT PROTECTION AGAINST NOSOCOMIAL

Basic structure and line of defence  
(Patient hospitalized in ICU),  
PATIENT PROTECTED  
PATIENT SAFETY, AND  
STABILITY.

PATIENT PROTECTION

## EXTERNAL STRESSORS (predisposing fac

- Invasive medical devices: (Ventilator machine, endotracheal tube, tracheostomy tube IV Catheter, urinary catheter, central line,NGT,chest tube)
- Poor Environmental and personal hygiene
- Lack of aseptic procedures



## INTERNAL STRESSORS

- Critically ill status
- Low immunity of the patient

## REACTION:

Nosocomial infections try to attack the patient which is protected.

Adapted from Neuman system model (1995)

**Conclusion:**

This chapter has presented the theoretical and the empirical literature review including knowledge and practice of ICU nurses on prevention of nosocomial infections as presented in previous studies. The adapted conceptual framework for this study has also been presented to guide the study process, analysis and interpretation.

## **CHAPTER 3: METHODOLOGY**

### **3.1. INTRODUCTION**

This chapter discusses the design that was used to obtain the findings and the study area.

Population and sample is also highlighted in this chapter. The tool that was used in this study during data collection including its reliability and validity is presented. The procedure of data collection is also mentioned. Data analysis, management, and dissemination, ethical considerations and limitations of the study are also discussed.

### **3.2. STUDY APPROACH**

A quantitative study approach was used in this study

Quantitative research is a research approach which uses numerical information and measurement and analyses the information using statistical methods (Polit and Beck 2012) it is also defined as a more logical and data-led approach which provides a measure of what people think from a statistical and numerical point of view.

Quantitative methods emphasized objective measurements and the statistical analysis of data collected through questionnaire and observational check list.

### **3.3. STUDY DESIGN**

A quantitative descriptive cross-sectional study design was conducted.

The data was taken once in the study, using a structured and tested questionnaire which was administered to nurses for fulfillment.

Knowledge and practice of ICU on preventive measures of nosocomial infections was assessed.

Each subject was assessed at a single time in the study period.

Observational design was used to gain insight into what happened in practice, direct observation was potentially a more comprehensive method to ascertain how nurses perform in real situations and to identify differences in practice. Study involved the collection of data that specify the knowledge / practices and was conducted in participants' natural environments.

### **3.4. STUDY SETTING**

The study was conducted in Intensive care units of two referral hospitals in Kigali, namely Kigali University Teaching Hospital (KUTH known as CHUK) and Rwanda Military Hospital (RMH). CHUK is a referral hospital, located in Kigali City, Nyarugenge District. This hospital has a mandate of serving as the primary referral hospital and teaching students in Medical fields. The hospital receives patients from the entire country more than 40 district hospitals and has 445 beds, with an average occupancy rate of 72% (Lukas *et al.*, 2016, p.2).

This institution has a variety of different services (departments) including: Internal Medicine, Surgical, Paediatric, other specialized departments, and adult intensive care unit (ICU) which has a capacity of 14beds. The ICU of this hospital is a medical-surgical ICU receiving adult patients, presenting with life-threatening symptoms and those who are in need of continuous monitoring and ventilator support are admitted directly to the ICU. This unit receives also patients transferred from other services within the hospital, and it counts a number of 32 nurses.

Rwanda Military Hospital (RMH) is located in Kigali city, Kicukiro District. The average number of admissions to this hospital is made of 88% civilian and 20% military patients (RMH statistics office, 2015). This hospital also has a mandate of treating patients and teaching students in Medical fields. RMH serves civilian and military patients from the entire country and has capacity of 250 beds.

The hospital offers a variety of services through different departments which include; Internal Medicine, Surgical, Paediatric, and ICU, as well as other specialized departments. The ICU of this hospital has 8 beds and receives patients aged from one month and above with medical conditions which require mechanical ventilation. Approximately the average number of admissions in ICU is between 14 and 18 patients per month and it counts for 19 nurses. (ICU unit manager book, 2016).

### **3.5. STUDY POPULATION**

The study population was nurses working in Intensive Care Unit at selected referral hospitals which were CHUK and RMH during data collection period.

### **3.6. SAMPLING**

#### **3.6.1. Study sample**

Thirty two nurses working in ICU at CHUK and nineteen nurses working in ICU at RMH.

#### **3.6.2. Sampling strategy**

Total population sampling technique was used to obtain the sample, because the researcher wanted to include all participants who worked in Adult ICU of RMH and CHUK during data collection period, as the number of participants was low and all nurses working in ICU who accepted to participate were used as respondent in the study.

### **3.7. INCLUSION CRITERIA**

All consenting nurses working in intensive care unit at CHUK and RMH were included in the study.

### **3.8. EXCLUSION CRITERIA**

Nurses who were not working in ICU at CHUK or RMH were excluded from the study. The nurses working in ICU at CHUK and RMH who have not signed the consent form were excluded from the study.

### **3.9. DATA COLLECTION TOOL AND PROCEDURES**

#### **3.9.1. Data collection instruments**

Knowledge of nurses working in ICU towards preventive measures of nosocomial infection was assessed using a self-administered questionnaire. A questionnaire validated by Kamunge, (2013, p.123-125) in her study “Exploring knowledge, attitudes and practices of registered nurses regarding the spread of nosocomial infections” was adapted and the items assessing attitude were removed. The questionnaire has assessed knowledge of nurses regarding preventive measures of nosocomial infections and the observational checklist was used to assess the practice. The questionnaire which seeks knowledge was written in English and Kinyarwanda. Each participant has chosen to respond in the language which was most suitable for him/her.

Knowledge was assessed using Likert scale, 4 points were given to respondent who strongly agree to the correct statement, 3 points for those who agree; 2 points for those who disagree and 1 point to nurses who strongly disagree to the correct statement.

Four items were used for questions to assess the knowledge of nurses working in ICU:

- General preventive measures,
- Preventive measures of ventilator-associated pneumonia,
- Preventive measures related to intravascular devices (peripheral and central catheter)
- Preventive measures of Catheter Associated Urinary Tract Infections (CAUTI)

The total marks were summarized in percentages, knowledge level was categorized into adequate knowledge  $\geq 70\%$ , and moderate knowledge was set between 61-69% and poor knowledge  $\leq 60\%$ .

The observational checklist was adapted from the questionnaire validated by Kamunge (2013) and the standard guidelines of the Centers for Disease Control and Prevention(2015) to assess the level of practice on preventive measures of nosocomial infections in ICU. The content of the checklist included 5 items:

- Preventive practices on hand washing
- Suctioning from endotracheal tube or tracheostomy
- Oral care
- Urinary catheter care
- Intravascular catheter care and management.

From these 5 items, 35 statements were listed to observe the practice of nurses working in ICU. The correct practice has weighed 1 mark and the wrong or missed practice was equal to 0. Practice level of nurses working in ICU was categorized in Good practice  $\geq 60\%$  and Poor practice  $< 60\%$

### **3.9.2 Validity of the tool**

The self-administered questionnaire tool was validated before its use in the previous study (Kamunge, 2013) with good content validity and face validity as determined by expert in infection control practices.

### 3.9.3 Content validity

Summary of content Validity: objectives and measurement

<b>Research objectives</b>	<b>Items for measurement on Questionnaire and checklist</b>
Socio-demographic characteristics	Section one : Questions 1 -----5
Knowledge	Section two: Questions 1 -----30
Practice	Section three: Observational Checklist of 35 procedures observed
Association	During analysis

### 3.9.4 Reliability of the tool

The reliability of the tool was measured by the author with Cronbach's alpha of 0.66. The questionnaire was translated from English to Kinyarwanda. Before data collection, the pilot study was performed on 5 nurses working in ICU at CHUB. The internal consistence was measured with Cronbach's alpha of 0.896, which is a good reliability coefficient.

### 3.9.5. Procedure

After receiving the Institutional Review Board (IRB) approval and the letter from the Dean of faculty To Whom It May Concern, the researcher contacted the authority of the two referral hospitals to ask permission to collect data. During the staff meeting, the participants were explained the purpose of the study and were clearly communicated that the participation in the study is fully voluntary without any influence or force (See Appendix I).

All 51 nurses working in ICUs voluntarily accepted to participate in the study and have signed the consent form for both knowledge and observation. After consent approval, the participants received the questionnaire to be completed within 30 minutes without influence from each other. A sealed box with a hole for collection of questionnaires was provided in the unit manager's officer. Data collection was done in the period of three weeks for each hospital and questionnaires were completed during break time to avoid interruption of patient's care. The observation of the nurses 'practice was done during working hours, day and night shifts. (See Appendix II)

### **3.10. DATA ANALYSIS**

Data was recorded in questionnaire and checklist then was been entered in a computer. The Statistical Package for Social Studies (SPSS version 21) was used to analyze data. Descriptive and inferential statistics were used in analysis of data. Frequencies and percentages were computed and the Chi-square test, Fisher test were used to test the association between socio-demographic characteristics and knowledge and practice. The margin of error was set at 0.05, thus the p value of less than 0.05 was considered significant.

### **3.11. DATA MANAGEMENT**

Data was retrieved from the questionnaires and checklists and stored into the computer, protected with a personal password. The questionnaires and checklists were stored in a locked room to ensure the confidentiality of information. The papers were stored in confidential manner, under lock and key and will be destroyed after five years.

### **3.12. DATA DISSEMINATION**

The study findings will be communicated to the participating hospital management committees and to the study participants. They will also be orally presented in front of the panel. The final research will also be presented in conferences and articles in peer reviewed journals.

### **3.13. ETHICAL CONSIDERATION**

The data was collected after obtaining the approval from Institutional Review Board of the College of Medicine and Health sciences, University of Rwanda, and the permission to conduct research in both referral hospitals was guaranteed by the respective hospital authorities. Participants have been explained the purpose of research and be handed in written document explaining in detail the purpose and the process of research. The participants have been explained that they had right to refuse the participation and that the participation in the study was fully voluntary (Appendix I). Study participants who signed the consent for the questionnaire have also accepted to be observed. The questionnaires were anonymous and were filled by participants themselves after signing the concert form. The study did not cause any harm to participants. (Appendix II)

## CHAPTER 4. RESULTS

This chapter consists of two sections: the first section deals with the presentation of demographic data of the sample of the participants, the second section is the description of findings about level of knowledge and practice among nurses working in ICU on preventive measures of nosocomial infections in referral hospitals. This study was done in CHUK and RMH.

