THESIS

ASSESSING MEASURES FOR PREVENTING VENTILATOR ASSOCIATED PNEUMONIA AMONG NURSES WORKING IN INTENSIVE CARE UNITS: A CASE OF TWO SELECTED REFERRAL HOSPITALS IN KIGALI

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ASSESSING MEASURES FOR PREVENTING VENTILATOR ASSOCIATED PNEUMONIA AMONG NURSES WORKING IN INTENSIVE CARE UNITS: A CASE OF TWO SELECTED REFERRAL HOSPITALS IN KIGALI

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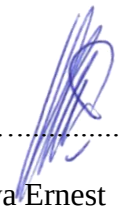
DECLARATION

I, Ernest RURIRIMBWA, do hereby declare that this research dissertation titled "Assessing measures for preventing ventilator associated pneumonia among nurses working in intensive care units: A case of two selected referral hospitals in KIGALI'' submitted in partial fulfillment of the requirements for the degree of Master of Science in Nursing (Critical Care and Trauma), at the University of Rwanda, College of Medicine and Health Sciences, is my original work and has not been presented anywhere and will not be presented to any other University for 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.



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Ruririmbwa Ernest

ABSTRACT

Background: Ventilator associated pneumonia (VAP) is the most common hospital acquired infection in intensive care units (ICUs). This infection has been found to be associated with increased duration on mechanical ventilation, longer hospital stay, higher treatment costs as well as increased rate of morbidity and mortality. The aim of this study was to assess measures of preventing VAP among nurses working in ICUs.

Methodology: A descriptive cross-sectional study design was adopted. A proportionate stratified sampling method was used to select 72 participants for the self administered questionnaire and 30 for observed practices at two selected referral hospitals in Kigali. Data were analyzed using the statistical package for the social sciences software (SPSS), version 20.0. Descriptive statistics, Pearson chi-square, Fisher's exact test and simple logistic regressions were used in data analysis.

Results: Forty two (58.3%) participants were female, 38 (52.8%) were aged between 30 to 39 years and 38 (52.8%) had advanced diploma (A1) in General Nursing. Most participants [58 (80.6%)] had no critical care nursing qualification and 31 (43.1%), had work experience from 1 year to 3years. Most of the nurses [63(87.5%)] reported that they adhere to hand washing. Only 14 (46.7%) were observed to be adhering to hand washing practices. On bivariate analysis, having critical care training course was the only variable significantly associated with adherence to endotracheal tube suctioning for both self-reported and observed data ($p = 0.001$ and $p = 0.002$, respectively). Simple logistic regression analysis showed that nurses with critical care nursing qualification were fourteen times (OR 14.1: CI 3.3 - 58.5 and OR 15.5: CI 2.6 - 92.6 respectively) more likely to adhere to endotracheal tube suctioning and to all measures for preventing ventilator associated pneumonia.

Conclusion: Only 7 (9.7%) self- reported and 4 (13.3%) observed participants demonstrated acceptable levels of adherence to VAP prevention strategies. Having a critical care nursing training course was statistically significantly associated with adherence to measures for endotracheal tube suctioning as a measure for VAP prevention. The major barriers on implementing preventive measures of VAP among nurses working in ICUs were lack of material resources for endotracheal tube suctioning and oral hygiene.

Key words: Intensive care nurses, mechanical ventilation, ventilator associated pneumonia, infection prevention and control measures in mechanical ventilation.

DEDICATION

I sincerely dedicate this work to:

Almighty God

My family, family friends and all our relatives, for invaluable support shown.

May the Almighty God bless you all.

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LIST OF ACRONYMS AND ABBREVIATIONS

%:	Percentages
^{O} C:	Temperature in degrees celsius
CDC:	Center for disease control
UTHK:	University Teaching Hospital of Kigali
CMHS:	College of Medicine and Health Sciences
ETS:	Endotracheal suctioning
ETT:	Endotracheal tube
FREQ:	Frequency
GCS:	Glasgow coma scale
HAI:	Hospital acquired infection
HOBE:	Head of bed elevation
HRS:	Hours
ICU:	Intensive care unit
NICU:	Neonates intensive care unit
OETT:	Oral endotracheal tube
PICU:	Pediatric intensive care unit
RMH:	Rwanda Military Hospital
UTI:	Urinary tract infections
VAP:	Ventilator associated pneumonia
WHO:	World health organization

CHAPTER ONE: INTRODUCTION

1.0 INTRODUCTION

This chapter contains background to the study, problem statement, aims of the study, research objectives, and research questions, significance of the study and definitions of concepts.

1.1 BACKGROUND

Ventilator associated pneumonia (VAP) is defined as Hospital acquired infection (HAI) which may cause inflammation of the pulmonary parenchyma because of the action of an infectious agent in patients undergoing mechanical ventilation.VAP happens up to 48 hours after intubation and mechanical ventilation (Miyuki et al., 2014, p. 43).The use of an artificial airway and mechanical ventilation are commonly life saving measures in critically ill patients admitted in ICUs. These interventions add to the risk of respiratory infections particularly VAP due to the invasive endotracheal tube that can allow immediate entry of infectious microorganisms into the lower respiratory tract since the tube is put in the trachea (Ramirez and Torres, 2012, p.86). The commonest bacterial infections among patients undergoing mechanical ventilation in ICUs are the klebsiella pneumonia, staphylococcus aureus, pseudomonas aeruginosa and acinetobacter baumanniiare. The most reported signs and symptoms are fever greater than 38ºC with no other cause, purulent tracheal secretions, positive tracheal aspirate, and chest X-ray showing new or continued diffuse infiltrate which is not attributable to any other causes (Behari and Kalafatis, 2015, p.16). VAP is the second most frequent hospital acquired infection after urinary tract infection in intensive care unit patients accounting for 20% of hospital acquired infection in this population (Shaaban, 2013, p.66). VAP is normally seen in patients admitted in neurological ICUs occurring in 10-25% of all ICU patients and generally resulting in high mortality, which might range from 22 to 71% (Bajpai et al., 2013, p. 51). The prevalence of VAP recorded in developing countries was 9–27 % (Kalanuria, Zai and Mirski, 2014, p.1). Higher prevalence rates of between 25% and 36% were reported in sub-Saharan Africa (Behari and Kalafatis, 2015, p.16). In Kenya, a study conducted at Kenyatta National Hospital showed that the incidence of VAP was 12.2% among ICU patients and up to 28% in the mechanically ventilated patients.

The commonest bacterial pathogens isolated on tracheal aspirates were klebsiella (23.1%), citrobacter (12.8%), staphylococcus aureus (12.8%), pseudomonas aeruginosa (10.3%) and acinetobacter species (10.3%) (Njoki, 2013, p. 1).

In another study done in Uganda by Namutebi and Kwizera (2015, p. 1) the incidence of VAP among ICU patients was reported to be 38 %. The most commonly isolated organisms were acinetobacter species (37.5%), klebsiella pneumonia (35.3%), pseudomonas auroginosa (14.7%), staphylococcus ureus (5.9%) and enterobacter species (5.9%). In Rwanda Military Hospital, 18 patients were admitted in ICU from 1st May-1st June 2016. Records in the ICU show that 14 of these patients were mechanically ventilated and 1 case (5%) of klebsiella was diagnosed. Another 1 (5%) case showed a sign of VAP through a new infiltrate on chest X-ray (Rwanda Military Hospital ICU report book, 2016). Such hospital acquired infections were observed to be even higher at the University Teaching Hospital in Kigali where a surveillance to monitor hospital-acquired infections reported 50.0% hospital acquired infection in ICU and 23.1% in NICU (Lukas et al., 2016, p.1).

1.2 PROBLEM STATEMENT

Ventilator associated pneumonia (VAP) is the most common hospital acquired infection in intensive care unit with a prevalence of 9-27% (Kalanuria,Zai and Mirski, 2014, p.1). VAP is a cause for concern because it is associated with increasing mortality rate of 68.2% (Galal, Youssef and Ibrahiem, 2016, p. 6) . This infection leads to many consequences such as increased duration on mechanical ventilation causing longer hospital stay (4 to 5 days) and higher treatment costs (Melville, 2012, p. 2). Several measures against VAP such as hand washing, oral hygiene, positioning of the patient and tracheal suctioning are reported to be implemented in Rwandan hospitals but there is little knowledge of the extent to which these measures are actually used to prevent VAP. What are also not well known could be the barriers or facilitation associated with preventive measures of VAP in intensive care units. The present study aims to assess the extent to which measures for preventing VAP among intensive care nurses working at the University Teaching Hospital of Kigali and Rwanda Military Hospital are put into practice and also to study on associated possible barriers.

1.3 THE AIM OF THE STUDY

The aim of this study was to assess measures for preventing ventilator associated pneumonia (VAP) in relation to hand washing, oral hygiene, patient positioning at an angle of 30-45 degree and endotracheal suctioning among nurses working in intensive care units.

1.4 RESEARCH OBJECTIVES

1. To determine the proportion of ICU Nurses adhering to hand washing, oral hygiene, patient positioning at an angle of 30-45 degree and endotracheal suctioning for preventing VAP.
2. To assess factors promoting measures for preventing VAP among nurses working in intensive care units.
3. To identify possible barriers on implementing preventive measures of VAP among nurses working in intensive care units.

1.5 RESEARCH QUESTIONS

1. What is the proportion of ICU Nurses adhering to hand washing, oral hygiene, position of the patient and endotracheal suctioning for preventing VAP?
2. What are the factors that promote measures for preventing VAP among nurses working in intensive care units?
3. What are the possible barriers to implementing measures for preventing VAP among nurses working in intensive care units?

1.6 SIGNIFICANCE OF THE STUDY

Data generated from this study will be beneficial to ICU nurses in implementing the preventive measures for ventilator associated pneumonia. Concerning nursing administration, the results from this study will guide hospital policy makers to come up with prevention and control protocols to enhance the existing measures with an intention of shortening patients' length of stay in ICU and decrease the risk of morbidity and mortality rate. Finally, the results of this study will be a basis for further nursing research on evidence based measures to prevent ventilator associated pneumonia. In terms of nursing education, nurse educators could utilize results on identified areas of weakness and strengthen the instruction of nurses on prevention of ventilator associated pneumonia.

1.7 DEFINITION OF CONCEPTS

Ventilator: Is a machine which provides artificial means to assist patients who may not breathe on their own because of illness, trauma, congenital defects, or drugs (WHO, 2011, p. 1).

In this study, a ventilator should be understood to be a machine used in the ICU to assist patients who are unable to breathe effectively on their own.

Ventilator associated pneumonia: Is one of the commonest encountered hospital acquired infections in ICUs that develops within 48 hours or later following endotracheal intubation (Keyt, Faverio and Restrepo, 2014, p. 814). In this study, VAP should be understood to mean nosocomial pneumonia in a patient mechanically ventilated supported by endotracheal tube or tracheostomy tube with no signs or symptoms of respiratory infection prior to mechanical ventilator support.

Intensive care unit: In this study should be understood as a special unit in a hospital, where critically ill patients or highly dependent patients who require close monitoring can be cared for by well qualified and specially trained staff working under the best possible conditions.

Critical care nurse: These are nurses working in the intensive care units, neonatal intensive care units and high dependency units of referral hospitals in Kigali city.

1.8 STRUCTURE OF THE STUDY

This study is composed of six chapters namely: introduction, literature review, methodology, results, discussion as well as a conclusion and recommendations.

1.9 CONCLUSION

In this chapter, an overview of the research has been given including the background of the study, the statement of the problem, aim and objectives, research questions, significance of the study as well as the structure of the study. In addition, the definitions of concepts were defined.

CHAPTER TWO: LITERATURE REVIEW

2.0 INTRODUCTION

This chapter of literature review is composed of five topics beginning with theoretical literature, followed by empirical literature, critical review and research gap identification as well as a conceptual framework.

2.1 THEORETICAL LITERATURE

This section of theoretical literature is based on eight components related to the study variables. These components are ventilator associated pneumonia, hand washing, oral hygiene, positioning of the patient, endotracheal suctioning practices, risk factors for ventilator associated pneumonia, factors preventing ventilator associated pneumonia as well as possible barriers.

2.1.1 VENTILATOR ASSOCIATED PNEUMONIA

Ventilator associated pneumonia (VAP) is the most commonly encountered hospital acquired infections in ICUs that occurs within forty eight (48) hours or later following endotracheal intubation (Keyt, Faverio and Restrepo, 2014, p. 814).It is manifested clinically by fever greater than 38ºC with none other cause, leukocytosis plus purulent tracheal secretions, change in character of sputum, increases in respiratory secretions, suctioning requirement and new infiltrate on chest radiograph. VAP increases the risk of morbidity and mortality, duration of staying in the critical care unit, length of time on the mechanical ventilator and increased health care costs (Kalanuria, Zai and Mirski, 2014b, p. 1). The causes of VAP usually depend on the period of mechanical ventilation, numerous factors associated with intubation and mechanical ventilation alter normal defenses against infection. Moreover, the endotracheal tubes provide a direct route to inoculation of the lungs with bacteria. Inoculation is caused by inadequate hand washing, using the same gloves from patient to patient and contaminated respiratory devices such as nebulizers, spirometers, bag valve mask devices, suction machines and suction catheters (Keyt, Faverio and Restrepo, 2014, p. 815).

A study done by Lance-Smith and Nardi, (2012, p. 46) emphasized that the washing and decontamination of hands before and after contact with patients and wearing gloves are important actions in the prevention of VAP. However, intensive care nurses are in the best position to implement the measures for preventing VAP and provide nursing care as they are at the patient's bedside 24 hours.