### 4.1. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS

**Table 4. 1: Identification of socio-demographic characteristics of the participants**

<b>Variables</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Gender</b>		
<i>Male</i>	18	35.3%
<i>Female</i>	33	64.7%
<b>Age</b>		
<b>&lt; 20</b>	2	3.9%
<b>20-40</b>	40	78.4%
<b>41-60</b>	9	17.6%
<b>Level of education</b>		
<i>Advanced diploma(A1)</i>	37	72.5%
<i>Bachelor's degree (A0)</i>	14	27.5%
<i>Masters</i>	0	0%
<i>Other....</i>	0	0%
<b>Working experience in ICU</b>		
<b>&lt;1y-10y</b>	36	70.6%
<b>11-20</b>	15	29.4%
<b>&gt;20</b>	0	0%
<b>Training on prevention of nosocomial infection</b>		
<i>Yes</i>	35	68.6%
<i>No</i>	16	31.4%

**Table 4. 1.** above shows socio-demographic characteristics of the participants . The majority of participants were females 64.71% while males were 35.29% and majority of the participants were aged between 20 and 40 years representing 78.43%.The table also illustrated the level of education of nurses working in Intensive Care Unit. 72.55% of them had A1 level (advanced diploma) while 27.45% had A0 level (bachelor's degree). The working experience ranged between 0 to 10 years and represent 70.6% while 29.6%, their experience was between 11 to 20 years. 70.6% represented nurses who were trained on prevention of nosocomial infection or infection control, while 31.4% did not receive any training.

## 4.2 KNOWLEDGE OF NURSES ON PREVENTIVE MEASURES OF NOSOCOMIAL INFECTIONS

This section shows the level of knowledge of nurses working in ICU towards preventive measures of nosocomial infection. Knowledge was assessed using Likert scale, 4 points were given to respondent who strongly agree to the correct statement, 3 points for those who agree; 2 points for those who disagree and 1 point to nurses who strongly disagree to the correct statement. Knowledge level was categorized into adequate knowledge ( $\geq 70\%$ ), moderate knowledge was set between 61-69% and poor knowledge ( $\leq 60\%$ ).

**Table.4. 2: Knowledge of general preventive measures of nosocomial infection**

Statements		Frequency	Percentage
Aware hand hygiene guidelines	strongly disagree	1	2.0%
	Disagree	4	7.8%
	Agree	22	43.1%
	strongly agree	24	47.1%
Use of alcohol /antiseptics in hand hygiene reduces nosocomial infection	strongly disagree	1	2.0%
	Disagree	3	5.9%
	Agree	22	43.1%
	strongly agree	25	49.0%
Nosocomial infection may be transmitted through medical equipment	strongly disagree	1	2.0%
	Disagree	2	3.9%
	Agree	16	31.4%
	strongly agree	32	62.7%
Always being fully compliant with preventive guidelines even when workload increases or in emergencies	strongly disagree	2	3.9%
	Disagree	10	19.6%
	Agree	22	43.1%
	strongly agree	17	33.3%
Knowledge of safety precautions for disposal of needles, catheters...and risk of transmission of infection	strongly disagree	1	2.0%
	Disagree	3	5.9%
	Agree	22	43.1%
	strongly agree	25	49.0%

The table.4.2above shows the knowledge of nurses towards general preventive measures of nosocomial infections. 47.1% of participants responded strongly agree to be aware of guidelines for hand hygiene, while 43.1% among them responded agree to that statement.

25 participants (49.0%) reported strongly agree that the used alcohol /antiseptics in hand hygiene reduce nosocomial infection. Regarding nosocomial infection transmitted through medical equipment, 32 participants (62.7%) strongly agree with the statement while 2 (5.9%) disagree. 22(43%) of participants follow guidelines while 16% did not follow guidelines of preventive measures when workload increases or in emergencies.

**Table.4. 3: Nurses' knowledge of preventive measures of ventilator-associated pneumonia**

Statements		Frequency	Percentage
Discard the suction catheter after single use	strongly disagree	6	11.8%
	Disagree	14	27.5%
	Agree	14	27.5%
	strongly agree	17	33.3%
Insertion of the suction catheter into the ETT tube is a sterile procedure	strongly disagree	3	5.9%
	Disagree	3	5.9%
	Agree	8	15.7%
	strongly agree	37	72.5%
Head of the bed elevation at 30-45 degrees in ventilated patient to prevent aspiration of secretion and VAP	strongly disagree	0	0.0%
	Disagree	4	7.8%
	Agree	19	37.3%
	strongly agree	28	54.9%
Wearing sterile gloves during ETT suctioning is required	strongly disagree	5	9.8%
	Disagree	2	3.9%
	Agree	13	25.5%
	strongly agree	31	60.8%
Oral care should be performed every 4-6 hours and whenever necessary	strongly disagree	2	3.9%
	Disagree	12	23.5%
	Agree	25	49.0%
	strongly agree	12	23.5%

Continuous training to ICU nurses on prevention of nosocomial infection contributes to decreased rates of VAP	strongly disagree	0	0.0%
	Disagree	4	7.8%
	Agree	21	41.2%
	strongly agree	26	51.0%
ETT suctioning should be done to patient as needed	strongly disagree	2	3.9%

Statements		Count	Percentage
	Disagree	3	5.9%
	Agree	19	37.3%
	strongly agree	27	52.9%
Early weaning a patient from the ventilator reduces the risk for VAP	strongly disagree	6	11.8%
	Disagree	7	13.7%
	Agree	16	31.4%
	strongly agree	22	43.1%
Nurse is required to wash hands before and after ETT/Oral suctioning	strongly disagree	1	2.0%
	Disagree	2	3.9%
	Agree	12	23.5%
	strongly agree	36	70.6%
Unplanned extubation increases risk of aspiration, therefore increases the risk of VAP	strongly disagree	6	11.8%
	Disagree	12	23.5%
	Agree	21	41.2%
	strongly agree	12	23.5%

The table 4.3 above shows the knowledge of nurses about infection preventive measures of ventilator-associated pneumonia. Among 51 nurses working in ICU, 14 nurses (27.5%) disagree to discard the suction catheter after single use, 33.3% of them strongly agree to that statement. While 68.8% of the respondents strongly agree that the insertion of the suction catheter into the ETT tube is a sterile procedure, 5.9% of the respondents did not. 60.8% of nurses strongly agree that during ETT suctioning, it is required to wear sterile gloves, however 5 nurses (9.8%) did not agree. Continuous training to ICU nurses contributes to decreased rates of VAP, 51% of nurses strongly agree, and 7.8% of them disagree. According to reduced risk of VAP by early weaning the patient from ventilator, 43.1% strongly agree and 11.8% did not agree. The same number of nurses 12 (23.5%) strongly agree, and disagree concerning the statement that the unplanned extubation should increase the risk of VAP by aspiration of secretions.

**Table.4. 4:** *Below shows Nurses' knowledge on preventive measures related to intravascular devices associated infections (central and peripheral catheters).*

Parenteral nutrition, lipid emulsions, blood & blood products should be changed every 24h,as they support the growth of bacteria	strongly disagree	7	13.7%
	Disagree	10	19.6%
	Agree	26	51.0%
	strongly agree	8	15.7%
The cannula or needle must be secured to maintain stability to prevent trauma to the vein, entry of micro-organisms which is facilitated by cannula movement	strongly disagree	3	5.9%
	Disagree	4	7.8%
	Agree	26	51.0%
	strongly agree	18	35.3%
A transparent, semi-permeable, polyurethane is the best to use on the central line site dressing	strongly disagree	4	7.8%
	Disagree	9	17.6%
	Agree	29	56.9%
	strongly agree	9	17.6%
Central venous catheter dressing should be changed every 7 days or when the dressing becomes damp, soiled or loose	strongly disagree	5	9.8%
	Disagree	7	13.7%
	Agree	24	47.1%
	strongly agree	15	29.4%
Topical antibiotic ointment should not be used on the insertion site of the catheter, because it promotes fungal infections and anti- microbial resistance	strongly disagree	4	7.8%
	Disagree	24	47.1%
	Agree	16	31.4%
	strongly agree	7	13.7%
The risk of infection increases with the length of the time the intravascular device remains in place	strongly disagree	2	3.9%
	Disagree	3	5.9%
	Agree	15	29.4%
	strongly agree	31	60.8%
Inspect the insertion site of the catheter a minimum of once every 24hours,redness,pain,swelling on the site should be recorded	strongly disagree	0	0.0%
	Disagree	3	5.9%
	Agree	31	60.8%
	strongly agree	17	33.3%
Rotate the peripheral line at 72hours intervals, use of aseptic technique and manipulations to reduce risk of infection	strongly disagree	1	2.0%
	Disagree	4	7.8%
	Agree	18	35.3%
	strongly agree	28	54.9%
Contamination risks of intravascular devices should be minimized by cleaning the ports with antiseptic and using sterile equipment	strongly disagree	2	3.9%
	Disagree	2	3.9%
	Agree	22	43.1%
	strongly agree	25	49.0%

Table 4.4 above shows nurses' knowledge on preventive measures related to intravascular devices associated infections (central and peripheral catheters).

Only 7.8% of nurses disagree to the statement that securing the IV cannula and maintaining its stability prevent trauma to the vein thereby prevent the entry of microorganisms 35.3% of respondents strongly agree on that. The statements that topical antibiotic ointment should not be used to the site of IV cannula to prevent microbial resistance, majority of nurses 24 (47.1%) disagree, while 13.7% strongly agree. Changing central line dressing in 7 days or when it becomes damp soiled or loose, was accepted by 47% of nurses, and 13.7% did not.

Concerning the risk of infection that increases with the length of the time the device remains in place, 90.2% of nurses agree to the statement, only 5 nurses (9.8%) disagree. 54.9% of participants agree that peripheral IV catheter should be changed at 72 hours of interval, and 9.8% of them disagree.