2.1.2. HAND WASHING

Hand washing is an important measure to prevent VAP for patients undergoing mechanical ventilation in intensive care units. In 2009, World Health Organization (WHO) recommended the following five moments of hand washing: (1) before touching the patients, (1) after body fluid exposure risk (2) before clean/aseptic procedure, (4) after touching a patient (5) after touching a patient's surroundings. In the same context, WHO indicated when and why each moment is needed as clarified in the table below:

Table 2.1: Five moments for hand hygiene according to WHO, 2009

1.	Before touching a patient	When?	Clean your hands before touching a patient when approaching him/her.
		Why?	To protect the patient against harmful germs carried on your hands
2.	Before clean/ Aseptic procedure	When?	Clean your hands immediately before performing a clean/aseptic procedure.
		Why?	To protect the patient against harmful germs, including the patient's own, from entering his/her body.
3.	After body fluid exposure risk	When?	Clean your hands immediately after an exposure to risk of body fluids (and after glove removal).
		Why?	To protect yourself and the health-care environment from harmful patient's germs.
4.	After touching a patient	When?	Clean your hands after touching a patient and her/his immediate surroundings, when leaving the patient's side.
		Why?	To protect yourself and the health-care environment from harmful patient's germs.
5.	After touching patient surroundings	When?	Clean your hands after touching any object or furniture in the patient's immediate surroundings, when leaving even if the patient has not been touched.
		Why?	To protect yourself and the health-care environment from harmful patient germs.

(World Health Organization, 2009, p.1)

2.1.3 ORAL HYGIENE CARE

Aspiration of oropharyngeal secretions and gastric contents having bacteria is an essential step in the pathogenesis of VAP (Niël-weise et al., 2011, p. 1). However, oral care is a significant nursing practice to stop VAP increase in intensive care units. As oral care is an element of daily nursing practice, there is need to develop and implement mouth care programs for patients regularly. Oral care is the use of a sponge or tooth brush three times per day with an oral chlorhexidine gluconate (0.12%) to clean the inside of intubated patients' mouths (Atay and Karabacak, 2014, p. 822). A study conducted by Par, Badovinac and Plancak (2014, p. 76) in Croatia on "Oral hygiene is an important factor for prevention of ventilator associated pneumonia" and noted that, besides VAP prevention, quality oral care does an important function in maintaining local health. Therefore, oral care of the mechanically ventilated patients in ICU must be taken as an important part of routine nursing activity and not only a measure of VAP prevention. Instead, oral care has been found to be also a crucial treatment with a profound effect on the patient's general health.

2.1.4 POSITION OF THE PATIENT

Elevation of the heads of beds for gastric-fed patients on mechanical ventilation is a significant nursing intervention to reduce gastro esophageal reflux, aspiration and VAP. In the supine position, a patient's oesophagus is placed horizontally and regurgitation and aspiration of stomach contents are common. In the semi- Fowler's position (head of bed elevated to 45º) the throat is on top of the horizontal axis and reflux of gastric contents is countered by gravity (Li Bassi and Torres, 2011, p. 57). Aspiration of gastric contents channels bacterial to go through to the lungs and this becomes a paramount factor in the growth of VAP. Outcomes of pulmonary aspiration depend on the volume and chemical composition of the aspirated material. However, positioning of the head of the bed between 30º and 45º is therefore very important, unless medically contraindicated (Metheny and Frantz, 2013, p. 53).

2.1.5 ENDOTRACHEAL SUCTIONING PRACTICES

Endotracheal suctioning (ETS) is a process that may constitute a risk factor for VAP by increasing microbial colonization of the lower airway. Unsafe endotracheal suctioning practices have been experienced globally during recent years due to adverse reactions. Nurse practitioners want to take all essential measures to ensure that patients are safe and there is high quality of nursing care (Jansson et al.,2013, p.99)**.**

The patients who are managed on mechanical ventilation need an artificial airway, either an endotracheal tube or a tracheotomy tube. The patients frequently retain tracheobronchial secretions due to impaired cough reflex, decreased mucociliary clearance, and possibly increased mucus production. Endotracheal suctioning is essential to remove retained tracheobronchial secretions and ICU nurses assume the responsibility for removal of these secretions. Even though endotracheal suctioning is essential, it should be done only as needed because the procedure can result in hypoxemia, dysrhythmias, damage of the tracheal mucosa as well as VAP (Ashworth, Melody and Sole, 2015, p. 319).

2.1.6. RISK FACTORS OF VENTILATOR ASSOCIATED PNEUMONIA

Critically ill patients often need an endotracheal intubation and mechanical ventilation as lifesaving measures (Ramirez and Torres, 2011, p. 86). These interventions may complicate to ventilator associated pneumonia and many other risk factors have been identified. These risk factors are classified into three categories such as host; device and personnel related risk factors. Chronic obstructive pulmonary disease, acute respiratory distress syndrome, immunosuppression and various organ system failures for example, lower the level of consciousness and are therefore considered as host related risk factors of medical conditions. Device related risk factors include the presence of ETT itself, the ventilator circuit and additional invasive devices such as nasogastric tubes (Martin-Loeches and Pobo,2010, p.117). The failure to practice proper techniques in addition to improper hand hygiene may result in the risk of cross contamination between the patient and the nurse. For this reason, such nursing omissions and errors are considered to be personnel related risk factors (Shaaban, 2013, p. 67).

2.1.7 FACTORS PREVENTING VANTILATOR ASSOCIATED PNEUMONIA

Critical care nursing training course

A study conducted by Jam Gatell *et al.*, (2012, p. 290) in Critical Care Centre, Hospital de Sabadell, Spain found that the training activities and evidence based protocols aimed at an intensive care nurses, improving the care quality and decreasing the gap between scientific knowledge and actual performance were very important. The study concluded that the training program improved Intensive care nurses' theoretical knowledge and adherence to measures of prevention of preventing VAP.

Another study done in Lebanon by Ismail and Zahran, (2015, pp. 42- 48) on the effect of nurses training on ventilator associated pneumonia prevention (VAP) bundle on VAP incidence rate at a critical care unit. It was a control and experimental study where two groups of patients were sequentially enrolled. It compared the knowledge and skills related to the ventilator associated pneumonia prevention bundle of nurses before and after training. With respect to the head elevation of 30-45 degrees, it was seen that 25% of nurses only adhered to this practice before the training compared to 91.7% of nurses after training p- value =0.000. This study demonstrated nurses' knowledge and skills regarding ventilator associated pneumonia prevention bundle were improved after the training program. Additionally, the training program on ventilator associated pneumonia prevention bundle directed to nurses in ICU dramatically decreased the incidence of ventilator associated pneumonia.

Implementation of policies and guidelines

A study done in Saudi Arabia by Ibrahim and Youssef (2015, pp. 41-51) on impact of implementation nursing guidelines on minimizing ventilator associated pneumonia among intensive care patients. A quasi experimental design was used. The study setting was medical and surgical intensive care units in King Fahd Hospital (Saudi Arabia). The study subject composed of two groups, the first group was made of 30 nurses provided direct nursing care to the patients and second group was composed of all patients admitted to intensive care units and received mechanical ventilation during the study period as well as free from any signs of pneumonia. As inclusion criteria the X-ray was done to observe the shadow of pneumonia in the chest before and after admission for both the control and experimental groups of patients. Total number of 180 patients which divided into two groups, the first was control group of 90 patients received ordinary nursing care and second was an experimental group of 90 patients received their care after applying nursing guidelines by nurses for minimizing ventilator associated pneumonia. The study revealed that 48.9% of studied patients had positive chest radiograph suggestive ventilator associated pneumonia in pre nursing guidelines and this percentage decreased to 22.2% in post nursing guidelines.

Another study done in South Africa by Matlakala and Botha,(2016, pp.49-54) on intensive care unit nurse managers' views regarding nurse staffing in their units in South Africa. It used a qualitative, exploratory and descriptive design.

The study was conducted in the adult general ICUs of four private hospitals in the Tshwane metropolitan area in Gauteng province, South Africa. The participants were four ICU managers from each of the four ICUs and they were sampled from a population of ICU nurses working in ICUs with12 or more beds. Data was collected from four unit managers using individual semi-structured interviews. The study revealed that with regard to the acuity level of ICU patients, such as intubated and ventilated, or patients on high dosages of inotropic drugs; the nurse to patient ratio should be one nurse to one patient (1:1).

2.1.8 POSSIBLE BARRIERS FOR VAP PREVENTION

In this section, as it was found in other researches, the barriers like lack of time or heavy workload, lack of knowledge, forgetfulness, lack of supplies and facilities are thought to be cross-cutting barriers to all practices for VAP prevention. Preventive practices such as hand washing, oral hygiene, positioning of the patient and tracheal suctioning will be inadequately or improperly done in the presence of such barriers.

Lack of material resources

In qualitative study conducted in Egypt by Lohiniva et al., (2015, p. 669) through focus group discussion, the majority of nurses in both Hospitals identified lack of hand hygiene to be due to a shortage of products (soap or alcohol) and sinks as the main constraint to complying with hand hygiene guidelines. The possible problem varied from one department to another and some health care department workers were expected to walk to the next department for hand washing.

Another quantitative cross-sectional survey done in Finland by Jansson *et al.*, (2013,p. 216) "On critical care nurses' knowledge of adherence to and barriers towards evidence-based guidelines for the prevention of ventilator associated pneumonia". With the sample size of 101 participants revealed that an overall self-reported adherence of measures for preventing ventilator associated pneumonia was 84.0%. The main self-reported barriers towards evidence-based guidelines were inadequate resources.

Workload

The same study conducted in Egypt found that many respondents mentioned that a heavy workload prevented them from following hand hygiene policies especially in the evening and night shifts. Others stated that the workload was always high and therefore it always impacted hand hygiene practices (Lohiniva *et al.*, 2015, p. 669).

2. 2 EMPIRICAL LITERATURE

This section of the empirical literature is emphasizing on evidence based findings on five components related to the variables of this study. Research studies on adherence to the implementation measures for preventing ventilator associated pneumonia, hand hygiene in ICU, oral care of the mechanically ventilated patients, positioning of the mechanically ventilated patients and an endotracheal suction (ETS) in ventilated patients are discussed in this section.

2.2.1 ADHERENCE TO THE IMPLEMENTATION MEASURES FOR PREVENTING VENTILATOR ASSOCIATED PNEUMONIA

A wide variety of scales measuring levels of adherence are well documented. This study utilized measures of adherence from an Iranian study. This study was a descriptive study that focused on compliance with the standards for prevention of ventilator associated pneumonia by nurses in the intensive care units. The sample size was 120 nurses in 11 ICUs at 4 hospitals affiliated to the Isfahan University of Medical Sciences, Isfahan. A checklist was used to evaluate the performances of 120 nurses in the ICU. The checklist was composed of VAP preventive measures recommended by the centers for disease control and prevention (CDC). The result showed that an adherence to hand hygiene based on the standard hand washing protocols was 32.5%, oral hygiene was 87.5%, use of sterile techniques to suction the airway through open technique was 41.6% and 30-45° elevation of the head of the bed was 96.6 %. The study suggested and recommended a standard percentage rating scale for adherence as unacceptable for 0–25%, average for 26–50%, relatively acceptable for 51–75% , and acceptable range was 76 –100% (Tabaeian, Yazdannik and Abbasi, 2017,p.32). Therefore, the present study utilized this rating scale to classify adherence to measures for preventing ventilator associated pneumonia.

2.2.2 HAND HYGIENE IN THE INTENSIVE CARE UNIT

A study was conducted in Brazil by Santos and Celina, (2015, pp. 21–23) on “adherence to the five moments for hand hygiene among intensive care professionals”. In this study, a total of 793 observations were analyzed. The observation rate for hand washing was 43.7% and hand washing wasn’t done in 446 (56.2%) of the observations. In the same study it was found that the most adherences to hand hygiene (53.5%) were among the physiotherapists and the least adherences (29.2%) were among the nursing staff.

The moments with the highest levels of compliance were "after touching the patient" (31.3%) and "after touching patient surroundings" (27.2%). The lowest adherence rates to hand hygiene were "before touching the patient" (18.4%) and "before aseptic procedure" (20.9%).

Almost similar results were reported in another study conducted by Mahfouz, El Gamal and Al-Azraqi, (2013, pp. 730 –731) on "hand hygiene non-compliance among intensive care units health care workers in Aseer Central Hospital, south-western Saudi Arabia". Observations were made on 236 as total number in intensive care units of the hospital. The sample comprised 179 nurses, 34 physicians and 23 other health care workers (X-ray and respiratory therapists, ECG technicians and physiotherapists) generally, hand washing hygiene noncompliance of 41.0% was observed. A total of 36.2 % used alcohol rub and 22.8% were compliant to hand washing. In summary noncompliance observed in the five moments of hand washing in various proportions. A total of 59.3% were found to be non- compliant with hand washing before patient contact, 16.9% after patient contact, and 22.7% after contact with patient surroundings, 52.7% before aseptic procedure and 30.8% after body fluid exposure. On comparing the non-compliance rates for the specific categories of health care providers, 51.9% physicians, 60.9% nurses and 66.7% other health care providers were noncompliant with hand washing before patient contact. In terms of noncompliance with hand washing before aseptic procedures, 52% physicians, 87.0% nurses and 79.3% other health workers were non-compliant. While 12.5% physicians were non-compliant with hand washing after body fluid exposure, higher percentages of non-compliance were seen among nurses (50%) and other health workers 30.0%.

A total of 34.3% physicians were non-compliant with hand-washing after patient contact. However, lower percentages of non-compliance in this regard were noticed were among nurses (8.1%) and other health workers (14.8%). The highest rates of non-compliance after patient surrounding contact were also reported among physicians (46.3%) while nurses and other health workers reported lower rates of 12.5% and 11.6% respectively (Mahfouz, El Gamal and Al-Azraqi, 2013, pp. 730 –731) .

2.2.3 ORAL CARE OF THE MECHANICALLY VENTILATED PATIENTS

The study conducted at Badem School of Health, Istanbul, Turkey on "Oral care in patients on mechanical ventilation in intensive care unit" showed that nurses performed oral evaluation but no standard form for oral examination was stated. Although 71% nurses performed an oral assessment before starting oral care, none could describe what assessment tool was used.

Chlorhexidine 0.12% solution with oral swabs was used for oral care by 75% of nurses, while 84% used gauze pads and 34% used toothbrushes. However, oral care practice frequency remained unspecified. Use of recommended oral care solutions remain poor despite evidence from literature review done between the years of 2000-2012.