**Table.4. 5: Nurses ‘knowledge of preventive measures of Catheter Associated Urinary Tract Infections (CAUTI)**

Statements		Count	Percentage
The best way to prevent CAUTI is to not insert the catheter	strongly disagree	14	27.5%
	Disagree	20	39.2%
	Agree	10	19.6%
	strongly agree	7	13.7%
Use of sterile equipment, aseptic technique, trained staff during catheter insertion are among preventive measures of CAUTI	strongly disagree	2	3.9%
	Disagree	4	7.8%
	Agree	19	37.3%
	strongly agree	26	51.0%
Urinary drainage bag below the level of the bladder and in a stand that prevent contact of floor	strongly disagree	3	5.9%
	Disagree	5	9.8%
	Agree	20	39.2%
	strongly agree	23	45.1%
Maintained close drainage system and unobstructed urine flow prevent infections	strongly disagree	2	3.9%
	Disagree	6	11.8%
	Agree	27	52.9%
	strongly agree	16	31.4%
Teaching patient, family member or caretaker about urinary catheter maintenance, can contribute to the prevention of CAUTI	strongly disagree	2	3.9%
	Disagree	2	3.9%
	Agree	28	54.9%
	strongly agree	19	37.3%
Maintaining a sterile closed urinary drainage system is a central to the prevention of CAUTI	strongly disagree	2	3.9%
	Disagree	1	2.0%
	Agree	26	51.0%
	strongly agree	22	43.1%

Table.4.5. illustrates the nurses’ knowledge of preventive measures of Catheter Associated Urinary Tract Infections (CAUTI). Use of sterile equipment, aseptic technique, trained staff to insert the urinary catheter, was accepted by 26 nurses (51%), only 6 nurses (11.7%) disagree to the statements. 15.7% of respondents disagree to the statements that urinary bag should be below the level of the bladder, prevent contact of floor and maintaining close system drainage, while 52.9% of nurses strongly agree to the statements. 37.3% of participants agree that when patient and family member or caretaker are educated about urinary catheter maintenance, it can contribute to the prevention of CAUTI, while 7.8% of nurses did not agree.

**Table4.6: Summary of the overall level of knowledge of nurses working in ICU towards preventive measures of nosocomial infection**

<b>Level of Knowledge Points</b>	<b>Frequency</b>	<b>Percentage of frequency</b>
Adequate knowledge $\geq 70\%$	22	43.1%
Moderate knowledge 61-69%	24	47.1%
Poor knowledge $\leq 60\%$	5	9.8%
Total	51	100.0%

Table 4.6 above demonstrates the summary of the overall level of knowledge of nurses working in ICU towards preventive measures of nosocomial infections. Knowledge was assessed using Likert scale, 4 points was given to respondent who strongly agree to the correct statement, 3 points for those who agree; 2 points for those who disagree and 1 point to nurses who strongly disagree to the correct statement. Knowledge level was categorized into adequate knowledge  $\geq 70\%$ , moderate knowledge was set between 61-69% and poor knowledge  $\leq 60\%$ .

43.1 of nurses working in ICU have adequate knowledge of preventive measures of nosocomial infections, 47.1% have moderate knowledge and 9.8% have poor knowledge.

### 4.3. PRACTICE OF PREVENTIVE MEASURES OF NOSOCOMIAL INFECTIONS

This section describes observation of nurses' practice on preventive measures of NCI. The contents of the observational checklist included: preventive practices on hand washing, suctioning from endotracheal tube (ETT) or tracheotomy, oral care, urinary catheter care and intravascular devices care and management. For the checklist, the correct practice has weighed 1 mark and the wrong or missed practice was equal to 0.

**Table.4. 7: Practice of hand washing during procedures**

Statements		Count	Percentage
Before entering ICU	<i>wrong or missed practice</i>	38	74.5%
	<i>correct practice</i>	13	25.5%
Before touching the patient	<i>wrong or missed practice</i>	34	66.7%
	<i>correct practice</i>	17	33.3%
After patient contact	<i>wrong or missed practice</i>	5	9.8%
	<i>correct practice</i>	46	90.2%
Before any procedure	<i>wrong or missed practice</i>	46	90.2%
	<i>correct practice</i>	5	9.8%
After drawing or manipulating patient's body fluid	<i>wrong or missed practice</i>	1	2.0%
	<i>correct practice</i>	50	98.0%
After removing proper or sterile gloves	<i>wrong or missed practice</i>	9	17.6%
	<i>correct practice</i>	42	82.4%
Wash hand or use of alcohol or other antiseptics between each patient contact	<i>wrong or missed practice</i>	36	70.6%
	<i>correct practice</i>	15	29.4%
After touching inanimate surfaces and objects in patient's surroundings	<i>wrong or missed practice</i>	27	52.9%
	<i>correct practice</i>	24	47.1%

The table 4.7above shows the practice of hand washing during procedures.

38 nurses (74.5%) working in ICU did not wash hands before entering in ICU. Only 25.5% did. Washing hand before any procedure or before touching the patient was not done by almost all nurses 46 (90.2%), while the procedure was bee done by 9.8% of nurses.98.0% of participants washed hands after drawing or manipulating body fluid, while 2.0% of them did not. 70.6% of nurses working in ICU did not wash hand or using alcohol between each patient contact. After touching inanimate surfaces and objects surrounding the patient, 52.9% did not wash hand, therefore 47.1% have washed their hands.

**Table.4. 8:** Practice of preventive measures during ETT suctioning

Practice observed		Count	Column N %
Hand washing before suctioning	<i>wrong or missed practice</i>	38	74.5%
	<i>correct practice</i>	13	25.5%
Prepare sterile equipment required for suctioning	<i>wrong or missed practice</i>	14	27.5%
	<i>correct practice</i>	37	72.5%
Position the patient in a semi recumbent position	<i>wrong or missed practice</i>	1	2.0%
	<i>correct practice</i>	50	98.0%
Wear sterile gloves	<i>wrong or missed practice</i>	23	45.1%
	<i>correct practice</i>	28	54.9%
Insert the suctioning catheter into ETT gently by using aseptic technique	<i>wrong or missed practice</i>	23	45.1%
	<i>correct practice</i>	28	54.9%
Discard the suction tube immediately after one single use	<i>wrong or missed practice</i>	50	98.0%
	<i>correct practice</i>	1	2.0%
Hand washing after suctioning	<i>wrong or missed practice</i>	2	3.9%
	<i>correct practice</i>	49	96.1%

Table 4.8 above demonstrates the practice of infection preventive measures during endotracheal tube suctioning (ETT) .A large number of nurses 38 (74.5%) did not wash hands before ETT suctioning, only13 nurses 25.5% washed hands before the procedure. Furthermore 72.5% of nurses prepared sterile equipment required for suctioning, while 27.5% did not. Wearing sterile gloves before suctioning, 45.1% represented the nurses who did not wear sterile gloves and 54.9% of nurses have worn sterile gloves before suctioning. Almost all nurses 50 (98.0%) did not discard the suction catheter after one single use, only 1 nurse have discarded the suction catheter after one single use.

**Table.4. 9: The level of nurses 'practice on preventive measures concerning mouth care.**

		Count	Column N %
Hand washing before oral care	<i>wrong or missed practice</i>	45	88.2%
	<i>correct practice</i>	6	11.8%
Apply clean gloves	<i>wrong or missed practice</i>	7	13.7%
	<i>correct practice</i>	44	86.3%
Clean mouth using toothbrush or gauze moistened with mouth wash	<i>wrong or missed practice</i>	10	19.6%
	<i>correct practice</i>	41	80.4%
Hand washing after oral care	<i>wrong or missed practice</i>	13	25.5%
	<i>correct practice</i>	38	74.5%
Perform oral care at least 2 times a day	<i>wrong or missed practice</i>	51	100.0%
	<i>correct practice</i>	0	0.0%
Hand washing before any procedure	<i>wrong or missed practice</i>	42	82.4%
	<i>correct practice</i>	9	17.6%

Table 4.9 the previous table demonstrates the level of nurses' practice on preventive measures concerning mouth care. The majority of participants 45 (82.2%) did not wash their hands before oral care, only 6 nurses 11.8% did it before. However, a large number of nurses 38 (74.5%), prefers to wash hands after oral care than they do before. No any nurse has performed oral care 2 times a day.

**Table4. 10: Practice of preventive measures of nosocomial infections during urinary catheter care**

		Count	Column N %
Change urinary catheter no more than 7 days from the day of insertion	<i>wrong or missed practice</i>	22	43.1%
	<i>correct practice</i>	29	56.9%
Keep collection bag below the level of the bladder	<i>wrong or missed practice</i>	5	9.8%
	<i>correct practice</i>	46	90.2%
Keep collection bag off floor all the time	<i>wrong or missed practice</i>	7	13.7%
	<i>correct practice</i>	44	86.3%
Wash hand after urinary catheter or urinary bag manipulation	<i>wrong or missed practice</i>	2	3.9%
	<i>correct practice</i>	49	96.1%
Documentation of catheter insertion date	<i>wrong or missed practice</i>	29	56.9%
	<i>correct practice</i>	22	43.1%
Documentation of amount of urine and color	<i>wrong or missed practice</i>	8	15.7%
	<i>correct practice</i>	43	84.3%

Table4.10. the above table shows the nurses' practice on preventive measures of nosocomial infections during urinary catheter care. 90.2% corresponded to nurses who kept the collection bag below the level of the bladder, and 9.8% of the nurses did not. Keeping the collection bag off floor all the time, only 13.7% of nurses did not do, while 86.3% of them kept the collection bag off floor all the time during observation. Almost all nurses (96.1%) washed hand after urinary catheter or urinary bag manipulation. 84.3% of nurses documented the amount of urine and color, however 15.7% of them did not documented

**Table4. 11: Practice of preventive measures of nosocomial infections during peripheral and central venous catheter care**

Statement		Count	Column N %
Change central venous catheter dressing within 7days or when the dressing becomes damp, soiled or loose	<i>wrong or missed practice</i>	11	21.6%
	<i>correct practice</i>	40	78.4%
Respect of aseptic procedures during central line dressing change	<i>wrong or missed practice</i>	1	2.0%
	<i>correct practice</i>	50	98.0%
Cleaning the ports at least once a day and using aseptic procedures	<i>wrong or missed practice</i>	40	78.4%
	<i>correct practice</i>	11	21.6%
Aseptic manipulations during drug and infusion administration	<i>wrong or missed practice</i>	12	23.5%
	<i>correct practice</i>	39	76.5%
When removing peripheral IV line ,and put a dressing to protect the site against microorganism entry	<i>wrong or missed practice</i>	17	33.3%
	<i>correct practice</i>	34	66.7%
during drug and infusion administration	<i>wrong or missed practice</i>	5	10.0%
	<i>correct practice</i>	45	90.0%
when taking laboratory samples	<i>wrong or missed practice</i>	2	4.0%
	<i>correct practice</i>	48	96.0%
Changing the peripheral IV catheter at 72 hours intervals	<i>wrong or missed practice</i>	33	66.0%
	<i>correct practice</i>	17	34.0%

Table 4.11 this table above demonstrates the practice of nurses on preventive measures of nosocomial infection concerning peripheral and central venous catheter care. 40 nurses (78.4%) changed the central catheter dressing when it became damp, soiled or loose, while the others 11(21.6%) did not change the dressing. Majority of the nurses 78.4% have not respected aseptic procedures when cleaning the central line pots, only 21.6% cleaned the pots with aseptic procedures.

When removing peripheral IV catheter, 66.7% of nurses applied the dressing to protect the site against microorganism entry; however 33.3% of the nurses did not apply any dressing.

**Figure 4 1: The overall level of practice of nurses working in ICU towards the preventive measures of nosocomial infection.**

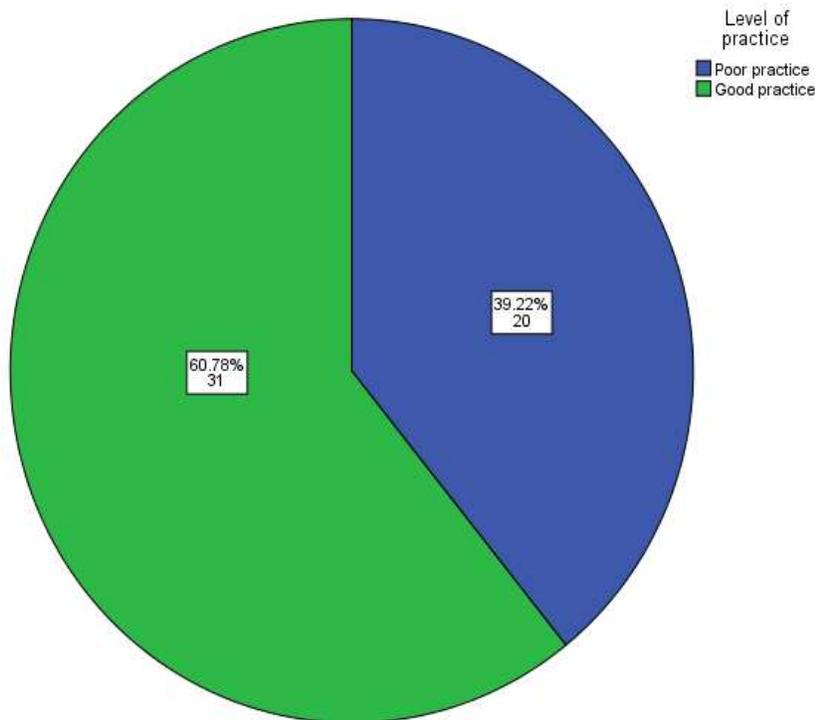


Figure 4. 1 above shows the overall level of practice of nurses working in ICU towards the preventive measures of nosocomial infection. Practice was assessed using observational checklist and 1 point was given to nurses who had correctly done the practice of the procedure, and 0 point was given to nurses who had wrongly done the practice or had missed the practice to the procedure. Practice level was categorized into Good practice ( $\geq 61\%$ ) and Poor practice ( $\leq 60\%$ ). 31 nurses (60.78%) working in ICU had good practice while 20 nurses (39.22%) had poor practice.

#### 4.4. RELATIONSHIP BETWEEN SOCIO-DEMOGRAPHIC CHARACTERISTICS AND LEVEL OF KNOWLEDGE

**Table4. 12:** Shows the socio-demographic characteristics and education and training of nurses working in ICU and their level of knowledge in cross tabulation.

socio-demographic characteristics		Level of knowledge			
		Adequate knowledge	Moderate knowledge	Poor knowledge	Total
		Count	Count	Count	Count
Gender of participant	Male	9	9	0	18
	Female	13	15	5	33
Age of participants in years	<20	1	1	0	2
	20-40	17	18	5	40
	41-60	4	5	0	9
Level of nursing education					
Advanced diploma (A1)		12	20	5	37
Bachelor's degree (A0)		10	4	0	14
Participant working experience in ICU	<1year -10	16	17	3	36
	11-20years	6	7	2	15
Participant training about nosocomial infection or infection control	Yes	16	16	3	35
	No	6	8	2	16

Table 4.12 above shows that among 18 male nurses, 9 had adequate knowledge, and 9 had moderate knowledge whereas in 33 female nurses, 13 had adequate knowledge, 15 had moderate and 5 had poor knowledge. No statistically significant relationship was found between gender and the level of knowledge ( $p=0.249$ , Fisher's Exact Test). Among 40 nurses in age group 20-40 years, 17 had adequate knowledge and 18 had moderate knowledge, 5 had poor knowledge. 4 nurses in age-group 41-60 years had adequate knowledge and 5 nurses in the same age-group had moderate knowledge, no one had poor knowledge in this age-group. One nurse aged below 20 years had adequate knowledge and one nurse had moderate knowledge.

**Table4. 13:** Fisher’s exact test showing relationship between socio-demographic characteristics and level of knowledge

		Level of knowledge
Gender of participant	Fisher’s Exact	2.849
	Sig.	.249
Age of participants in years	Fisher’s Exact	1.596
	Sig.	.901
Level of nursing education of the participant	Fisher’s Exact	6.079
	Sig.	<b>.049*</b>
Participants working experience in ICU	Fisher’s Exact	.549
	Sig.	.821
Participant training about nosocomial infection or infection control	Fisher’s Exact	.590
	Sig.	.753

\*Significance at 0.05 levels

Table4.13above demonstrates that among 37 nurses with A1 level of nursing education, 12 (32%) had adequate knowledge and 20 (54%) had moderate knowledge , 5 (13%) have poor knowledge whereas among 14 nurses with A0 level of nursing education, most of them (10 representing 71%) had adequate knowledge and 4 had moderate knowledge and no one had poor knowledge. The level of knowledge is statistically significantly associated with the level of nursing education (p=0.049, Fisher’s Exact test) with nurses A0 level showing more adequate knowledge than A1 level (table 4.12).Among 36 participants with working experience of 10 years or less, 16 had adequate knowledge, 17 had moderate knowledge, and 3 had poor knowledge; for those between 11-20 years of working experience, 6 participants had adequate knowledge, 7 had moderate knowledge and 2 had poor knowledge (table 4.12)

Among 35 participants who received training on nosocomial infection or infection control, 16 had adequate knowledge, other 16 had moderate knowledge, and only 3 respondents had poor knowledge. In addition; among 16 nurses, who did not participate in training, 6 had adequate knowledge and 8 had moderate knowledge and 2 had poor knowledge (table 4.12). The level of knowledge was not statistically associated with the participants’ years of working experience in ICU; (p=0.821, Fisher’s Exact test), and the participants’ training about nosocomial infection (p=0.753, Fisher’s Exact test) as shown in table above.

#### 4.5. RELATIONSHIP BETWEEN SOCIO-DEMOGRAPHIC CHARACTERISTICS AND LEVEL OF PRACTICE

**Table4.14. Socio-demographic characteristics, education and training of nurses working in ICU and level of practice**

		Level of practice		
		Poor practice	Good practice	Total
		Count	Count	Count
Gender of the participant	Male	6	12	18
	Female	14	19	33
Age of the participant	<20 years	0	2	2
	20-40 years	18	22	40
	41-60 years	1	7	8
Level of nursing education of the participant	A1	18	19	37
	A0	2	12	14
	Masters	0	0	0
	Other	0	0	0
Participant working experience in ICU	<1year -10	16	20	36
	11-20	4	11	15
	>20	0	0	0
Participant training about nosocomial infection or infection control	Yes	12	23	35
	No	7	8	15

The table 4.14 above shows the cross tabulation between participant's gender, age, level of nursing education, working experience, training about nosocomial infections and level of practice. There are 12 males versus 19 females with good practice and 6 males versus 14 females with poor practice. Among 40 nurses in age group 20-40 years, 22 had good practice and 18 have poor practice; 7 nurses in age-group 41- 60 years had good practice and 1 nurse in the same Age-group had poor practice. All 2 nurses aged below 20 years had good practice. Among 37 nurses with A1 level of nursing education, 19 had good practice and 18 had poor practice whereas among 14 nurses with A0 level of nursing education, most of them (12) had good practice and only 2 had poor practice.

**Table4.15. Pearson Chi-Square Tests and Fisher's Exact test showing the relationship between socio-demographic characteristics and level of practice**

		Level of practice
Gender of the participant	Chi-square	.404
	Df	1
	Sig.	.525
Age of the participant	Fisher's Exact	3.996
	Sig.	.098
Level of nursing education	Chi-square	5.031
	Df	1
	Sig.	<b>.025*</b>
Participant working experience in ICU	Chi-square	1.404
	Df	1
	Sig.	.236
Participant training about nosocomial infection or infection control	Chi-square	.495
	Df	1
	Sig.	.482

\*Significance at 0.05 levels

Table4.15 above shows that the level of practice is statistically significantly associated with the level of nursing education (p- value 0.025). Among 36 participants with working experience of 10 years or less, 20 have good practice and 16 have poor practice; for those with 11-20 years of working experience, 11 have good practice and 4 have poor practice. Among 35 participants who received training on nosocomial infection or infection control, 23 have good practice and 12 have poor practice; and among 15 who did not participate in training on nosocomial infection or infection control, 8 have good practice and 7 have poor practice .The level of practice of participants was not statistically associated with the participants' years of working experience in ICU (p-value 0.236), and was not even associated with the participant training about nosocomial infection or infection control (p-value0.482). In the other words, for nurses who had many years of working experience, their practice was not far different from that of nurses who had fewer years. The same for nurses who were trained on nosocomial infection or infection control, and have demonstrated the level of practice not different from those who did not receive any training.

## **CHAPTER 5: DISCUSSION OF RESULTS**

### **5.1 INTRODUCTION**

This study aimed to assess knowledge and practice on preventive measures of nosocomial infections among nurses working in intensive care unit of referral hospitals. Findings from other studies have been used in discussing the results from the current study, then a discussion focusing on each objective, recommendations and conclusions from the study findings are given.