There is evidence that chlorhexidine uses for oral care is important to reduce ventilator associated pneumonia and tooth brushing with chlorhexidine is also recommended to provide higher oral care standards for patients on mechanical ventilation. However, more research on the effect of tooth brushing has been suggested. Literature also showed that oral care practice frequency was 2;3 and 4 times a day and these frequencies were incorporated in oral care evaluation tools (Atay and Karabacak, 2014, p 821).

2.2.4 POSITIONING OF THE MECHANICALLY VENTILATED PATIENTS

A study was done in Spain on "Evaluation of head of bed elevation compliance in critically ill patients under mechanical ventilation in a polyvalent intensive care unit".

A total of 2639 observations were performed within four periods. Worldwide head of bed elevation compliance was 24.0%; and the median angle head of bed elevation was 24^0 (Llaurado-serra et al., 2015, p. 329)**.**

2.2.5 ENDOTRACHEAL SUCTION (ETS) IN VENTILATED PATIENTS

The University Hospital, Oulu, Finland conducted a study on "Evaluation of endotracheal suctioning practices of critical care nurses". A total of 40 critical care nurses, but mainly registered nurses (98%) with more than 10 years ICU experience. The results showed that in terms of practices before endotracheal suctioning event, chest auscultation of patients prior to ETS was done by 2(5.3%), the procedure was explained to the patient by 24 (61.5%), hyperoxygenation before suctioning was done by 23(57.5%), 21(56.8%) checked cuff pressure, 10 (25%) protected the eyes from secretions and 26 (65%) effected central venous catheter protection from secretions. Data was collected on the practices of infection control.

Hand disinfection prior to suctioning was done by 26 (72.2 %) participants, wearing gloves 40 (100%), wearing apron 13 (32.5%), wearing of face mask 39 (97.5) and maintenance of the sterile procedure during suctioning was observed in 25 (67.6%).

During ETS event, 10 (25%) instilled sodium chloride, 38 (95%) used suction catheter sizes less than or equal a half of internal diameter of (ETT), 30 (75%) made ≤ 2 suctioning passes, for 29 (72.5 %) the suctioning duration was < 15 seconds and suctioning was done by two nurses as a team in 34 (85%) of the observed cases. The observed practices after ETS event were that within 10 seconds after suctioning, 33 (82.9%) reconnected the patient to oxygen, 25 (62.5 %) hyperoxygenated the patients, 0 (0%) auscultated patients' chests, 21 (55.3%) reassured patients, 6 (23.1%) checked the cuff pressure and 21 (55.3%) performed hand disinfection post suctioning (Jansson et al., 2013, pp. 99–102).

2.3. CRITICAL REVIEW AND RESEARCH GAP IDENTIFICATION

This section of the critical review and research gap identification is based on four elements starting by hand washing, oral hygiene, endotracheal suctioning as well as positioning of the patients. Nursing practice gaps pertaining to these four elements were identified.

2.3.1 HAND WASHING

A study was conducted in Brazil by Santos and Celina, (2015, p. 27) on "adherence to the five moments for hand hygiene among intensive care providers". In this study, it was observed that healthcare providers' adherence rate to hand hygiene was 43.7%, which is considered as low. Nurses had the most worrisome and lowest adherence to hand hygiene (29%) and yet nurses have more frequent and direct contact with patients.

The lowest percentages of adherence to hand washing were observed during the moments before touching the patient and before aseptic procedures. These findings show that hand washing practices in the unit is the most fragile point. To verify adherence to hand hygiene techniques, hand hygiene inspection is essential.

2.3.2 ORAL CARE

A study was done by Atay and Karabacak, (2014, p. 827) on "Oral hygiene in patients on mechanical ventilation in intensive care unit'. They mentioned that in ICU patients, oral hygiene is an important practice for preventing VAP. However, there is no standard on oral care tool, clarity of oral care practice frequency as well as appropriate solution and materials.

2.3.3 ENDOTRACHEAL SUCTIONING

In the study conducted at University Hospital, Oulu, Finland by Jansson et al.,(2013, p. 103), it was confirmed that the most important discrepancies were seen on infection control practices, which may constitute important risk factors for ventilator associated pneumonia. Infection control prevents microbial colonization of the lower airway and the sterile technique is also encouraged during the open suctioning procedure.

2.3.4 PATIENT POSITIONING

If funds permit, it appears the use of a head of the bed elevation (HOBE) measuring device is the most objective means to ascertain the correct position of elevating the head of bed at 30^0 to 45^0 to prevent regurgitation and aspiration of stomach contents. However, most studies utilize observation checklists alone. A Spanish prospective observational study expressed similar sentiments. This study by Llaurado-serra et al.,(2015, p. 329) was on "Evaluation of head of bed compliance in critically ill patients under mechanical ventilation in a polyvalent intensive care unit". A total of 2639 observations were performed within four periods.

Head of the bed elevation (HOBE) was recorded from all patients requiring mechanical ventilation with no absolute contraindications for HOBE. The contraindications for HOBE were pelvic fracture, suspected or confirmed spinal injury. The observation check list was used for collecting data and it was reported that an observation checklist alone is not a good indicator for the evaluation of the HOBE compliance and was associated with overestimation.

So the HOBE measuring device was recommended for future studies as it was not associated with inaccurately increased compliance levels.

2.4 CONCEPTUAL FRAMEWORK

The study was done by assessing measures for preventing VAP among nurses working in ICUs using the conceptual model derived from PubMed article entitled "Risk factors and Interventions for ventilator associated pneumonia in Pediatric patients" (Morinec, Jacalyn Iacaboni and Mcnett, 2012, p. 437). The model was based on variables that are linked to Ventilator associated pneumonia and influenced by (1) Nursing interventions, (2) respiratory interventions, and (3) patients variable which is composed of modifiable and non-modifiable risk factors for Ventilator associated pneumonia. The most important outcome for the study was the VAP. VAP results in prolonged length of stay in the pediatric intensive care unit. Therefore PICU length of stay is the second outcome variable. There are several independent variables influencing these two outcome variables as indicated in Fig 2.1.

Conceptual model of the study variables

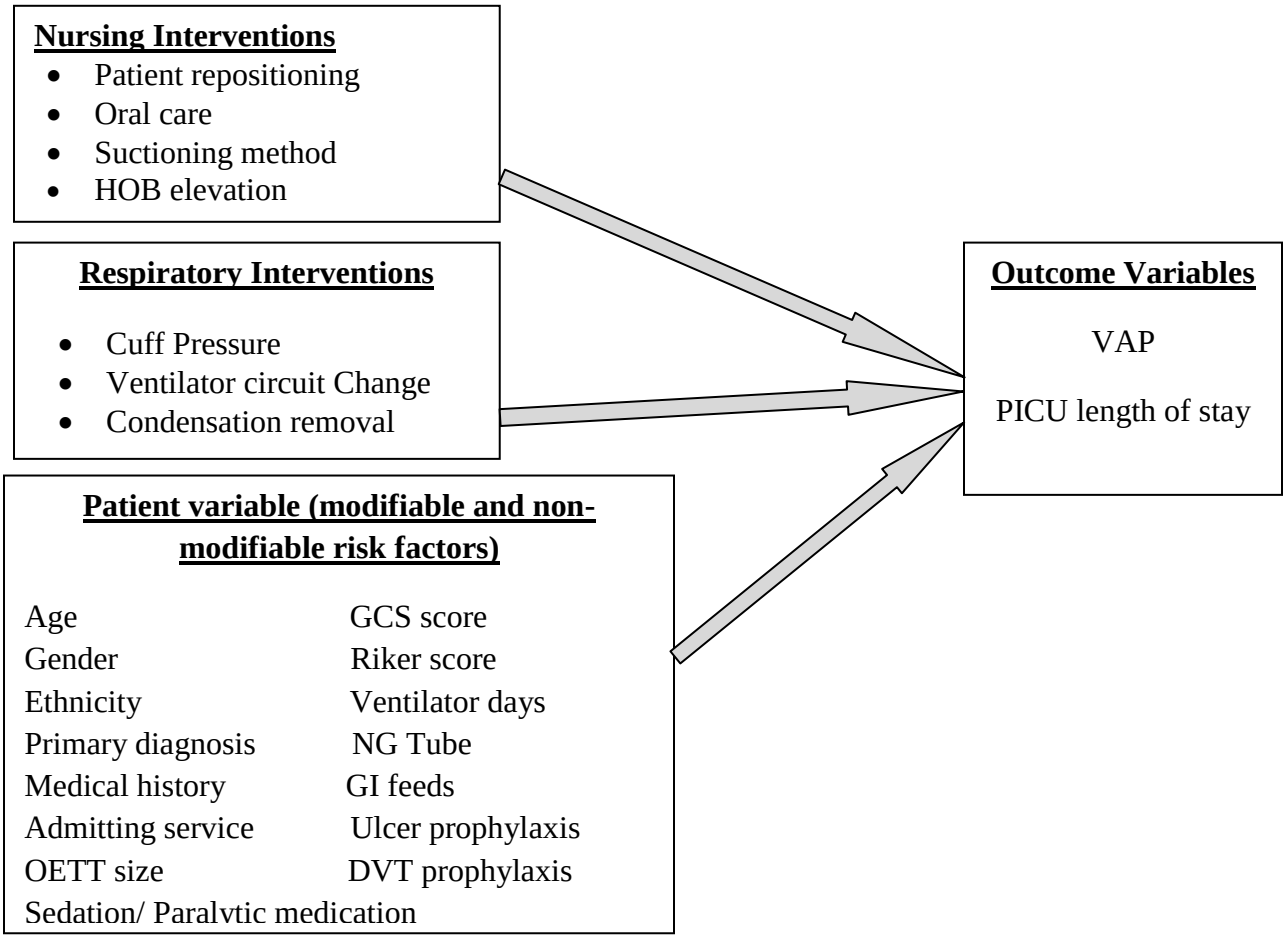

Figure 2.2: The conceptual model of the study variable by Morinec, Jacalyn Iacaboni and Mcnett, (2012, p. 437)

The above chosen model was helpful in the sense that most ICU nurses will use this to provide a comprehensive approach to understand the nursing measures for preventing VAP in ICUs with focus on hand washing, oral hygiene, ETT suctioning and positioning of patients. In the conceptual model developed from the above (fig 2.1) the study was composed of the following variables (1) demographic characteristics such as age, gender, education level and years of experience, (2) promoting factors that include critical care nursing course, availability of policy/guideline and use of policy/guideline, (3) possible barriers like lack of materials, lack of time, workload and forgetfulness, (4) dependent variables such as hand washing, oral hygiene**,** positioning of the patient and endotracheal suctioning. Though some of the independent variables have been correlated with the adherence.

Conceptual model of the study variables

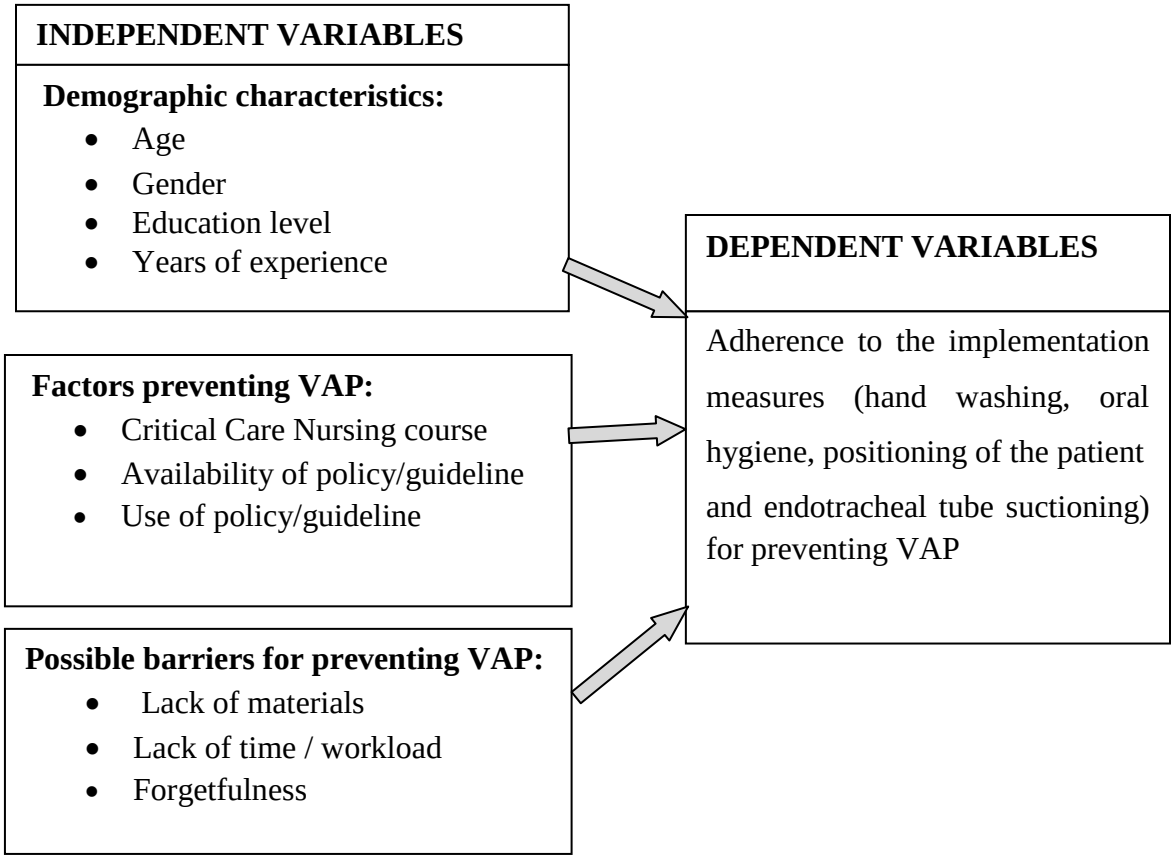

Figure 1: Conceptual framework developed from the conceptual model of Morinec, Jacalyn Iacaboni and Mcnett, (2012, p. 437)

2.5 CONCLUSION

In chapter two the theoretical literature was described in detail based on the study variables.