### **5.2 SOCIO- DEMOGRAPHIC CHARACTERISTICS**

Socio-demographic information was assessed in this study;

The majority of participants were females 64.71% while males were 35.29% .

The current study reported that 3.9% of respondents were less than 20years old, 78.43% were aged between 20 and 40 years, representing 78.43%, and 17.6% of participants were ranged between 41-60 years old.

When assessing the level of nursing education, the study found only two levels among nurses working in ICU. 72.55% of participants were advanced diploma (A1) holders, and 27.45% held bachelor's degree (A0).

The working experience ranged between 0 to10 years and represented 70.6%, 29.6% of participants, their experience were between 11 to 20 years, and no one had experience more than 20 years. Concerning training; 70.6% represented nurses who were trained on prevention of nosocomial infection or infection control, while 31.4% did not receive any training.

### **5.3 KNOWLEDGE OF PREVENTIVE MEASURES OF NOSOCOMIAL INFECTION**

In terms of participants knowledge the majority had moderate knowledge 24 (47.1%). Who demonstrated adequate knowledge were 22 (43.3%) and poor knowledge was found among 5 (9.8%) This findings contrasts the study conducted by Freahiywot et al; (2015)who found inadequate nurses knowledge on prevention of nosocomial infection. Other study conducted in Iran found that 43% of nurses had poor knowledge (Sarani *et al.*, 2016, p. 195).

Africa showed that nurses had not adequate knowledge about nosocomial infection prevention (Fashafsheh, 2015; Enein, (2011).

This finding is in agreement with that of the study conducted by (Eskander and Elfeky, 2013, p.160), that revealed poor knowledge in the standard preventive measures of nosocomial infections. This difference may be due to updated Continuing Professional Development (CPD) programs at all levels (public and private) to further enable health professionals to deliver quality health services and safe care practice. It has been reported that the knowledge of nurses about nosocomial infection depends on many factors including educational level and trainings. (Suchitra, (2007) reported that training has a positive impact on the improvement of knowledge, attitude and practice in healthcare personnel.

However, this study showed poor knowledge in preventive measures of NI in ventilator associated pneumonia (table 4.3) where 43.3% of respondents stated that the suction catheter should be used more than once instead of being discarded after single use, and this can be associated with poor equipment. This goes in the same line with the findings of (Dasgupta, Das and Hazra, 2015, p.13) who reported poor knowledge of respondents for the same statement.

The results obtained from the study conducted by (Kamunge, 2013, p.30) suggested that a small percentage of nurses acknowledged that they were less compliant with recommended preventive guidelines during episodes of increased work-load or emergency situations, this finding goes in agreement with the results of this study (table 4.2) on general preventive measures of nosocomial infection where a large number of participants ( 76.4%) reported to be always full compliant and few respondents reported being less compliant.

In terms of association between socio-demographic characteristics and level of knowledge, among 14 nurses holding bachelor's degree(A0) level of nursing education, most of them 71% had adequate knowledge and 4 had moderate knowledge and no one demonstrated poor knowledge( table 4.12). The study findings demonstrated that the level of knowledge, was statistically significantly associated with the level of nursing education (p value =0.049) nurses holding A0 level showing more adequate knowledge than A1 level (table 4.13).

In agreement with the study findings showed by Aiken et al.,2003, p .6 , have reported the association between nurses' level of education and positive patient outcomes. The researcher explained that nurses who had high level of nursing education had also good knowledge, consequently to good practice in providing nursing quality of care then contributing to the decreased of nosocomial infections and their consequences to patients admitted in ICU.

#### **5.4 PRACTICE OF NOSOCOMIAL INFECTION PREVENTION PROCEDURES**

The level of practice of 51 nurses working in ICUs on preventive measures of nosocomial infections was assessed by using the observational checklist. The results of the current study showed that 31nurses (60.78%) working in ICU had good practice while 20 nurses (39.22%) had poor practice.

These study findings are contrary to the results of the study conducted in Uganda and found poor practice in hand washing, because nurses considered hand washing as method of self-protection rather than a way of prevention of infection transmission from patient-to-patient (Sethi *et al.*, 2012, p. 917).

However, the study conducted in Nigeria found that 76% of nurses washed hand in-between patients care and nurses recognized that hand washing is important in prevention of hospital-acquired infections (Iliyasu *et al.*, 2016)

Observation of hand washing at important procedures revealed wrong or missed practice during some procedures. The quality of nursing care depends to a large extent on the knowledge, skills, attitude and activities of the practicing nursing staff. Even if the majority of participants reported good knowledge about nosocomial infection prevention, their knowledge has not been transformed into good practice. However the study conducted by Allah et al., 2010 showed a high level of practice where almost all participants (99.1%) had high level of practice in relation to nosocomial infection prevention.

It has been reported that the knowledge affects the attitudes and then after a change in terms of practice can be observed influence practice change (Launiala, 2009). The results of this study showed poor practice in some procedures during observation. In terms of hand washing,74.5% of nurses did no wash hand before intering in ICU,almost all nurses( 90.2%) did not wash hand before touching the patient and 74.5% did not wash hand before ETTsuctioning.

Surprisingly the findings shown in the research conducted by (Said, 2012, p.31) reported that; of 30 nurses observed ,none washed hands before intering the ICU and only 33% washed hands before ETT suctioning. The current study revealed that the level of practice was significantly associated with the level of nursing education ( $p=0.025$ ),participants who reported holding bachelor's degree (A0) showed having good practice compared to those with advanced diploma (A1).

This is similar to the findings showed by (Aiken et al., 2003, p.) reported the association between nurses' level of education and positive patient outcomes, and stated that in practice, higher education can make the difference in patient safety in many situations of health care. In addition, the study conducted by (Suchitra, 2007, p.7) reported that training has a positive impact on the improvement of practice in healthcare personnel.

The level of practice of participants was not statistically associated with the participants' years of working experience in ICU ( $p$ -value 0.236), and was not even associated with the participant training about nosocomial infection or infection control ( $p$ -value0.482). In the other words, for nurses who had many years of working experience, their practice was not far different from that of nurses who had fewer years. The same for nurses who were trained on nosocomial infection or infection control, and have demonstrated the level of practice not different from those who did not receive any training

## **CHAPTER6. CONCLUSION AND RECOMMENDATIONS**

### **6.1 CONCLUSION**

The study was conducted on a sample of 51nurses working in intensive care unit of referral hospitals. The main purpose of the study was to assess knowledge and practice on preventive measures of nosocomial infections among nurses working in Intensive Care Unit of selected public referral hospitals. As a summary of the overall level of knowledge of nurses working in ICU towards preventive measures of nosocomial infection, the study showed that 43.1% of participants had adequate knowledge, 47.1% had moderate knowledge and 9.8% had poor knowledge.

A large number of nurses working in ICU demonstrated adequate knowledge on preventive measures of nosocomial infection, but that knowledge did not reflect in their practice. The results of the current study reported a large number of nurses who did not wash hands before entering ICU; therefore hand hygiene was reported to be the single most effective means of preventing the horizontal transmission of infections with 50% reduction of nosocomial infections.

The knowledge and practice of nurses working in ICU towards the prevention of nosocomial infections needs to be improved through refresher workshop and trainings to recall and reinforce acquired knowledge and skills of nursing care procedures in Intensive Care Unit.

## **6.2 RECOMMENDATIONS**

### **To the Hospital**

Encourage nurses to reflect their knowledge into practice and being aware of preventive guidelines and policies of prevention of nosocomial infections such as hand washing. Observation of strict utilization of infection preventive measures and correction of poor practice. Retraining of nurses in terms of continuing in-service educational training and refresher workshop about nosocomial infection prevention are necessary to reinforce acquired knowledge and skills of nursing care procedures in intensive care unit and to continue to update their knowledge and practice.

### **To the Ministry of Health**

Rwanda human resources for health should continue to support the implementation of updated Continuing Professional Development (CPD) programs for nurses to enable health professionals to deliver quality health services and safe care practice.

To support nurses especially advanced diploma nurses (A1) to rise their level of nursing education by providing opportunities and avail all necessary requirements for nursing studies, thereby increasing the level of knowledge and practice for nurses.

### **To Nursing Education**

Incorporation of nosocomial infection preventive measures in curriculum of nurses at all level of nursing education is recommended action to improve knowledge and practice about nosocomial infection prevention among nurses working in ICUs.

### **To Researcher**

Similar study is recommended to include large sample size in other ICUs which provide care for critically ill patients in Rwanda, and further research on factors affecting implementation of nosocomial infection preventive measures in ICU are recommended.

### **6.3. LIMITATIONS OF THE STUDY AND CHALLENGES**

Time limitation: the researcher waited for long time to get permission from the hospitals to allow her to collect data, so the time for data collection was shorter than it was planned.

That was a challenge to the researcher to meet the academic schedule for thesis submission.

The sample size of this study was small; the findings should not be generalized to the all population. The study was done only in Public Hospitals; its generalizability may be limited.

Hawthorne effect: where by participant awareness of being observed may cause them to change the way they practice during the period of data collection (observation)

Furthermore, budgetary limitations had not permitted the researcher to extend the study in many areas of the country.

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## **APPENDIX**

## **APPENDIX I: INFORMATION TO PARTICIPATE TO THE RESEARCH**

My name is **Marianne NYIRANTIBIBAZA**. I am a Master Student in Nursing, Critical care and Trauma track at University of Rwanda. I am conducting my research project to finalize Master's degree in Nursing. I would like to ask your permission to participate in this study which is called "**knowledge and practice of preventive measures of nosocomial infections among nurses working in ICU in selected referral hospitals**".

**The purpose of the research:** The purpose of this research is to assess knowledge and practice of preventive measures of nosocomial infections among nurses working in ICU in referral hospitals.

There will be a questionnaire to be filled and a check list that will be used when observing the practice of infection control measures.

**Confidentiality:** The questionnaire will not have your name and will be filled by yourself with respect to anonymity. The information you will give will not be disclosed and will be used for the purpose of research only.

**Risks:** There is no harm that will happen due to participation in this research. The answer from the questionnaire will not affect the work performance score. No risks will be caused by this study and the participation is fully voluntary without any kind of force.