The empirical literature also was described in detail related to the variables of this study and emphasized on evidence based findings. The Critical review and research gap identification in relation to hand washing, oral hygiene, endotracheal suctioning and patient positioning were identified. In addition, the conceptual framework was designed.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 INTRODUCTION

This chapter describes the research methodology that has been used in this study and it includes research design, research approach, research setting, population, sampling, sampling strategy, sample size, data collection instruments, data collection procedure, data analysis, ethical considerations, data management, data dissemination, limitations and challenges.

3.1 RESEARCH DESIGN

This study used a descriptive cross-sectional study design to assess implementation measures for preventing ventilator associated pneumonia in ICUs among public referral hospitals in Kigali. The researcher also conducted an observation on implementation measures for preventing ventilator-associated pneumonia among nurses of the same units.

3.2 RESEARCH APPROACH

In this study, a researcher has used quantitative approach where a set of dichotomous and leading questions were structured and observation checklist organized according to the study objectives have been used to assess the implementation measures for preventing ventilator associated pneumonia by ICU nurses among public referral Hospitals in Kigali.

3.3 RESEARCH SETTING

This study has been conducted in two selected public referral hospitals in Kigali specifically the University Teaching Hospital of Kigali (UTHK) and Rwanda Military Hospital (RMH).

UTHK is located in Kigali city, Nyarugenge district. This hospital has a mandate of serving as the primary referral hospital and teaching students in health fields. The hospital receives patients from the entire country more than 40 district hospitals and has 445 beds and with an average occupancy rate of 72% (Lukas et al., 2016, p. 5). This institution offers a variety of services including intensive care units which are Pediatric Intensive Care Unit (PICU) with a capacity of 3 beds and adult Intensive Care Unit (ICU) which has a capacity of 7 beds. RMH is located in Kigali city, Kicukiro district. This hospital also has a mandate of treating patients and teaching students in health fields. RMH serves civilian and military patients from the entire country and has a capacity of 250 beds.The average number of admissions to this hospital is 88% civilian and 12% military patients (RMH statistics office, 2015). 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/surgical conditions which require mechanical ventilation.

The neonates' intensive care unit (NICU) of this hospital has 4 beds and admits the newborn patients aged less than a month presenting with life-threatening symptoms and those who are in need of continuous monitoring and ventilation. Approximately the average number of admissions of ICU is between 14 and 18 patients per month while NICU is 4 to 6 neonates per month (ICU unit manager book, 2016).

3.4 POPULATION

The study population for this research was 87 nurses working in ICUs of two selected referral hospitals in Kigali. This included 39 ICU nurses at RMH and 48 ICU nurses at UTHK.

3.4.1 INCLUSION CRITERIA

To be enrolled in the study, the Nurse had to be:

1. A registered nurse by the Rwanda Nurses and Midwives Council who work in ICUs. Those registered nurses not working in ICUs would lack the relevant experience in VAP prevention
2. Randomly selected and consent to participate in this study

3.4.2 EXCLUSION CRITERIA

1. Nurses who were on leave during data collection
2. Nurses with less than six months of working experience in ICUs because they lacked enough experience

3.5 SAMPLING

The researcher used a proportionate stratified sampling to select study participants from nurses working in ICUs of Rwanda Military Hospital and University Teaching Hospital of Kigali. In this, the sample chosen from each stratum is in proportion to the size of total population.

3.5.1 SAMPLING STRATEGY

All nurses from ICUs in RMH and UTHK who met the study inclusion criteria were eligible for the study and therefore were in the sampling frame for our study. A stratum in this study was each referral hospital and the researcher used a proportionate because the numbers of nurses in these strata were not equal. UTHK had 55.2% (48 nurses) and RMH had 44.8% (39 nurses) of the total target population (87 nurses). Within each stratum, all ICU nurses who met the inclusion criteria were selected.

3.5.2 SAMPLE SIZE CALCULATION

To calculate the sample size, a researcher used a formula of (Krejcie and Morgan,1970, p. 1)

$$N = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)}$$

Where:

n = required sample size.

$\mathbf{X^2}$ = the critical value for the corresponding 95% confidence interval.

N = the population size.

P = the estimated proportion of the outcome (assumed to be 0.50 since we don't have any previous conducted study in Rwanda to estimate the proportion of nurses with implementation measures for preventing VAP among referral Hospital).

D = is the level of significance for the study results which is set at 5%

Based on our study, the target population size is 87 nurses for all strata.

This means all nurses from RMH are 39 and those from UTHK are 48.

The researcher calculates the specific sample size as follows:

$$n = \frac{(1.96)^2 \times 87 \times 0.5(1-0.5)}{(0.05)^2 \times (87-1) + (1.96)^2 \times 0.5(1-0.5)} = 71.08$$

The sample size for this study was equal to 72 respondents.

The table below indicates the sample size from each referral hospital:

Table 3.1: Sample size calculation from each referral hospital

Referral hospital	**Sample frame**	**%**	**Simple size**	**%**
Rwanda Military Hospital	39	44.8	33	45.8
University Teaching Hospital of Kigali	48	55.2	39	54.2
Total	87	100	72	100

3.6 DATA COLLECTION

3.6.1 DATA COLLECTION INSTRUMENTS

A questionnaire and observation checklist were used as tools for data collection. The questionnaire comprised of closed ended questions which consisted of seven sections. The first section dealt with demographic characteristics of the respondents and had four items namely: age, gender, education level and years of experience. The second section had ten questions related to the factors promoting measures for preventing ventilator associated pneumonia including critical care nursing training, critical care nursing certification, availabilities and use of policies or guidelines of hand washing, oral hygiene, positioning of the patient at an angle of 30 to 45 degrees and endotracheal suctioning. The third section had five questions related to measures of hand washing or sanitization and its barriers. The fourth section comprised two questions related to the measures of oral hygiene and its barriers. The fifth section comprised of two questions related to measures of patients positioning and its barriers. The sixth section had two questions related to measures of endotracheal tube suctioning and its barriers. The seventh section consisted of one question related to the adherence of all the measures for preventing the ventilator associated pneumonia. To be considered adherent in these five (5) areas, participants had to achieve an overall score of 12. Every correct response was awarded a score of one point.

3.6.2 VALIDITY AND RELIABILITY OF INSTRUMENTS

The questionnaire used was developed and tested by Hiroko Kiyoshi-Teo, Michael D. Cabana and Froelicher, (2014, pp. 202–206). This was used in article entitled "Adherence to institution-specific ventilator-associated pneumonia prevention guidelines''. The researcher asked for permission from the author to utilise the tool and permission was granted (Annexure I). Some of the questions were adopted and others modified based on related literature. Validation of the researcher's modified questionnaire and observation checklist was done by critical care nurse experts to see if the tool was accurate and well adapted to clinical practice reality. The instrument was pre-tested on ten people to ensure that it is readable and easily understandable.In response to the results from the pilot study, errors were rectified and adapted in the questionnaire and observation checklist. Also reliability was tested with a test-retest approach by distributing the questionnaires two times to the same ten participants and Cronbach's alpha coefficient = 0.711 on the second set of results.

These results showed that the instrument was reliable measuring VAP prevention strategies. According Sharma, B. (2016) acceptable Cronbach's alpha is equal or greater than 0.7.

Table 2.2: Content validity relating objectives, conceptual framework and questionnaire

Objectives	**Conceptual framework**	**Items on questionnaire**
Objective 1: To determine the proportion of ICU Nurses adhering to hand washing, oral hygiene, position of the patient and endotracheal suctioning for preventing VAP	Adherence to the implementation measures of: • hand washing, • oral hygiene, • positioning of the patient • endotracheal tube suctioning	Question from each section (2, 3, 4, 5, 6 and 7) related to an adherence of hand washing, oral hygiene, position of the patient and endotracheal suctioning for preventing VAP.
Objective 2: To assess factors promoting measures for preventing VAP among nurses working in intensive care units.	**Promoting factors:** • ICU staff training • Availability of policy/guideline • Use of policy/guideline	**Section 2 :** Questions related to the factors promoting measures for preventing VAP
Objective 3: To evaluate possible barriers on preventive measures of VAP among nurses working in intensive care units.	**Possible Barriers:** • Lack of materials • Lack of time • Workload • Forgetfulness	**Section 3 :** Questions related to the measures of hand washing or sanitization and its barriers **Section 4 :** Questions related to the measures of oral hygiene; and its barriers **Section 5 :** Questions related to the measures of patient positioning ; and its barriers **Section 6 :** Questions related to the measures of an endotracheal tube suctioning; and its barriers

3.6.3 DATA COLLECTION PROCEDURE

After obtaining ethical clearance and permission from the CMHS research committee and the hospitals research committee, the researcher approached the Nurse Managers and explained the purpose of the study to them. Thereafter, the researcher requested for time to meet critical care nursing staff to proceed with data collection and to observe them. The participants who agreed to participate in the study signed the consent forms, and they were informed about the use of code numbers instead of participants' name. The questionnaires were in English language because all nurses in two selected referral hospitals were trained in English and they were using it in their daily working activities. Each respondent read and responded to the questions and the researcher was available to answer any question from the respondents though the researcher kept away from close proximity of the participants while filling the forms for assuring anonymity.

The respondents completed the questionnaire in their free time such that it did not interrupt their work. After signing the informed consent forms and completing the questionnaires, the participants were requested to put them together in the sealed envelopes and the researcher collected those envelopes instead of collecting individual questionnaires.

The principal investigator and six data collection enumerators conducted the observation on implementation measures for preventing VAP in critical care settings among nurses attending the mechanically ventilated patients. At the UTHK three data collection enumerators were selected and trained and each one observed five ICU nurses in the five days consecutively under the supervision of the principal investigator. The participants were not alerted that they were being observed at that time with a purpose of avoiding selection and information bias.

The researcher applied the same process at RMH. An overall number of 30 participants were observed within two weeks.

3.7 DATA ANALYSIS

Data collected were analyzed using descriptive statistics such as the frequency distributions and percentages. Inferential statistics, namely the bivariate analysis (Pearson chi-square and Fishers exact test) were used to find associations between various variables and adherence to all measures for preventing ventilator associated pneumonia (VAP). Adherence on self- reported was considered if the participants answered yes to all questions related to measures for preventing VAP while for observed participants it was considered if the participants practiced each measure correctly step by step according to the standard guidelines and policies.

Underlying assumptions for each data set were checked to choose an appropriate inferential statistical test. Pearson chi-square was used when expected frequency for each cell in the association was greater than five.

In contrast Fisher's exact test was used whenever each cell in the association of variables had expected frequency equal to five or less. Simple logistic regression analysis was also used to predict measure of an endotracheal tube suctioning. The results obtained from those different statistical analyses were presented in tables. The researcher used statistical package for the social sciences software (SPSS), version 20 for the data analysis.

3.8 ETHICAL CONSIDERATIONS

After getting research clearance from the CMHS research ethics committee, the researcher submitted the letter to the Director Generals of the two selected referral hospitals and the permission for data collection was granted (Annexure VI). In collaboration with the Division manager of nursing and unit manager, the researcher met with the ICU nursing staff, and described the aim of the study and the procedures to be used. All participants were allowed to ask questions if not clear. The participants were allowed to refuse to answer any particular question as well as to discontinue participation in the study at any time without any penalty. Participation in the study was voluntary and all responses were anonymous and treated with confidentiality. The code was used on the questionnaires instead of names and after completing them, participants put the questionnaires in the same envelope. The researcher kept the questionnaires in a locked cupboard and no other person had access to those data.

A detailed consent form for study participants is shown in annexure IV.

3.9 DATA MANAGEMENT

All data in two selected referral hospitals were collected by the researcher using questionnaires and observation checklists. The questionnaires were checked for completeness and data were entered in an excel sheet then imported to statistical package for the social sciences software (SPSS), version 20 for data analysis. Before analysis data cleaning was done in SPSS. The soft copies of data were kept in a password controlled personal computer. The coded questionnaires are being kept in locked cupboard and. After five years they will be destroyed by burning them.

3.10 DATA DISSEMINATION

After analyzing the data, the researcher presented findings to the school of nursing and midwifery. Also the researcher will present them to the respective hospitals, prepare a manuscript for publication and finally findings will be presented in local and international conferences before being published in reputable journals.

3.11 LIMITATIONS AND CHALLENGES

The limitations and challenges to this study was the time to get ethical clearance approval. The research ethics committee from the referral hospitals meets once in the month, so to get the ethical clearance approval from those referral hospitals delayed the scheduled time for data collection for a period of approximately four weeks. To overcome this delay, data collectors were recruited to cut down on data collection time. However, recruitment of data collectors caused financial constraints as the process had financial implications which had not been initially planned for.

3.12 CONCLUSION

In chapter three the research methodology of the study was described in detail. The research design, research approach, research setting, population, sampling, sampling strategy, sample size, data collection instruments, validity and reliability of instruments as well as content validity relating objectives, conceptual framework and questionnaire well explained in detail. Data collection procedure, data analysis, ethical considerations, data management, data dissemination, limitations and challenges were also described.

CHAPTER FOUR: PRESENTATION OF RESULTS

4.0 INTRODUCTION

The results of this study were based primarily on the data obtained from the two selected referral hospitals in Kigali. A total of the 72 ICU nurses were recruited and completed the questionnaires, thirty of them were observed during their clinical practices to assess the adherences on measures of hand washing, oral hygiene, positioning of the patients and endotracheal tube suctioning for preventing ventilator associated pneumonia.
The researcher analyzed the self-respondent questionnaires and participant observations separately. Data were analyzed using the statistical package for the social sciences software (SPSS), version 20.0. Descriptive statistics including frequencies and percentages were first performed. Afterwards bivariate and logistic regression analyses were conducted to identify relationships among study variables and predictors of outcome measures but logistic regression analyses of the participants' observation were not done because they had a low number which adhered to overall measures and they could not be predicted in the model.

4.1 DESCRIPTIVE ANALYSIS OF PARTICIPANT RESPONSES

Descriptive analysis was used to interpret the demographic data: age, sex, education level, years of working in ICU, critical care nursing course and critical care nursing qualification**.** Preventive measures and its barriers, availability and implementation of policies /guidelines and adherence to all measures in relation to hand washing, oral hygiene , patient positioning and endotracheal suction were presented in tables showing frequencies and percentages.

4.1.1 DEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANT RESPONDENTS

The response rate of the participants (N=72) was 100%. According to the results, the majority [38 (52.8%)] were in the age category between 30-39 years. By looking on the gender 30 (41.7%) participants were male and 42 (58.3%) were female. Many of the participants [38 (52.8%)] had advanced diploma (A1) in General Nursing. Most participants [58 (80.6%)] had no Critical Care Nursing course. Work experience was also considered and the majority [31 (43.1%)] were between 1 to 3years. Table 4.1 below shows the summary of characteristics of the participants in frequencies and percentages of each characteristic.

Table 4.1: Demographic characteristics of the participant respondents

Demographic characteristics	PARTICIPANTS RESPONSE (N = 72)	
	Frequency	**Percentage**
Age		
20-29	24	33.3
30-39	38	52.8
40 and above	10	13.9
Total	**72**	**100.0**
Gender		
Female	42	58.3
Male	30	41.7
Total	**72**	**100.0**
Education level		
Advanced diploma (A1)	38	52.8
Bachelor's degree (A0)	34	47.2
Total	**72**	**100.0**
Critical care nursing training course		
Yes	14	19.4
No	58	80.6
Total	**72**	**100.0**
Critical care nursing qualification		
No critical care nursing course	58	80.6
Certificate in critical care nursing	10	13.9
Diploma in critical care nursing	4	5.6
Total	**72**	**100.0**
Working experience in ICUs		
6 Months -1 Year	6	8.3
>1-3 Years	31	43.1
> 3-5 Years	22	30.6
> 5 years	13	18.1
Total	**72**	**100.0**

4.1.2 AVAILABILITY AND IMPLEMENTATION OF POLICY /GUIDELINE

Of the 72 participants, the majority [64 (88.9 %)] answered that they had hand washing policy/ guideline. Among those who answered that they had it, 41 (56.9%) read it always. Regarding oral hygiene policy/ guideline, few of the participants [19 (26.4%)] answered that they had it whereas a high number of 53 (73.6) answered that they did not have it and 12 (16.7%) answered that they read it always. Concerning positioning of the patients' policy/ guideline, a large proportion of [46 (63.9%)] answered that they had and 30 (41.7%) reported they read it always. About an endotracheal tube suctioning policy/ guideline, half of the participants [36 (50.0%)] answered that they had it and 17 (23.6%) stated that they read it always while 19 (26.4%) said they read it sometimes. Table 4.2 below shows availability of each policy /guideline and frequencies of reading.

Table 4.2: Summary statistics of availability and implementation of policy /guideline

Policy /guideline	**PARTICIPANTS RESPONSE (N=72)**				
	Availability of policy /guideline		**Reading of policy /guideline**		
	Yes n (%)	**No n (%)**	**Always n (%)**	**Sometimes n (%)**	**Not read at all n (%)**
Hand washing	64 (88.9)	8 (11.1)	41 (56.9)	23 (31.9)	8 (11.1)
Oral hygiene	19 (26.4)	53 (73.6)	12 (16.7)	7 (9.7)	53 (73.6)
Positioning of the patients	46 (63.9)	26 (36.1)	30 (41.7)	16 (22.2)	26 (36.1)
Endotracheal tube suctioning	36 (50.0)	36 (50.0)	17 (23.6)	19 (26.4)	36 (50.0)

n = number of frequencies, % = percentage

4.1.3 MEASURES OF HAND WASHING AND ITS BARRIERS

During the study period; seventy two nurses received the questionnaires and all returned them. ICU Nurses who answered that they wash or sanitize hands before entering in intensive care units were 66 (91.7%). Among those who did not wash their hands before entering in ICU 1(1.4%) did not do it because of lack of water, 2 (2.8%) because of lack of soap, 2 (2.8%) because of lack of alcohol rub and 1 (1.4%) because of forgetfulness. Those who washed or sanitized their hands before touching a patient were 68 (94.4%) of those who did not, 2 (2.8%) did not because of lack of alcohol rub, 2 (2.8%) because of forgetfulness and 1 (1.4%) because of lack of time. A large proportion, [69 (95.8%)] wash or sanitize the hands after touching a patient, 1 (1.4%) did not because of forgetfulness, 1 (1.4%) because of lack of alcohol rub and 1 (1.4%) because of lack of time. Those who wash or sanitize their hands after touching different patients were 68 (94.4%), 2 (2.8 %) did not do it because of forgetfulness and 2 (2.8%) because of lack of alcohol rub. A high number [70 (97.2%)] of participants wash or sanitize hands after contact with a source of microorganisms, 1 (1.4 %) did not do it because of lack of water and 1 (1.4%) because of lack of alcohol rub. Table 4.3 below shows frequencies and percentages of each step of hand washing and its barriers.

Table 4. 3: Summary statistics of hand washing and its barriers

Hand washing	**PARTICIPANTS RESPONSE (N=72)**					
	Yes n (%)	**No** n (%)				
		Barriers				
		Lack of water	Lack of soap	Lack of alcohol rub	Lack of time	Forgetfulness
before entering in ICUs	66 (91.7)	1(1.4)	2 (2.8)	2 (2.8)		1 (1.4)
before touching a patient	68 (94.4)			2 (2.8)	1 (1.4)	1 (1.4)
after touching a patient	69 (95.8)			1 (1.4)	1 (1.4)	1 (1.4)
after touching different patients	68 (94.4)			2 (2.8)		2 (2.8)
after contact with source of microorganisms	70 (97.2)		1 (1.4)		1 (1.4)	

4.1.4 MEASURES OF THE ORAL HYGIENE AND ITS BARRIERS

Of the 72 participants 33 (45.8%) answered that they perform oral care two times per shift to the patients who are mechanically ventilated, 13 (18.1%) said they did not perform oral care two times because of lack of materials, 9 (12.5%) because of lack of time and 3 (4.2%) because of forgetfulness. Concerning to one who is responsible for making sure that the patients receive appropriate oral hygiene, a large proportion [58 (80.6%)] of participants reported that oral hygiene of the patients who are mechanically ventilated is nurses' responsibility while 8 (11.1%) reported that oral hygiene is a shared responsibility between doctors and nurses. Table 4.4 below shows oral hygiene responses in frequencies and percentages.

Table 4.4: Summary statistics of oral hygiene and its barriers

	PARTICIPANTS RESPONSE (N=72)		
Oral hygiene and its barriers		**Frequency**	**Percentage**
	Yes (two times per shift)	33	45.8
	Yes (once per shift)	14	19.4
	No (lack of materials)	13	18.1
	No (lack of time / workload)	9	12.5
	No (forgetfulness)	3	4.2
	Total	**72**	**100.0**
Person responsible for making sure that patients receive appropriate oral hygiene	Nurses' responsibility	58	80.6
	ICU Nurse unit manager	6	8.3
	Shared responsibility between doctors and nurses	8	11.1
	Total	**72**	**100.0**

4.1. 5 MEASURES OF THE PATIENT POSITIONING AND ITS BARRIERS

Of the 72 participants, 46 (63.9%) participants answered that they always position the patients at the angle of 30^0 to 45^0 while 12 (16.7%) said that they don't because of lack of time, 9 (12.5%) because of contraindications and 5 (6.9%) because of forgetfulness. A large proportion [60 (83.3%)] reported that they were responsible for making sure that patients are positioned at an angle of 30^0 to 45^0 and 11 (15.3 %) reported that it is a shared responsibility between doctors and nurses. Table 4.5 below shows the frequencies and percentages of the patients positioned at an angle of 30^0 to 45^0 and its barriers.

Table 4.5: Summary statistics of the patient positioning and its barriers

	PARTICIPANTS RESPONSE (N=72)		
		Frequency	**Percentage**
Positioning of the patients at an angle of 30^0 to 45^0 and its barriers	Yes	46	63.9
	No (forgetfulness)	5	6.9
	No (lack of time / workload)	12	16.7
	No (contraindications)	9	12.5
	Total	**72**	**100.0**
Person responsible for making sure that patients are positioned at an angle of 30^0 to 45^0	Nurses' responsibility	60	83.3
	ICU Nurse unit manager	1	1.4
	Shared responsibility between doctors and nurses	11	15.3
	Total	**72**	**100.0**

4.1.6 MEASURES OF ENDOTRACHEAL TUBE SUCTIONING AND ITS BARRIERS

Of the 72 participants, only 28 (38.9%) of the participants answered that they perform sterile technique suctioning while the majority [38 (52.8%)] did not because of lack of materials and 6 (8.3%) because of lack of time. A large proportion [64 (88.9%)] of participants answered that performing sterile technique suctioning is a nurse's responsibility while 6 (8.3%) answered that it is shared responsibility between doctors and nurses. Table 4.6 below shows the responses of participants on an endotracheal tube suctioning with frequencies and percentages.

Table 4.6: Summary statistics of endotracheal tube suctioning and its barriers

	PARTICIPANTS RESPONSE (N=72)		
		Frequency	**Percentage**
Endotracheal tube suctioning with sterile technique	Yes	28	38.9
	No (lack of materials)	38	52.8
	No (lack of time / workload)	6	8.3
	Total	**72**	**100.0**
Person responsible for making sure that an endotracheal tube suctioning is to be performed with sterile technique	Nurses' responsibility	64	88.9
	ICU Nurse unit manager	2	2.8
	Shared responsibility between doctors and nurses	6	8.3
	Total	**72**	**100.0**

4.1.7 PARTICIPANTS SELF REPORTED ADHERENCE TO ALL MEASURES FOR VAP PREVENTION

Adherence was considered after the participant answered all questions related to measures for preventing ventilator associated pneumonia including hand washing or sanitization, oral hygiene, patient positioning and endotracheal suctioning and knowing that it is his/her responsibilities. The participant was considered as adhering to hand washing or sanitization if he/she answered yes to all questions related to hand washing or sanitization on the questionnaire.

These participant were also considered as adhering to providing oral hygiene if he/she recognized that oral hygiene is his/her responsibility and performed it at least twice or once per shift. For patient positioning, the participant was accounted as adhering if he/she always positioned the patient at angle of 30^0 to 45^0 and recognized that it is the nurses' responsibility. The participant was considered as adhering to an endotracheal tube suctioning if he/she answered yes, that he/she always performed a sterile endotracheal tube suctioning and also recognized that it is the nurses' responsibility. Therefore, the overall adherence of the participants to prevention of VAP was considered if adherence was fulfilled on each measure.

Of the 72 participants, a large proportion of 63 (87.5%) were adhering to hand washing and sanitization while only 24 (33.3%) ICU nurses were adhering to oral hygiene then the overall in all measures only 7 (9.7%) of the participants were adhering. Table 4.7 below shows adherence of all measures.

Table 4.7: Summary statistics of self -reported adherence to all measures for VAP prevention

	PARTICIPANTS RESPONSE (N=72)		
Adherence to measures	**Yes n (%)**	**No n (%)**	**Total n (%)**
Adherence to hand washing or sanitization	63 (87.5)	9 (12.5)	72 (100)
Adherence to oral hygiene	24 (33.3)	48 (66.7)	72 (100)
Adherence to patient positioning at an angle of 30 to 45	46 (63.9)	26 (36.1)	72 (100)
Adherence to endotracheal tube suctioning with sterile technique	23 (31.9)	49 (68.1)	72 (100)
Adherence to all measures (hand washing, oral hygiene, position of the patient and endotracheal tube suctioning)	7 (9.7)	65 (90.3)	72 (100)

4.2 BIVARIATE ANALYSIS OF PARTICIPANTS' SELF REPORTS

Bivariate analysis was used to determine association between demographic characteristics: age, sex, education level, years working in intensive care unit and critical care nursing course and adherence to all measures for preventing ventilator associated pneumonia. These ventilator associated pneumonia preventive measures were hand washing, oral hygiene, patient positioning as well as endotracheal suction.

4.2.1 DEMOGRAPHIC CHARACTERISTICS AND SELF REPORTED ADHERENCE TO HAND WASHING

As shown below in table 4.8, there is association between socio demographic characteristics and adherence to measures of hand washing or sanitization. Those general characteristics are age, gender, education level, years of experience and critical care nursing course. The Fisher's exact test indicated that there was no statistical significant relationship found because for each variable p-value was greater than 0.05.

Table 4.8: Association between demographic characteristics and self- reported adherence to measures of hand washing or sanitization

Demographic characteristics	PARTICIPANTS RESPONSE (N=72)				
	Adherence to measure of hand washing or sanitization				
	Adherence n (%)	Non adherence n (%)	Total n (%)	Statistical test used	P- value
Age					
20-29 Years	22 (91.7)	2 (8.3)	24(100)	Fisher's exact	0.788
30-39 Years	32 (84.2)	6 (15.8)	38 (100)	test	
40 and above	9 (90)	1 (10)	10 (100)		
Total	63 (87.5)	9 (12.5)	72 (100)		
Gender					
Female	38 (90.5)	4 (9.5)	42 (100)	Fisher's exact	0.476
Male	25 (83.3)	5 (16.7)	30 (100)	test	
Total	63 (87.5)	9 (12.5)	72 (100)		
Education level					
Advanced diploma (A1)	34 (89.5)	4 (10.5)	38 (100)	Fisher's exact	0.727
Bachelor's degree (A0)	29 (85.3)	5 (14.7)	34 (100)	test	
Total	63 (87.5)	9 (12.5)	72 (100)		
Years of experience					
6 Months -1 Year	5 (83.3)	1 (16.7)	6 (100)	Fisher's exact	0.511
>1 - 3 Years	29 (93.5)	2 (6.5)	31 (100)	test	
> 3 - 5 Years	18 (81.8)	4 (18.2)	22 (100)		
> 5 years	11 (84.6)	2 (15.4)	13 (100)		
Total	63 (87.5)	9 (12.5)	72 (100)		
Critical care nursing training course					
Yes	12 (85.7)	2 (14.3)	14 (100)	Fisher's exact	0.999
No	51 (87.9)	7 (12.1)	58 (100)	test	
Total	63 (87.5)	9 (12.5)	72 (100)		

P- Value significant at $p < 0.05$

4.2.2 DEMOGRAPHIC CHARACTERISTICS AND SELF REPORTED ADHERENCE TO ORAL HYGIENE

Table 4.9 shows the association between socio demographic characteristics and adherence to measure of oral hygiene of the patient mechanically ventilated. The Fisher's exact test and Pearson chi-square were calculated and there were no statistical significant relationship found because for each variable p-value was greater than 0.05.