**Benefits:** No direct benefits to you from this research, however, the results of this research will give information on the level of knowledge and practice of nurses working in ICU about nosocomial infection prevention and will improve the profession of nursing through in-service training and adjustment of nursing curriculum.

If you have any problem concerning this project, contact College of Medicine and Health sciences Institutional Review Board chairperson on 0788490522 or Deputy Chairperson on 0783340040. If you agree to participate in this research, please sign the consent form next.

Sincerely

Marianne NYIRANTIBIBAZA student, Tel 0788659400, Email: nyimanna@yahoo.fr

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Prof.BUSISIWE Bhengu, PhD, Email: [bhengub2@ukzn.ac](mailto:bhengub2@ukzn.ac).

***APPENDIX II:***

**INFORMED CONSENT FORM**

I..... consent /accept to participate in this research project entitled: **“Knowledge and practice of preventive measures of nosocomial infections among nurses working in ICU of referral hospitals”** conducted by NYIRANTIBIBAZA Marianne, UR/CMHS/Nyarugenge Campus.

I have been explained the study in detail and its purpose. I understand that the information I will provide will be kept confidential, it will be used only for the purpose of the current study. I also understand that I have the right to withdraw from this study at any time and ask for clarification if there is any difficult. My participation is voluntary and no force has been used and I will not encounter any risk as related to this project.

Participants signature----- Date -----

Researcher signature -----Date -----

***APPENDIX III:***

## QUESTIONNAIRE AND INSTRUCTIONS

This questionnaire will focus on preventive measures of most common nosocomial infections in ICU such as: Ventilator Associated Pneumonia (VAP), Catheter Associated Urinary Tract Infection (CAUTI) and Intravascular Blood Stream Infection.

### Instructions:

This survey collects data anonymously. Please check in the box that corresponds to your response.

### SECTION 1:

#### Socio-demographic characteristics

1. Gender: Male  Female
2. Age: < 20 years  20 -40  41 - 60
3. What is your higher level of nursing education? A1  A0  Master's   
Other (please specify)
4. Year of working experience in ICU < 1-10years  11-20  > 20
5. Have you ever participated in in-service training or workshops about nosocomial infection prevention or infection control? YES  NO

## SECTION 2:

### Assessment of knowledge about preventive measures of nosocomial infections among nurses working in ICU.

To complete this section, please circle the number which corresponds to how you agree with the given statement.

**1. Strongly disagree**

**2. Disagree**

**3. Agree**

**4. Strongly agree**

#### ICU nurses' Knowledge on preventive measures of nosocomial infections

<b>1</b>	I am fully aware of the recommended guidelines for hand hygiene for prevention of nosocomial infections	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>2</b>	Following recommended guidelines for hand washing/ hygiene in the use of alcohol based solutions or other antiseptics before and after helping a patient to move, or lifting/ transferring the patient in and out of bed, reduces transmission of nosocomial infection	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>3</b>	Nosocomial infections may be transmitted via medical equipment such as syringes, thermometers, needles, catheters, stethoscopes etc.	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>4</b>	It is always necessary to be fully compliant with recommended guidelines for reducing transmission of nosocomial infections even when workload increases or in emergencies cases	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>5</b>	I know the safety precautions for disposal of needles, syringes, catheters etc. and risk of transmission of nosocomial infections	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>6</b>	A nurse is required to discard a suction catheter immediately after one single use	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>7</b>	Insertion of the suction catheter into the endotracheal tube is a sterile procedure	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>8</b>	Head of the bed elevation should be ranging from 30-45 degrees on ventilated patient to prevent aspiration of secretions and therefore	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

	preventing VAP				
9	A nurse caring for a ventilated patient is required to wear sterile gloves during ETT suctioning	1	2	3	4
10	Oral care should be performed by using a swab moistened with mouth wash and water every 4 to 6 hours and whenever necessary	1	2	3	4
11	Continuous training to ICU nurses on prevention of nosocomial infection contributes to decreased rates of VAP	1	2	3	4
12	ETT suctioning should be done to patient as needed	1	2	3	4
13	Early weaning a patient from the ventilator reduce the risk for VAP	1	2	3	4
14	A nurse caring for a ventilated patient is required to wash hands before and after oral / ETT suctioning	1	2	3	4
15	Unplanned extubation is associated with increased risk of aspiration therefore increase the risk for VAP	1	2	3	4
16	Fluids such as parenteral nutrition, lipid emulsions, blood and blood products should be changed more frequently every 24hours as they have been seen to support the growth of bacteria	1	2	3	4
17	The best way to prevent CAUTI(Catheter Urinary Tract Infection) is to not insert a catheter	1	2	3	4
18	Use of aseptic technique ,sterile equipment and only properly trained staff to insert the catheter ,are among the preventive measures of CAUTI	1	2	3	4
19	Position the urinary drainage bag below the level of the bladder on a stand that prevents contact with the floor	1	2	3	4
20	Once urinary catheter inserted, maintained closed drainage system and unobstructed urine flow to prevent infections	1	2	3	4
21	Teaching patient and family about appropriate catheter maintenance contributes to the decreased of CAUTI	1	2	3	4
22	Maintaining a sterile closed urinary drainage system is central to the prevention of the CAUTI	1	2	3	4
23	Once inserted the cannula or needle must be secured to maintain stability to prevent trauma to the vein and entry of micro-organisms to the wound which is facilitated by cannula movement	1	2	3	4

24	A transparent, semi permeable, polyurethane dressing permits continuous visual inspection of the insertion site ,it is impermeable to bacteria and allows the patient to shower, so is the best to use on catheter site dressing	1	2	3	4
25	Central venous catheter dressing should be changed within 7 days or when the dressing becomes damp, soiled or loose	1	2	3	4
26	Topical antibiotic ointment on the insertion sites should not be used because of their potential to promote fungal infections and anti-microbial resistance	1	2	3	4
27	The risk of infection increases with the length of time the intravascular device remains in place	1	2	3	4
28	The catheter site should be inspected a minimum of once every 24hours,documented in patient records and any redness, pain or swelling should be reported	1	2	3	4
29	To reduce the risk for infection ,In adult peripheral lines should be rotated at 72 hours intervals ,and aseptic technique must be used for catheter site care and all manipulations of the system	1	2	3	4
30	Contamination risks of intravascular devices should be minimized by cleaning the access ports with an appropriate antiseptic and accessing the port with sterile devices	1	2	3	4

***Thank you for responding to these questions, your contribution to this research is very important.***

### SECTION 3:

#### OBSERVATIONAL CHECK LIST

**Instructions:** The correct practices will weight **1**mark, the wrong practices **or** missed practices will equal to **0** mark.

**Coding:**

**0.** Wrong practice **or** Missed practice

**1.** Correct practice

<b>PREVENTIVE PRACTICES</b>	<b>Wrong practice Or Missed practice</b>	<b>Correct practice</b>
<b>I. HAND WASHING</b>		
1.Hand washing before entering ICU		
2.Before touching the patient		
3.After patient contact		
4. Before any procedure		
5. After drawing or manipulating patient's body fluid		
6. After removing proper or sterile gloves		
7. Wash hand or use of alcohol based solutions or other antiseptics between each patient contact		
8.Wash hands after touching inanimate surfaces and objects in patient's surroundings		
<b>II. SUCTIONING FROM THE ETT/TRACHEOSTOMY</b>		
1.Hand washing before suctioning		
2.Prepare sterile equipment required for suctioning		
3. Position the patient in a semi recumbent position		

4. Wear sterile gloves		
5. Insert the suction catheter into the ETT gently by using aseptic technique		
6. Discard suction tube immediately after one single use		
7. Hand washing after suctioning		
<b>III. ORAL CARE</b>		
1. Hand washing before oral care		
2. Apply clean gloves		
3. Clean mouth using toothbrush or gauze moistened with mouth wash		
4. Hand washing after oral care		
5. Perform oral care at least 2 times a day		
<b>IV. URINARY CATHETER CARE</b>		
1. Hand washing before any procedure		
2. Change urinary catheter no more than 7 days from the day of insertion		
3. Keep collection bag below the level of the bladder		
4. Keep collection bag off floor all the time		
5. Wash hand after any urinary catheter or urinary bag manipulation		
6. Documentation of Catheter insertion date		
7. Documentation of amount of urine and color		
<b>V. CENTRAL LINE CARE</b>		
1. Change central venous catheter dressing within 7 days or when the dressing becomes damp, soiled or loose		
2. Respect of aseptic procedures during central line dressing change		

3. Cleaning the ports at least once a day and using aseptic procedures		
4. Aseptic manipulations during drug and infusion administration		
<b>VI. PERIPHERAL IV LINE CARE</b>		
<b>Use of aseptic procedures during:</b>		
1. when removing peripheral IV line, and put a dressing to protect against microorganism entry		
2. drugs and infusion administration		
3. when taking laboratory samples		
4. Rotate the peripheral IV line at 72 hours intervals		

**APPENDIX 4:**

**IBAZWA MU KINYARWANDA**

**URUPAPURO RW'IBAZWA**

**Uru rupapuro rw'ibazwa rurarebana n'uburyo hafatwa ingamba zo rwanya indwara zikunze kwandurira mubitaro by'indembe muri zo harimo: umusonga uturuka ku mashini zifasha umurwayi guhumeka, indwara ziterwa no gushyirwamo umupira usohora inkari n'izituruka ku nshinge zishyirwa mu mumitsi iyobora amaraso.**

**Amabwiriza:**

Ubu bushakashatsi bushakisha bukusanya amakuru hatariho amazina y'abujuje impapuro.

Reba mu kazu kabijyenewe abariho ushyira igisubizo cyawe.