Table 4.9: Association between demographic characteristics and self- reported adherence to oral hygiene

Demographic characteristics	PARTICIPANTS RESPONSE (N=72)				
	Adherence to measure of oral hygiene				
	Adherence n (%)	Non adherence n (%)	Total n (%)	Statistical test used	P- value
Age					
20-29 Years	11 (45.8)	13 (54.2)	24 (100)	Fisher's exact test	0.174
30-39 Years	9 (23.7)	29 (76.3)	38 (100)		
40 and above	4 (40)	6 (60)	10 (100)		
Total	24 (33.3)	48 (67.3)	72 (100)		
Gender					
Female	17 (40.5)	25 (59.5)	42 (100)	Pearson chi-square	0. 204
Male	7 (23.3)	23 (76.7)	30 (100)		
Total	24 (33.3)	48 (67.3)	72 (100)		
Education level					
Advanced diploma (A1)	15 (39.5)	23 (60.5)	38 (100)	Pearson chi-square	0. 318
Bachelor's degree (A0)	9 (26.5)	25 (73.5)	34 (100)		
Total	24 (33.3)	48 (67.3)	72 (100)		
Years of experience					
6 Months -1 Year	1 (16.7)	5 (83.3)	6 (100)	Fisher's exact test	0.912
>1 - 3 Years	11 (35.5)	20 (64.5)	31 (100)		
> 3 - 5 Years	8 (36.4)	14 (63.6)	22 (100)		
> 5 years	4 (30.8)	9 (69.2)	13 (100)		
Total	24 (33.3)	48 (67.3)	72 (100)		
Critical care nursing training course					
Yes	6 (42.9)	8 (57.1)	14 (100)	Fisher's exact test	0.529
No	18 (31.0)	40 (69.0)	58 (100)		
Total	24 (33.3)	48 (67.3)	72 (100)		

P- Value significant at $p < 0.05$

4.2.3 DEMOGRAPHIC CHARACTERISTICS AND SELF-REPORTED ADHERENCE TO ENDTRACHEAL TUBE SUCTIONING

As shown below in table 4.10, researcher illustrate association between general characteristics and adherence to measure of an endotracheal tube suctioning calculated using fisher's exact test indicated that there were statistical significant associations between critical care nursing course and adherence to an endotracheal tube suctioning; p-value <0.001. Concerning age group, gender, education level and years of experience, Pearson chi-square and the Fisher's exact test showed that there were no statistical significant relationships found because for each variable p-value was greater than 0.05.

Table 4.10: Association between demographic characteristics and self-reported adherence to an endotracheal suctioning

Demographic characteristics	PARTICIPANTS RESPONSE (N=72)				
	Adherence to measure an endotracheal suctioning				
	Adherence n (%)	Non adherence n (%)	Total n (%)	Statistical test used	P- value
Age					
20-29 Years	5 (20.8)	19 (79.2)	24 (100)	Fisher's exact test	0.247
30-39 Years	13 (34.2)	25 (65.8)	38 (100)		
40 and above	5 (50)	5 (50)	10 (100)		
Total	23 (31.9)	49 (68.1)	72 (100)		
Gender					
Female	12 (28.6)	30 (71.4)	42 (100)	Fisher's exact test	0.609
Male	11 (36.7)	19 (63.3)	30 (100)		
Total	23 (31.9)	49 (68.1)	72 (100)		
Education level					
Advanced diploma (A1)	9 (23.7)	29 (76.3)	38 (100)	Pearson chi-square	0.134
Bachelor's degree (A0)	14 (41.2)	20 (58.8)	34 (100)		
Total	23 (31.9)	49 (68.1)	72 (100)		
Years of experience					
6 Months -1 Year	1 (1`6.7)	5 (83.3)	6 (100)	Fisher's exact test	0.770
>1 - 3 Years	11 (35.5)	20 (64.5)	31 (100)		
> 3 - 5 Years	8 (36.4)	14 (63.6)	22 (100)		
> 5 years	3 (23.1)	10 (76.9)	13 (100)		
Total	23 (31.9)	49 (68.1)	72 (100)		
Critical care nursing training course					
Yes	11(78.6)	3(21.4)	14(100)	Fisher's exact test	0.001*
No	12 (20.7)	46 (79.3)	58 (100)		
Total	23 (31.9)	49 (68.1)	72 (100)		

P- Value significant at $p < 0.05$

4.2 DEMOGRAPHIC CHARACTERISTICS AND SELF-REPORTED ADHERENCE TO PATIENT POSITIONING

From table 4.11 below shown the association between socio demographic characteristics and adherence to measure of patient positioning. The Pearson chi-square and Fisher's exact test were calculated and there were no statistical significance revealed because for each variable p-value was greater than 0.05.

Table 4.11: Association between demographic characteristics and self-reported adherence to patient positioning

Demographic characteristics	PARTICIPANTS RESPONSE (N=72)				
	Adherence to measures of patient positioning				
	Adherence n (%)	Non adherence n (%)	Total n (%)	Statistical Test used	P- Value
Age					
20-29 Years	16 (66.7)	8 (33.3)	24 (100)	Fisher's exact test	0.837
30-39 Years	23 (60.5)	15 (39.5)	38 (100)		
40 and above	7 (70)	3 (30)	10 (100)		
Total	46 (63.9)	26 (36.1)	72 (100)		
Gender					
Female	27 (64.3)	15 (35.7)	42 (100)	Pearson chi-square	0.999
Male	19 (63.3)	11 (36.7)	30 (100)		
Total	46 (63.9)	26 (36.1)	72 (100)		
Education level					
Advanced diploma (A1)	28 (73.7)	10 (26.3)	38 (100)	Pearson chi-square	0.087
Bachelor's degree (A0)	18 (52.9)	16 (47.1)	34 (100)		
Total	46 (63.9)	26 (36.1)	72 (100)		
Years of experience					
6 Months -1 Year	3 (50)	3 (50)	6 (100)	Fisher's exact test	0.682
>1 - 3 Years	21 (67.7)	10 (32.3)	31 (100)		
> 3 - 5 Years	15 (68.2)	7(31.8)	22 (100)		
> 5 years	7 (53.8)	6 (46.2)	13 (100)		
Total	46 (63.9)	26 (36.1)	72 (100)		
Critical care nursing training course					
Yes	9 (64.3)	5 (35.7)	14 (100)	Pearson chi-square	0.999
No	37 (63.8)	21 (36.2)	58 (100)		
Total	46 (63.9)	26 (36.1)	72 (100)		

P- Value significant at $p < 0.05$

4.2.5 DEMOGRAPHIC CHARACTERISTICS AND SELF-REPORTED ADHERENCE TO ALL MEASURES FOR VAP PREVENTION

As presented in Table 4.12 association between general characteristics and adherence to all measures of hand washing , oral hygiene , patient positioning and endotracheal tube suctioning was calculated and Fisher's exact test indicated that there was statistical significant association between critical care nursing course and adherence to all measures, p-value = 0.002. Concerning age group, gender, education level and years of experience, Fisher's exact test reveals that there was no statistical significance found because for each variable p-value was greater than 0.05.

Table 4.12: Association between demographic characteristics and self- reported adherence to the all measures for VAP prevention

Demographic characteristics	**PARTICIPANTS RESPONSE (N=72)**				
	Adherence to measures of hand washing, oral hygiene positioning of the patient and endotracheal tube suctioning				
	Adherence n (%)	**Non-adherence n (%)**	**Total n (%)**	**Statistical test used**	**P - value**
Age					
20-29 Years	2 (8.3)	22 (91.7)	24 (100)	Fisher's exact test	0.088
30-39 Years	2 (5.3)	36 (94.7)	38 (100)		
40 and above	3 (30)	7 (70)	10 (100)		
Total	7 (9.7)	65 (90.3)	72 (100)		
Gender					
Female	5 (11.9)	37 (88.1)	42 (100)	Fisher's exact test	0.692
Male	2 (6.7)	28 (93.3)	30 (100)		
Total	7 (9.7)	65 (90.3)	72 (100)		
Education level					
Advanced diploma (A1)	2 (5.3)	36 (94.7)	38 (100)	Fisher's exact test	0.243
Bachelor's degree (A0)	5 (14.7)	29 (85.3)	34 (100)		
Total	7 (9.7)	65 (90.3)	72 (100)		
Years of experience					
6 Months -1 Year	0 (0)	6 (100)	6 (100)	Fisher's exact test	0.936
>1 - 3 Years	3 (9.7)	28 (90.3)	31 (100)		
> 3 - 5 Years	3 (13.6)	19 (86.4)	22 (100)		
> 5 years	1 (7.7)	12 (92.7)	13 (100)		
Total	7 (9.7)	65 (90.3)	72 (100)		
Critical care nursing training course					
Yes	5 (35.7)	9 (64.3)	14 (100)	Fisher's exact test	0.002*
No	2 (3.4)	56 (96.6)	58 (100)		
Total	7 (9.7)	65 (90.3)	72 (100)		

P- Value significant at $p < 0.05$

4.3 LOGISTIC REGRESSION ANALYSIS OF SELF REPORTED RESPONSES

During logistic regression analysis as presented in Table 4.13 below, the researcher sought to analyze factors that determine the adherence to measures of ventilator associated pneumonia prevention. While doing the bivariate analysis, the researcher assessed the association of individual characteristics (age, gender, education level, experience and critical care nursing course) with overall adherence to measures for preventing VAP or adherence to endotracheal tube, hand washing, patient positioning and oral hygiene. This association was tested for both the participants' responses (N=72) and participants observation (N=30). During the association testing using chi-square testing and fisher's exact test, only one factor (critical care nursing course) was associated with adherence to endotracheal tube suctioning and overall adherence to all measures for preventing ventilator associated pneumonia in both participants' responses and participants' observation. Since overall adherence to measures for prevention of ventilator associated pneumonia and adherence to endotracheal tube suctioning were both binary outcomes, we used logistic regression analysis to determine if critical care nursing course can predict both outcomes in the participants responses (N=72) or in the observation responses (N=30). For participants' responses, nurses working in ICU who were trained with critical care nursing course were 15.5 times more likely to adhere to all measures for VAP prevention. On the other hand, nurse with the same training were 14.1 times more likely to adhere to endotracheal suctioning.

Table 4.13: Simple logistic regression of adherence to measures for VAP prevention

		PARTICIPANTS RESPONSES (N=72)		
Independent variable	**Dependent variables**	**Odds ratio (OR)**	**95% CI**	**P-value**
Critical care nursing training course	Adherence to endotracheal tube suctioning	14.1	3.3-58.5	0.001*
Critical care nursing training course	Adherence to all measures of hand washing, oral hygiene positioning of the patient and endotracheal tube suctioning	15.5	2.6-92.6	0.003*

4.4 DESCRIPTIVE ANALYSIS OF THE PARTICIPANTS OBSERVED VAP PREVENTIVE PRACTICES

Descriptive analysis of the participants observed practice was used to interpret the demographic characteristics data: age, gender, years working in intensive care unit, critical care nursing course and critical care nursing qualification. Practice to hand washing, oral hygiene, endotracheal suctioning and patients positioning as well as adherence to all measures for preventing ventilator associated pneumonia were presented in tables showing frequencies and percentages.

4.4.1 DEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS OBSERVED

An observation checklist was used to assess practice of nurses working in ICUs for preventing ventilator associated pneumonia. Of the 30 participants observed, the majority [18 (60%)] were aged between 30 and 39years. Concerning gender characteristics of the participants observed, 17 (56.7%) were female. With regard to the education level of the participants observed, the majority [22 (73.3%)] had diploma in General Nursing and a large proportion of 25 (83.3%) had no critical care nursing course. Concerning their work experience in ICUs, 20 (66.7%) of participants observed, had 3 to 5 years of working experience. Table 4.14 below shows characteristics of the participants observed in frequencies and percentages.

Table 4.14: Demographic characteristics of the participants observed

General characteristics	Participants observed (N = 30)	
	Frequency	**Percentage**
Age		
20-29	9	30.0
30-39	18	60.0
40 and above	3	10.0
Total	**30**	**100.0**
Gender		
Female	17	56.7
Male	13	43.3
Total	**30**	**100.0**
Education level		
Advanced diploma (A1)	22	73.3
Bachelor's degree (A0)	8	26.7
Total	**30**	**100.0**
Critical care nursing training course		
Yes	5	16.7
No	25	83.3
Total	**30**	**100.0**
Working experience in ICUs		
6 Months -1 Year	1	3.3
>1 - 3 Years	20	66.7
> 3 - 5 Years	8	26.7
5 Years and above	1	3.3
Total	**30**	**100.0**

4.4.2 OBSERVED PRACTICE OF HAND WASHING OR SANITISATION

Of the 30 participants observed, 26 (86.7%) washed their hands before entering in ICU, 25 (83.3%) before touching the patient, 26 (86.7%) after touching the patient, 27 (90.0%) after touching different patients and 28 (93.3%) after contact with a source of microorganisms. Table 4.15 below shows frequencies and percentages of hand washing practice.

Table 4.15: Summary statistics of observed hand washing practice

Washed or sanitized hands	**Participants observed (N =30)**		
	Yes n (%)	**No** n (%)	**Total** n (%)
before entering in ICU	26 (86.7)	4 (13.3)	30 (100)
before touching patient	25 (83.3)	5 (16.7)	30 (100)
after touching patient	26 (86.7)	4 (13.3)	30 (100)
after touching different patients	27 (90.0)	3 (10.0)	30 (100)
after contact with a source of microorganisms	28 (93.3)	2 (6.7)	30 (100)

4.4.3 OBSERVED PRACTICE OF PATIENTS POSITIONING

Of the 30 participants, a large proportion 24 (80.0%) of participants positioned patients at an angle of 30^0 to 45^0 while the remaining 6 (20.0%) did not. Table 12 below shows frequencies and percentages of patients positioned at angle of 30^0 to 45^0. Table 4.16 below shows the frequencies and percentages of the patient positioning.