**ICYICIRO CYA MBERE (1)**

**Imyirondoro n'indangamimerere**

1. Igitsina gabo  gore

2. imyaka: munsu ya 20  hagati ya 20 - 30  hagati ya 30-40  hagati ya 40-50   
hejuru ya 50

3. Ufite iyihe mpamyabushobozi icyiciro cya 1 cya kaminuza(A1 )

Icyiciro cya 2 cya kaminuza (A0)

Icyiciro cya 3 cya kaminuza (Master's)

Ibindi byiciro (sobanura)

4. Imyaka umaze ukorera mubitaro by'indembe: munsu y'umwaka 1  hagati ya 1-5   
hagati ya 6 -10  hagati ya 11-20  hejuru ya 20

5. Wigeze witabira amahugurwa cyangwa ibiganiri bijyanye no kwirinda indwara zandurira mubitaro? Yego  Oya

**ICYICIRO CYA KABIRI (2):**

**Ikusanyamakuru kubijyanye n’ubumenyi n’imikorere ku baforomo/kazi bakorera mubitaro by’indembe mu kwirinda indwara zandurira mu bitaro.**

Mukuzuzza iki cyiciro shyira uruziga kumubare ujyanye n’igisubizo uhitamo ukurikije ibi bikurikira:

**1. Ndabihakanye cyane**

**2. Ndabihakanye**

**3. Ndabyemeye**

**4. Ndabyeye cyane**

**Ubumenyi abaforomo/kazi bakorera mubitaro by’indembe bafite kubijyanye no kwirinda indwara zandurira mubitaro.**

<b>1</b>	Nzi neza ibitegetswe ngenderwaho ku birebana n’isuku y’intoki mu kwirinda indwara zandurira mu bitaro	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>2</b>	.Gukurikiza amabwiriza ngenderwaho ku bijyanye no gukaraba intoki cyangwa isuku y’intoki hakoreshejwe umuti w’alcol eg undi muti urwanya udukoko dutera indwara mbere na nyuma yo guhindukiza umurwayi,kumuterura,kumuvana kugitanda umushyira ku kindi,bigabanya ikwirakwizwa ry’indwara zandurira mu bitaro.	1	2	3	4
<b>3</b>	.Indwara zandurira mu bitaro zishobora gukwirakwizwa n’ibikoresho byo kwa muganga byanduye nk’inshinge, termometeri, stetoscope n,ibindi	1	2	3	4
<b>4</b>	Haba no bihe bikomeye nk’igihe akazi kabaye kenshi cyangwa mu	1	2	3	4

	gutabara umurwayi kuburyo bwihutirwa ni ngombwa buri gihe kubahiriza amabwiriza ngenderwaho yo kwirindakugirango habeho igabanuka ku gukwirakwiza indwara umurwayi yandurira mu bitaro				
<b>5</b>	Nzi neza uburyo bwo kwirinda no gushyira ahabugenewe inshinge zakoreshejwe kimwe n'ibindi bikoresho, n'ingaruka bishobora gutera nkokuba byakwirakwiza indwara zandurira mu bitaro	1	2	3	4
<b>6</b>	Umuforomo/kazi agomba kujugunya agapira gakurura amatembabuzi mumyanya y'ubuhumekero ako kanya akimara kugakoresha inshuro imwe	1	2	3	4
<b>7</b>	Gushyiramo agapira gakurura amatembabuzi mumyanya y'ubuhumekero bisaba gukoresha uburyo busukuye kandi budafite mikorobi	1	2	3	4
<b>8</b>	Umutwe w'uburiri ugomba kuba hagati ya dogere 30 na 45 ku murwayi uri ku mashini imufasha guhumeka kugirango hirindwe ko amatembabuzi yaca mumyanya y'ubuhumekero bikaba byamutera umusonga.	1	2	3	4
<b>9</b>	Umuforomo/kazi uri kuvura umurwayi uri ku mashini imufasha guhumeka agomba kwambara uturinda ntoki twabugenewe tudafite mikorobe mu gihe agiye gukurura amatembabuzi mu myanya y'ubuhumekero.	1	2	3	4
<b>10</b>	Isuku yo mu kanwa ikorwa hakoreshejwe agatambaro gatose n'amazi buri masaha 4 kugeza kuri 6 n'igihe cyose ubona ko ari ngombwa	1	2	3	4
<b>11</b>	Amahugurwa ahoraho kubaforomo/kazi bakora mu bitaro by'indembe kubijyanye no kwirinda indwara zandurira mubitaro, bituma umubare w'abarwayi bashobora kwandura izo ndwara ugabanuka	1	2	3	4
<b>12</b>	Gukura amatembabuzi mumyanya y'ubuhumekero ukoresheje agapira	1	2	3	4

	kabugenewe bigomba gukorwa burigihe uko bikenewe				
<b>13</b>	Kumenyereza umurwayi kumukura ku mashini imufasha guhumeka hakirikare bigabanya kuba yakwandura umusonga waterwa no kuba ari kuri iyo mashini.	1	2	3	4
<b>14</b>	Umuforomo/kazi uri kwita kumurwayi uri kubyuma bimufasha guhumeka asabwe gukaraba intoki mbere na nyuma yo guvana amatembabuzi mu myanya y'ubuhumekero akoresheje agapira kabugenewe.	1	2	3	4
<b>15</b>	Gukuramo agapira ko mu buhumekero mu buryo butiteguwe cyangwa butunguranye bituma amatembabuzi yinjira mu myanya y'ubuhumekero bityo bikongera ibyago byo kwandura umusonga	1	2	3	4
<b>16</b>	Imiti ikozwe mu mazi, ibijyanye n'ibiribwa biterwa mu mitsi y'amaraso,amaraso n'ibiyakomokaho bigomba guhindurwa buri masaha 24 kuko byagaragaye ko bishobora guha urwaho mu kwinjira kwa mikorobe na bagiteri mu mubiri.	1	2	3	4
<b>17</b>	Uburyo nyabwo bwo kwirinda kwandura indwara zo murwungano rw'inkari ni ukudashyiramo agapira gasohora inkari	1	2	3	4
<b>18</b>	Gukoresha ibikoresho bidafite mikorobi mu gushyiramo agapira gasohora inkari mu murwayi,kandi bigakorwa n'umuvuzi wabyigiye ni zimwe mu ngamba zo kurinda indwara z'urwungano rw'inkari zandurira mu bitaro	1	2	3	4
<b>19</b>	Ku murwayi ufite agapira gasohora inkari,agafuka kajyamo inkari kagomba kuba gafatishijwe kuri nivo iri hasi y'uruhago kandi bakakarinda kuba kakora hasi.	1	2	3	4
<b>20</b>	Kwigisha umurwayin'umuryangowe kubijyanye n'isuku no gufata neza agapira gasohora inkari ni ngombwa kuko bigabanya indwara zandurira murwungano rw'inkari.	1	2	3	4

<b>21</b>	Imicungire y'agapira gasohora inkari iyo kari mu murwayi,igomba gukorwa kuburyo irinda kwinjiza mikorobi ku murwayi ugafite,cyangwa no kuba izo mikorobi zakwirakwizwa kubandi barwayi.	1	2	3	4
<b>22</b>	Uburyo bukoreshwa bwo koza mu rwungano rw'inkari,iyo bukoreshwe neza,hagakoreshwa ibikoresho bidafite mikorobi kandi ubwo buryo bugakomeza kuba bufunze neza, byaba ari ingenzi mu kwirinda indwara zo mu rwungano rw'inkari zandurira mu bitaro.	1	2	3	4
<b>23</b>	Urushinge rwatewe mu mutsi uyobora amaraso, rugomba kuba rufatijwe neza kuburyo bururinda kunyeganyega kuko bishobora gukomeretsa umutsi bityo bikaba bishobora guha urwaho kwinjira kwa mikorobi zinyuze muri ibyo bikomere.	1	2	3	4
<b>24</b>	Mu gupfuka urushinge ruterwa mu mutsi munini uyobora amaraso byaba byiza hakoreshwe igiphuko gikozwe mu bikoresho bya plastiki byo mu bwoko bwa polyurethane kukobibonerana bikagaragaza imiterere y'inyuma y'urushinge,bikabuza amazi na za bagiterikwinjira mu mubiri bityo bigafasha n'umurwayi kuba yakaraba nta mpungenge.	1	2	3	4
<b>25</b>	Urushinge ruterwa mu mutsi munini uyobora amaraso rugomba gupfukwa buri iminsi 7, n'igihe cyose bigaragara ko igiphuko cyanduye.	1	2	3	4
<b>26</b>	Imiti y'amavuta ntikwiriye gukoreshwa isigwa aho urushinge rutereye ku mubiri kuko bishobora kongera ubukana bwa mikorobi bityo bikaba byaba intandaro yo kwandura indwara.	1	2	3	4
<b>27</b>	Urushinge ruterwa mu mutsi uyobora amaraso uko rumara iminsi myinshi mu mubiri niko byongeraga ibyago byo kuba umurwayi yakwandura indwara zandurira mu bitaro biturutse kuri urwo rushinge.	1	2	3	4
<b>28</b>	Urushinge ruterwa mu mutsi uyobora amaraso,rugoma kugenzurwa nibura rimwe mu masaha 24,kandi iyo aho urwo rushinge rutereye habyimbye, hatukura,cg hakaba hababaza umurwayi,bigomba	1	2	3	4

	kwandikwa muri dosiye y'umurwayi kandi hagatangwa raporo ku babishinzwe kugirango hakumirwe hakiri kare uburwayi bwahaturuka.				
<b>29</b>	Mu rwego rwo kwirinda no kugabanya indwara zandurira mu bitaro ziturutse ku nshinge ziterwa mu mitsi iyobobora amaraso,ni ngombwa gukoresha uburyo bw'isuku budafite mikorobi mu micungire y'urushinge ku murwayi kandi urwo rushinge rugomba guhindurwa bitarengeje amasaha 72 uherye igihe rwashyirwemo	1	2	3	4
<b>30</b>	Kuba umuntu yakwandura indwara binyuze mu nshinge zo kwa muganga ziterwa mu mitsi iyobora amaraso,bishobora kugabanuka hakoreshejwe uburyo bwo kwirinda nk' isuku,imiti yica udukoko dutera indwara ,n,ibikoresho bisukuye bidafite mikorobi mu micungire y'izo nshinge mu gihe ziri ku barwayi	1	2	3	4

***Murakoze kwitabira ubuskakashatsi, no gusubiza ibibazo uruhare rwanyu ni ingirakamaro.***

### ICYICIRO CYA GATATU (3)

#### LISTI Y'IBISHINGIRWAHO MU KUREBA IMIKORERE

Uburyo bwo kureba imikorere y'abaforo/kazi bakora mu bitaro by'indembe ku bijyanye n'ingamba zo kwirindaindwara zikunze kwandurira mubitaro by'indembe muri zo harimo: umusonga uturuka ku mashini zifasha umurwayi guhumeka, indwara ziterwa no gushyirwamo umupira usohora inkari n'izituruka ku nshinge zishyirwa mu mumitsi iyobora amaraso.