Table 4.16: Summary statistics of observed patient positioning practices

	PARTICIPANTS OBSERVED (N=30)	
Head of the bed elevated at an angle of 30^0 to 45^0	**Yes n(%)**	**No n(%)**
	24 (80.0)	6 (20.0)

4.4.4 OBSERVED PRACTICE OF ORAL HYGIENE

Of the 30 participants observed, all [30 (100%)] participants wore clean gloves before oral hygiene and also all of them [30 (100%)] suctioned secretions as they accumulated but only a small proportion [19 (63.3%)] washed or sanitized their hands before oral hygiene while 11(36.7%) did not. Table 4.17 below shows oral hygiene practices in frequencies and percentages.

Table 4.17: Summary statistics of observed oral hygiene practice

	PARTICIPANTS OBSERVED (N=30)	
Oral hygiene	**Yes** **n (%)**	**No** **n (%)**
Wash or sanitize hands before oral hygiene	19 (63.3)	11(36.7)
Explaining to patient about the procedure	17 (56.7)	13 (43.3)
Wear clean gloves	30 (100.0)	0.0 (0.0)
Cleaned mouth using toothbrush or gauze moistened with water	26 (86.7)	4 (13.3)
Rinsed mouth with a clean swab	26 (86.7)	4 (13.3)
Suctioned secretions as they accumulate, if necessary	30 (100.0)	0.0 (0.0)
Cleaned equipment and return it to its proper place	26 (86.7)	4 (13.3)
Washed or sanitized hands after oral care	27 (90.0)	3 (10.0)

4.4.5 OBSERVED PRACTICE OF ENDOTRACHEAL TUBE SUCTIONING

Of the 30 participants observed, a large proportion of 28 (93.3%) participants washed or sanitized their hands after suctioning but only 11 (36.7%) washed or sanitized hands before suctioning. Half of them, [15 (50.0%)] prepared sterile equipment required during suctioning, 15 (50.0%) wore sterile gloves and 14 (46.7%) inserted the catheter into the ETT gently using aseptic technique. Only 11(36.7%) discarded suction tube immediately after one single use.

Half of them [15 (50.0%)] checked cuff pressure. A small proportion of 5 (16.7%) participants wore face masks while only 6 (20.0%) wore aprons. Table 4.18 below shows the participants observed on an endotracheal tube suctioning in frequencies and percentages.

Table 4.18: Summary statistics of observed endotracheal tube suctioning practices

	PARTICIPANTS OBSERVED (N=30)	
Endotracheal tube suctioning	**Yes n (%)**	**No n (%)**
Washed or sanitized hands before suctioning	11(36.7)	19(63.3)
Explained to patient about the procedure	11(36.7)	19(63.3)
Wore apron	6 (20.0)	24(80.0)
Wore face mask	5 (16.7)	25(83.3)
Prepared sterile equipment required during suctioning	15 (50.0)	15(50.0)
Ensured environmental cleanliness	21 (70.0)	9(30.0)
Wore sterile gloves	15 (50.0)	15(50.0)
Inserted the catheter into the ETT gently using aseptic technique	14 (46.7)	16(53.3)
Discarded suction tube immediately after one single use	11 (36.7)	19 (63.3)
checked cuff pressure	15 (50.0)	15 (50.0)
Washed or sanitized hands after suctioning	28 (93.3)	2 (6.7)
Documentation	25 (83.3)	5 (16.7)

4.4. 6 OBSERVED ADHERENCE TO ALL MEASURES OF VAP PREVENTION

During observation, the observer observed the participants and offered the role to confirm adherence of the participant if he/she practiced correctly step by step each measure according to the standard guidelines and policies. Therefore, the overall adherence was considered on the participant observed if he/she had practiced correctly all measures without missing even one step. Of the 30 participants observed, a large proportion of 24 (80%) were adhering to patient position at an angle of 30-45 degrees and in the overall in all measures only 4 (13.3%) of the participants were adhering. Table 4.19 below shows the adherence rates determined as frequencies and percentages.

Table 4.19: Summary statistics of observed adherence to all measures of VAP prevention

	PARTICIPANTS OBSERVED (N =30)		
	Yes	**No**	**Total**
Adherence to measures	**n (%)**	**n (%)**	
Adherence to hands washing or sanitization	14 (46.7)	16 (53.3)	30 (100)
Adherence to oral hygiene	10 (33.3)	20 (66.7)	30 (100)
Adherence to patient positioning at an angle of 30^0 to 45^0	24 (80)	6 (20)	30 (100)
Adherence to endotracheal tube suctioning with sterile technique	6 (20)	24 (80)	30 (100)
Adherence to all measures (hand washing, oral hygiene, position of the patient and endotracheal suctioning)	4 (13.3)	26 (86.7)	30 (100)

4.5 BIVARIATE ANALYSIS OF THE OBSERVED PARTICIPANTS

Bivariate analysis of the observed participants was used to determine association between demographic characteristics: age, sex, education level, years working in ICU and critical care nursing course and observed adherence to all measures for preventing VAP in relation to practice of hand washing, oral hygiene, patient positioning and endotracheal suction.

4.5.1 DEMOGRAPHIC CHARACTERISTICS AND OBSERVED ADHERENCE TO PRACTICE OF HAND WASHING

Table 4.20 below, targeted to determine the association between socio demographic characteristics and adherence to measure of hand washing practice. The Fisher's exact test calculated and revealed that there were no statistical significant relationships found because for each variable p-value was greater than 0.05.

Table 4.20: Association between demographic characteristics and observed adherence to practice of hand washing

Demographic Characteristics	PARTICIPANTS OBSERVED (N=30)				
	Adherence to measure of hand washing or sanitization				
	Adherence n (%)	Non adherence n (%)	Total n (%)	Statistical test used	P- value
Age					
20-29 Years	5 (50)	5 (50)	10 (100)	Fisher's exact test	0.316
30-39 Years	9 (52.9)	8 (47.1)	17 (100)		
40 and above	0	3 (100)	3 (100)		
Total	14 (46.7)	16 (53.3)	30 (100)		
Gender					
Female	8 (47.1)	9 (52.9)	17 (100)	Fisher's exact test	0.999
Male	6 (46.2)	7 (53.8)	13 (100)		
Total	14 (46.7)	16 (53.3)	30 (100)		
Education level					
Advanced diploma (A1)	10 (45.5)	12 (54.5)	22 (100)	Fisher's exact test	0.999
Bachelor's degree (A0)	4 (50)	4 (50)	8 (100)		
Total	14 (46.7)	16 (53.3)	30 (100)		
Years of experience					
6 Months -1 Year	1 (100)	0 (0)	1 (100)	Fisher's exact test	0.352
>1 - 3 Years	8 (40)	12 (60)	20 (100)		
> 3 - 5 Years	5 (62.5)	3 (37.5)	8 (100)		
> 5 years	0 (0)	1 (100)	1 (100)		
Total	14 (46.7)	16 (53.3)	30 (100)		
Critical care nursing training course					
Yes	2 (33.3)	4 (66.7)	6 (100)	Fisher's exact test	0.657
No	12 (50)	12 (50)	24 (100)		
Total	14 (46.7)	16 (53.3)	30 (100)		

P- Value significant at $p < 0.05$

4.5.2 DEMOGRAPHIC CHARACTERISTICs AND OBSERVED ADHERENCE TO PRACTICE OF PATIENT POSITIONING

Table 4.21 below showed the association between socio demographic characteristics and adherence to measure of oral hygiene practice. The Fisher's exact test and Pearson chi-square were calculated and there were no statistical significance between variables because for each variable p-value was greater than 0.05.

Table 4.21: Association between demographic characteristics and observed adherence to practice of patient positioning

Demographic Characteristics	PARTICIPANTS OBSERVED (N=30)				
	Adherence to measure of patient positioning				
	Adherence n (%)	Non adherence n (%)	Total n (%)	Statistical test used	P- value
Age					
20-29 Years	6 (60)	4 (40)	10 (100)	Fisher's exact test	0.221
30-39 Years	15 (88.2)	2 (11.8)	17 (100)		
40 and above	3 (100)	0 (0)	3 (100)		
Total	24 (80)	6 (20)	30(100)		
Gender					
Female	15 (88.2)	2 (11.8)	17 (100)	Fisher's exact test	0.360
Male	9 (69.2)	4 (30.8)	13 (100)		
Total	24 (80)	6 (20)	30(100)		
Education level					
Advanced diploma (A1)	19 (86.4)	3 (13.6)	22 (100)	Fisher's exact test	0.300
Bachelor's degree (A0)	5 (62.5)	3 (37.5)	8 (100)		
Total	24 (80)	6 (20)	30(100)		
Years of experience					
6 Months -1 Year	1 (100)	0 (0)	1 (100)	Fisher's exact test	0.772
>1 - 3 Years	15 (75)	5 (25)	20 (100)		
> 3 - 5 Years	7 (87.5)	1 (12.5)	8 (100)		
> 5 years	1 (100)	0 (0)	1 (100)		
Total	24 (80)	6 (20)	30(100)		
Critical care nursing training course					
Yes	3 (50)	3 (50)	6 (100)	Pearson chi-square	0.075
No	21 (87.5)	3 (12.5)	24 (100)		
Total	24 (80)	6 (20)	30(100)		

P- Value significant at $p < 0.05$

4.5.3 DEMOGRAPHIC CHARACTERISTICS AND OBSERVED ADHERENCE TO PRACTICE OF ORAL HYGIENE

Table 4.22 below shows the association between socio demographic characteristics and adherence to measure of oral hygiene practice. The fisher's exact test was calculated and there were no statistical significant relationships revealed between variables because for each variable p-value was greater than 0.05.

Table 4.22: Association between demographic characteristics and observed adherence to practice of oral hygiene

Demographic Characteristics	PARTICIPANTS OBSERVED (N=30)				
	Adherence to measure of oral hygiene				
	Adherence n (%)	Non adherence n (%)	Total n (%)	Statistical test used	P- value
Age					
20-29 Years	2 (20)	8 (80)	10 (100)	Fisher's exact test	0. 336
30-39 Years	6 (35.3)	11 (64.7)	17 (100)		
40 and above	2 (66.7)	1 (33.3)	3 (100)		
Total	10 (33.3)	20 (66.7)	30 (100)		
Gender					
Female	6 (35.3)	11 (64.7)	17 (100)	Fisher's exact test	0.999
Male	4 (30.8)	9 (69.2)	13 (100)		
Total	10 (33.3)	20 (66.7)	30 (100)		
Education level					
Advanced diploma (A1)	7 (31.8)	15 (68.2)	22 (100)	Fisher's exact test	0.999
Bachelor's degree (A0)	3 (37.5)	5 (62.5)	8 (100)		
Total	10 (33.3)	20 (66.7)	30 (100)		
Years of experience					
6 Months -1 Year	0 (0)	1 (100)	1 (100)	Fisher's exact test	0.648
>1 - 3 Years	6 (30)	14 (70)	20 (100)		
> 3 - 5 Years	3 (37.5)	5 (62.5)	8 (100)		
> 5 years	1 (100)	0 (0)	1 (100)		
Total	10 (33.3)	20 (66.7)	30 (100)		
Critical care nursing training course					
Yes	4 (66.7)	2 (33.3)	6 (100)	Fisher's exact test	0.141
No	6 (25)	18 (75)	24 (100)		
Total	10 (33.3)	20 (66.7)	30 (100)		

P- Value significant at $p < 0.05$

4.5.4 DEMOGRAPHIC CHARACTERISTICS AND OBSERVED ADHERENCE TO PRACTICE OF ENDOTRACHEAL SUCTIONING

In table 4.23 below, the association between general characteristics by adherence to measure of an endotracheal tube suctioning practices of ICU Nurses calculated and Fisher's exact test revealed that there were statistical significant associations between critical care nursing course and adherence to the measure of an endotracheal tube suctioning, (p-value = 0.001).

Concerning age group, gender, education level and years of experience, Fisher's exact test and Chi-square tests revealed that there were no statistical significant because for each variable p-value was greater than 0.05.

Table 4.23: Association between demographic characteristics and observed adherence to practice of endotracheal tube suctioning

Demographic characteristics	PARTICIPANTS OBSERVED (N=30)				
	Adherence to measure of an endotracheal tube suctioning				
	Adherence n (%)	Non adherence n (%)	Total n (%)	Statistical test used	P- Value
Age					
20-29 Years	4 (40)	6 (60)	10(100)	Fisher's exact test	0.221
30-39 Years	2(11.8)	15 (88.2)	17 (100)		
40 and above	0 (0)	3 (100)	3 (100)		
Total	6 (20)	24 (80)	30 (100)		
Gender					
Female	3 (17.6)	14 (82.4)	17 (100)	Pearson chi-square	0.999
Male	3 (23.1)	10 (76.9)	13 (100)		
Total	6 (20)	24 (80)	30 (100)		
Education level					
Advanced diploma (A1)	4 (18.2)	18 81.8)	22 (100)	Pearson chi-square	0.645
Bachelor's degree (A0)	2 (25)	6 (75)	8 (100)		
Total	6 (20)	24 (80)	30 (100)		
Years of experience					
6 Months -1 Year	0 (0)	1 (100)	1 (100)	Fisher's exact test	0.772
>1 - 3 Years	5 (83.3)	1 (16.7)	6 (100)		
> 3 - 5 Years	1 (12.5)	7 (87.5)	8 (100)		
> 5 years	0 (0)	1 (100)	1 (100)		
Total	6 (20)	24 (80)	30 (100)		
Critical care nursing training course					
Yes	5 (83.3)	1 (16.7)	6 (100)	Fisher's exact test	0.001*
No	1 (4.2)	23 (95.8)	24 (100)		
Total	6 (20)	24 (80)	30 (100)		

P- Value significant at $p < 0.05$

4.5.5 DEMOGRAPHIC CHARACTERISTICS AND OBSERVED ADHERENCE TO ALL MEASURES FOR VAP PREVENTION

Table 4.24 shows the associations between socio demographic characteristics and adherence to measures of hand washing, oral hygiene positioning of the patient and endotracheal tube suctioning for preventing Ventilator associated pneumonia. The Fisher's exact test was used to test the association at significance level of 0.05. It showed that the critical care nursing course was associated with adherence to practice of all measures (p-value =0.001). Regarding age group, gender, education level and years of experience, Fisher's exact test reveals that there was no statistical significance observed because for each variable p-value was greater than 0.05.