Amabwiriza:

Ibyakozwe neza uko bikwiye bihwanye n, inota rimwe : **1**

Kuba bitakozwe cyangwa bigakorwa uko bidakwiye bihwanye na zeru : **0**

<b>IBIKORWA BYO KURINDA KWANDURA INDWARA ZANDURIRA MU BITARO</b>	<b>Ibyakozwe neza</b>	<b>Ibyakozwe nabi cyangwa ibitakozwe</b>
	<b>1</b>	<b>0</b>
<b>GUKARABA INTOKI</b>		
1. Gukaraba intoki mbere yo kwinjira mu bitaro by'indembe		
2. Mbere yo gukora ku murwayi		
3. Nyuma yo gukora ku murwayi		
4. Gukaraba intoki mu gihe umaze gukuramo uturindantoki		
5. Nyuma yo gukora kubintu byandujwe n' amavangingo, amaraso inkari n'ibindi		

6. Gukaraba intoki cyangwa ugakoresha alukoro cg undi muti wica mikorobi,mu gihe umaze gukora ku bikoresho byanduye,kandi ugiye gukomeza gufasha umurwayi: urugero nk'igihe umaze gufata ibimenyetso by'ubuzima		
7. Gukaraba intoki cyangwa gukoresha alukoro cyangwa undi muti wica mikorobi mu gihe urangije gukorera umurwayi ugiye kujya kuwundi		
8. Gukaraba intoki mu gihe umaze gukora ku bintu byanduye bishobora kuba byaba isoko cyangwa indiri ya za mikorobi		
9. Gukaraba intoki mbere na nyuma yo gukora ku mu rwayi		
10. Gukaraba intoki cyangwa gukoresha alukoro cyangwa undi muti wica mikorobi mu gihe urangije gukorera umurwayi ugiye kujya kuwundi		
<b>Uburyo bwo gukurura amatembabuzi mu myanya y'ubuhumekero unyuze mu gapira gafasha umurwayi guhumeka ukoresheje akandi gapira kabugenewe</b>		
1.Kubanza gukaraba intoki		
2. Gutegura ibikoresho bikenewe byabugenewe bidafite mikorobe		
3. Kureba neza ko ahakikije umurwayi hari isuku ihagije		
4.Kubanza gufata ibimenyetso by'ubuzima		
5.Kuryamisha umurwayi neza kuburyo umutwe w'igitanda weguka ku rugero rwa dogere hagati ya30 na 45		
6. Kongerera umurwayi umwuka kugirango azigame umwuka uhagije mu gihe uzaba uri gukuramo amatembabuzi mu mwanya y'ubuhumekero		
7. Kwambara uturindantoki twabugenewe tudafite mikorobe		
8 .Kwinjiza agapira gakurura amatembabuzi mu myanya y'ubuhumekero mu buryo nyabwo kandi buzira mikorobe		

9.Kutarenza amasegonda 10 mugihe winjije agapira mu mwanya y'ubuhumekero		
10.Kujugunya agapira mu gihe kamaze gukoreshwa		
11.Gukaraba intoki igihe cyose ukoze ku bintu bikikije umurwayi		
<b>ISUKU YO MU KANWA</b>		
1.Gukaraba intoki mbere yo gusukura umurwayi mu kanwa		
2.Kwambara uturindantoki dufite isuku		
3.Kuryamisha umurwayi muburyo atekanye (umutwe w'igitanda ugomba kuba uzamuye hagati ya dogere 30 na 45)		
4.Gusukura mu kanwa n'amenyo ukoresheje uburoso n' agatambaro gatose kandi gafite isuku		
5.Kubobeza ku minwa ukoresheje utuvuta tworoshye		
6.Gukaraba intoki mu gihe urangije gusukura umurwayi mu kanwa		
<b>IMICUNGIRE Y'AGAPIRA GASOHORA INKARI</b>		
1. Gukaraba intoki mbere yo kugira icyo ukora ku gapira		
2.Gushyiramo umupira usohora inkari muburyo nyabwo kandi butatera mikorobi (aho bishoboka)		
3.Gufatisha agafuka kajyamo inkari kuri nivo iri hasi y'uruhago rw'umurwayi		
4. Kurinda agafuka kajyamo inkari igihe cyose kuburyo kadakora hasi		
5.Guhindura agapira gasohora inkari bitarengeje iminsi 7 uhaye igihe kashyirwemo		
6.Kumenya kugenzura ibimenyetso bya infegisiyo itewe n'agapira kashyizwe mu rwungano rw'inkari ( urugero : inkari zirimo amashyira)		

7. Gukaraba intoki mu gihe urangije ibyo wakoraga birebana n'isuku y'agapira gasohora inkari.		
8. Kwandika ibyo wakoze muri dosiye y'umurwayi		
<b>IBIJYANYE NO KWIRINDA INDWARA ZITURUKA KU NSHINGE ZITERWA MU MUTSI IYOBORA AMARASO</b>		
1. Uburyo bwo gusukura no gupfuka urushinge rwo mu mutsi munini uyobora amaraso hakoreshejwe ibkoresho bitagira mikorobi		
2. Gushyiramo urushinge rwo mu mutsi uyobora amaraso hakoreshejwe uburyo butatera mikorobe		
3. Guhindura urushinge rwo mu mutsi mutoya uyobora amaraso bitarengeje amasaha 72 uherye igihe rwashyirwemo		
4. Kwita ku isuku y'urushinge rutewe mu mutsi uyobora amaraso kandi igakorwa kuburyo itateza mikorobe no mugihe cy'ifatwa ry'ibipimo byo muri laboratwari		

*SCHOOL OF NURSING AND MIDWIFERY*

*Kigali, on 28 / 02 /2017*

*Ref. No: ...../ 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 **NYIRANTIBIBAZA Marianne**, a final year student in the Masters of Science in Nursing at the University of Rwanda/College of Medicine and Health Sciences to collect data for her research dissertation entitled **KNOWLEDGE AND PRACTICE ON PREVENTIVE MEASURES OF NOSOCOMIAL INFECTIONS AMONG NURSES WORKING IN INTENSIVE CARE UNIT OF REFERRAL HOSPITALS**

This exercise that is going to take a period of 6 weeks starting from 1<sup>st</sup> March 2017 to 12<sup>th</sup> April 2017 will be done at **KIGALI UNIVERSITY TEACHING HOSPITAL (CHUK) AND RWANDA MILITARY HOSPITAL ( RMH )**

We are looking forward for your usual cooperation.

Sincerely,

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



## **INFORMED CONSENT FORM**

I.....consent /accept to participate in this research project entitled: “**KNOWLEDGE AND PRACTICE OF PREVENTIVE MEASURES OF NOSOCOMIAL INFECTIONS AMONG NURSES WORKING IN ICU OF SELECTED PUBLIC REFERRAL HOSPITALS**” Conducted by NYIRANTIBIBAZA Marianne, UR/CMHS/Nyarugenge Campus. I have been explained the study in detail and its purpose. I understand that the information I will provide will be kept confidential, it will be used only for the purpose of the current study. I also understand that I have the right to withdraw from this study at any time and ask for clarification if there is any difficult. My participation is voluntary and no force has been used and I will not encounter any risk as related to this project.

**Date and signature.....**



**CENTRE HOSPITALIER UNIVERSITAIRE  
UNIVERSITY TEACHING HOSPITAL**

**Ethics Committee / Comité d'éthique**

March 17<sup>th</sup>, 2017

Ref.: EC/CHUK/298/2017

**Review Approval Notice**

Dear Nyirantibibaza Marianne,

*Your research project: "Knowledge and practice on preventive measures of nosocomial infections among nurses working in intensive care unit of Referral Hospitals."*

During the meeting of the Ethics Committee of University Teaching Hospital of Kigali (CHUK) that was held on 17/03/2017 to evaluate your protocol of the above mentioned research project, we are pleased to inform you that the Ethics Committee/CHUK has approved your protocol.

You are required to present the results of your study to CHUK Ethics Committee before publication.

PS: Please note that the present approval is valid for 12 months.

Yours sincerely,



**John Nyirigira**  
The Secretary, Ethics Committee,  
University Teaching Hospital of Kigali

<<University teaching hospital of Kigali Ethics committee operates according to standard operating procedures (Sops) which are updated on an annual basis and in compliance with GCP and Ethics guidelines and regulations>>.

B.P. :655 Kigali- RWANDA [www.chk.rw](http://www.chk.rw) Tél. Fax : 00 (250) 576638 E-mail : [chuk.hospital@chukigali.rw](mailto:chuk.hospital@chukigali.rw)



March 31<sup>st</sup>, 2017

Ref.: EC/ RMH/ 123/ 2017

**REVIEW APPROVAL NOTICE**

Dear NYIRANTIBIBAZA Marianne  
UNIVERSITY OF RWANDA

Your research project: **“Knowledge and Practice on Preventive Measures of Nosocomial Infections among Nurses Working in Intensive Care Unit of Referral Hospitals”**.

With respect to your application for ethical approval to conduct the above stated study at Rwanda Military Hospital, I am pleased to confirm that RMH Ethics Committee has approved your study. This approval lasts for a period of **12 months** from the date of this notice, and after which, you will be required to seek another approval if the study is not yet completed.

You are welcome to seek other support or report any other study related matter to the Research office at Rwanda Military Hospital during the period of approval.

You will be required to submit the progress report and any major changes made in the proposal during the implementation stage. In addition, you are required to present the results of your study to RMH Ethics Committee before publication.

Sincerely,



**Dr. Pacifique MUGENZI**  
Lieutenant Colonel  
Co Chair: Rwanda Military Hospital Research Ethics Committee

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Email: [info@rwandamilitaryhospital.rw](mailto:info@rwandamilitaryhospital.rw)  
Tel: 0252586420  
P.o Box: 3377RWANDA MILITARY HOSPITAL



UNIVERSITY OF

RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 09/01/2017

Ref: CMHS/IRB/006/2017

Nyirantibibaza Marianne  
School of Nursing and Midwifery, CMHS, UR

Dear Nyirantibibaza Marianne

RE: ETHICAL CLEARANCE

Reference is made to your application for ethical clearance for the study entitled "*Knowledge And Practice On Preventive Measures Of Nosocomial Infections Among Nurses Working In Intensive Care Unit Of Referral Hospitals.*"

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.



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

*Prof. JB Gashuku*  
IRB Vice-Chair

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