Table 4.24: Demographic characteristics and observed adherence to practice of the all measures for VAP prevention

Demographic characteristics	PARTICIPANTS OBSERVED (N=30)				
	Adherence to measures of hand washing, oral hygiene positioning of the patient and endotracheal suctioning				
	Adherence n (%)	Non-adherence n (%)	Total n (%)	Statistical test used	P- value
Age					
20-29 Years	2 (20)	8 (80)	10 (100)	Fisher's	0.752
30-39 Years	2 (11.8)	15 (88.2)	17 (100)	exact test	
40 and above	0 (0)	3(100)	3(100)		
Total	4 (13.30)	26 (86.7)	30 (100)		
Gender					
Female	2 (11.8)	15 (88.2)	17 (100)	Fisher's	0.999
Male	2 (15.4)	11 (84.6)	13 (100)	exact test	
Total	4 (13.3)	26(86.7)	30 (100)		
Education level					
Advanced diploma (A1)	2 (9.1)	20 (90.9)	22 (100)	Fisher's	0.284
Bachelor's degree (A0)	2 (25)	6(75)	8(100)	exact test	
Total	4 (13.3)	26(86.7)	30 (100)		
Critical care nursing training course					
Yes	4 (66.7)	2 (33.3)	6 (100)	Fisher's	0.001*
No	0 (0)	24 (100)	24 (100)	exact test	
Total	4 (13.3)	26(86.7)	30 (100)		
Years of experience					
6 Months -1 Year	0 (0)	1 (100)	1 (100)	Fisher's	0.999
>1 - 3 Years	3 (15)	17 (85)	20 (100)	exact test	
> 3 - 5 Years	1 (12.5)	7 (87.5)	8 (100)		
> 5 years	0 (0)	1(100)	1(100)		
Total	4 (13.3)	26 (86.7)	30(100)		

P- Value significant at $p < 0.05$

4.6 CONCLUSION

The results of this study were analyzed using descriptive and bivariate analysis as well as simple logistic regression analysis. The research findings were presented in frequencies and percentages showing in tables. Most of the nurses 63(87.5%) reported that they adhere to hand washing. Only 14 (46.7%) were observed to be adhering to hand washing practices.

On bivariate analysis, having critical care training course was the only variable significantly associated with adherence to endotracheal tube suctioning for both self-reported and observed data ($p = 0.001$ and $p = 0.002$, respectively). Simple logistic regression analysis showed that nurses with critical care nursing qualification were (OR 14.1: CI 3.3 - 58.5 and OR 15.5: CI 2.6 - 92.6 respectively) times more likely to adhere to endotracheal tube suctioning and to all measures for preventing VAP respectively.

CHAPTER FIVE: DISCUSSION

5.0 INTRODUCTION

The main aim of this study was to assess measures for preventing ventilator associated pneumonia among nurses working in intensive care units. Within this context, this chapter is providing the discussion between three independent variables which are demographic characteristics, promoting factors, possible barriers and one dependent variable which is an adherence to the implementation measures (hand washing, oral hygiene, positioning of the patient and endotracheal suctioning) for preventing ventilator associated pneumonia.

The conceptual framework was utilized to put the study in context. The number of these variables (independent and dependent) reflects the objectives which serve as the basis to discuss the findings of the study. The results of this study were based primarily on the data obtained from ICU nurses working in two selected governmental referral hospitals in Kigali.

A total of 72 participants (selected ICU nurses) completed a self-administered questionnaire and 30 were observed during their practices related to all measures for preventing ventilator associated pneumonia. The response rates were 100% respectively. The strengths and limitations are discussed.

5.1 DEMOGRAPHIC CHARACTERISTICS

Of the 72 participants, [38 (52.8%) had advanced diploma (A1) in General Nursing. A small proportion [14 (19.4 %)] had critical care nursing qualification and only 31 (43.1%) had a working experience of 1year - 3years. These results seem to indicate that by and large, the critical care nurses at the two study sites have limited qualification and experience in critical care nursing. In more advanced countries, almost twice the percentage of critical care certified nurses were reported. A cross sectional descriptive study in 8 Northern California hospitals on adherence to institution specific ventilator associated pneumonia prevention guidelines confirmed this disparity. A total of 576 critical care nurses participated in the survey and revealed that 40% had nursing specialty certification such as critical care registered nurse or trauma nurse course certified (Hiroko Kiyoshi-Teo, Michael D. Cabana and Froelicher, 2014, p. 209).

Of the 30 participants observed, a small majority [18 (60 %)] were aged 30 to 39, only 17 (56.7%) were female and moderate majority [22 (73.3%)] had diploma in general nursing while a large proportion of 25 (83.3%) had no critical care nursing course. Concerning their work experience in ICU, 20 (66.7%) of ICU Nurses observed had 3 to 5 years of working experience.

In the study done in Iran, for example on "compliance with the standards for prevention of ventilator associated pneumonia by nurses in the intensive care units", of 120 observed nurses in 11 ICUs of 4 hospitals affiliated to the Isfahan University of Medical Sciences, Isfahan, 85.8% of the nurses were women and 14.2% were men. Regarding work experience, 85.8% of the ICU nurses had less than 10 years of experience. A large proportion, of 98.3% nurses had a bachelor's degree and 1.7% had a master's degree (Tabaeian, Yazdannik and Abbasi, 2017,p.32).

In addition, there are added disparities in the sample size whereby bigger sample sizes of 120 opposed to the 30 observed in the current study participants. A smaller sample size can fail to detect existing differences and to predict outcomes.

5.2 ADHERENCE TO THE IMPLEMENTATION MEASURES FOR PREVENTING VENTILATOR ASSOCIATED PNEUMONIA

Under this objective of determining the adherence to the implementation measures for VAP prevention, the following four practices: hand washing, oral hygiene, positioning of the patient and endotracheal suctioning were investigated. For each practice, adherence was determined and then the overall adherence was determined. In this study 30 ICU nurses were observed during their practices. Fourteen (46.7%) adhered to hand washing or sanitization, a small proportion [10 (33%)] adhered to oral hygiene, a large proportion [24(80%)] adhered to patient positioning at an angle of 30-45 degree, and only 6 (20%) adhered to infection preventive measures of an endotracheal tube suctioning. The overall adherence to all measures for preventing ventilator associated pneumonia was found to be 100% for only 4 (13.3%) of the observed nurses. Although previous studies concluded that adherence to VAP prevention among nurses was generally unacceptable, the proportion of nurses with acceptable adherence levels were higher than in the present study.

A study done in Iran by Tabaeian, Yazdannik and Abbasi,(2017,p.32) on compliance with the standards for prevention of ventilator associated pneumonia by nurses in the intensive care units reported higher proportions of nurses adhering to VAP prevention practices.

The study was a descriptive study, where the sample size was 120 nurses in 11 ICUs at 4 hospitals affiliated to the Isfahan University of Medical Sciences, Isfahan. A checklist was used to evaluate the performance of 120 nurses in the ICU. It was composed of VAP preventive measures by referring to the centers for disease control and prevention (CDC). The result showed that an adherence to hand hygiene based on the standard hand washing protocols was 32.5%, oral hygiene was 87.5%, use of sterile techniques to suction the airway through open technique was 41.6% and 30-45° elevation of the head of the bed was 96.6 %.

Based on the recommended percentage adherence scale for VAP prevention of 0–25% adherence representing unacceptable, 26–50% representing average, 51–75% representing relatively acceptable, and 76 –100% representing acceptable adherence(Tabaeian, Yazdannik and Abbasi, 2017, p.33), the current study had acceptable adherence only for measure of positioning the patient at an angle of 30-45 degrees, average adherence to hand washing or sanitization and oral hygiene, and unacceptable adherence to endotracheal tube suctioning with sterile technique. However, in this study the overall adherence to all measures (hand washing, oral hygiene, position of the patient and endotracheal suctioning) for preventing VAP was found to be 4 (13.3 %) which was unacceptable.

5.2.1 HAND WASHING AND SANITIZATION

Of the 72 ICU nurses who responded to the questionnaires, a large majority [66 (91.7%)] washed or sanitized hands before entering in intensive care units, only 1 (1.4%) didn't because of lack of water, 2 (2.8%) because of lack of soap, 2 (2.8%) because of lack of alcohol rub and 1 (1.4%) because of forgetfulness. Those who washed or sanitized the hands before touching a patient were a large proportion of 68 (94.4%), only 2 (2.8%) did not because of lack of alcohol rub, 2 (2.8%) because of forgetfulness and 1 (1.4%) because of lack of time. A large proportion of [69 (95.8%)] washed or sanitized the hands after touching a patient, only 1 (1.4%) did not because of forgetfulness, 1 (1.4%) because of lack of alcohol rub and 1 (1.4%) because of lack of time. Those who washed or sanitized the hands after touching different patients were a good majority of 68 (94.4%), only 2 (2.8 %) did not because of forgetfulness and 2 (2.8%) because of lack of alcohol rub. A high number of 70 (97.2%) ICU nurses washed or sanitized hands after contact with source of microorganisms, 1 (1.4 %) did not because of lack of water and 1 (1.4%) because of lack of alcohol rub.

A large majority of 63 (87.5%) of the 72 respondents adhered to hand washing or sanitization. Of the 30 participants observed, large proportion of 26 (86.7%) washed their hands before entering in ICU, 25 (83.3%) before touching the patient, 26 (86.7%) after touching patient, 27 (90.0%) after touching different patients and 28 (93.3%) after contact with a source of microorganisms. However, only 14 (46.7%) of the 30 participants observed were adhering on hand washing or sanitization. Through those two different processes of collecting data, the researcher found that the adherence on hand washing or sanitization to those who responded by questionnaires was almost double than those who were observed.

However in the current study the self-reported questionnaires pretended to be positive while answering compared to the observed participants.

The association between the adherence to hand washing or sanitization and demographic characteristics were evaluated and there were no significance as the chi^2 p- value is significant at $p > 0.05$. This means that to have an adherence or not to washing or sanitization does not correlate with the level of education, critical care nursing courses, years of experience, age or gender. Hand washing is an advantage measure to prevent VAP from patients who undergo mechanical ventilation in intensive care unit.

A study conducted in Brazil by Santos and Celina, (2015, pp. 21–23) on "adherence to the five moments for hand hygiene among intensive care professionals". A total of 793 observations were analyzed from July to December 2012. The observation rate for hand washing was 43.7% and hand washing was not done in 446 (56.2%) of the observations. In the same study it was found that the most adherence to hand hygiene was among the physiotherapists (53.5%) and the less adherence was among the nursing staff (29.2%). The observations with the highest levels of compliance were "after touching the patient" (31.3%) and "after touching patient surroundings" (27.2%). Indications with the lowest adherence rates to hand hygiene were "before touching the patient" (18.4%) and "before aseptic procedure" (20.9%). Hand hygiene did not occur in 446 (56.4%) of the observations, which is worrying. Another study was conducted by Mahfouz, El Gamal and Al-Azraqi, (2013, pp. 730 –73) on "Hand hygiene non-compliance among intensive care units health care workers in Aseer Central Hospital, south-western Saudi Arabia". Observations were made of 236 as total number in Intensive Care Units of the hospital. Generally, hand washing hygiene noncompliance of 41.0% was observed. Only 36.2 % was observed using alcohol rub while 22.8% was observed in hand washing compliance.

In summary noncompliance was observed in five moments of hand washing as follows:

(1) before patient contact was observed in 59.3% ;.(2) after patient contact was observed in 16.9%; (3) after contact with patient surroundings was observed in 22.7%;(4) before aseptic procedure was observed in 52.7%; and (5) after body fluid exposure" was observed in 30.8%. Non-compliance of health care providers: (1) before patient contact, physicians were observed in 51.9%; nurses were observed in 60.9% and other health workers were observed in 66.7%.

(2) Before aseptic procedure, physicians were observed in 52.0%; nurses were observed in 87.0% and other health care workers were observed in 79.3%. (3) After body fluid exposure, physicians were observed in 12.5%; nurses were observed in 50.0% and other health workers were observed in 30.0%. (4) After patient contact, physicians were observed in 34.3%; nurses were observed in 8.1% and other health workers were observed in 14.8%. (5) After patient surrounding contact, physicians were observed in 46.3%; nurses were observed in 12.5% and other health workers were observed in 11.6%. As the implication for this study when compared to the findings of other's studies, it showed that the adherence of the observed participants of this study (46.7%) is almost the same as the adherence rate of 46.4% in the study conducted in Brazil by Santos and Celina, (2015, pp. 21–23) but it is a beat higher than 29.8% from the study conducted in Saudi Arabia by Mahfouz, El Gamal and Al-Azraqi, (2013, pp. 730 –731).

5.2.2 ENDOTRACHEAL TUBE SUCTIONING

Of the 72 participants, only 28 (38.9%) answered that they perform sterile technique of endotracheal tube suctioning while 38 (52.8%) they did not perform because of lack of materials and 6 (8.3%) because of lack of time. Sixty four [64(88.9%)] answered that to perform suctioning with a sterile technique is the nurses' responsibility. Only 23 (31.9%) of the participants adhered to the endotracheal suctioning with a sterile technique. Of 30 participants observed, a large proportion of 28 (93.3%) of ICU Nurses wash or sanitize their hands after suctioning but only 11 (36.7%) washed or sanitized hands before suctioning.

Half of them, [15 (50.0%)] prepared sterile equipment required before suctioning, 15 (50.0%) wore sterile gloves and only 14 (46.7%) inserted the catheter into the ETT gently using aseptic technique. Only 11(36.7%) discarded the suction tube immediately after one single use, 15 (50.0%) checked cuff pressure and a small proportion of 5 (16.7%) ICU nurses wore face mask while 6 (20.0%) wore an apron. Only 6 (20 %) of the 30 participants observed adhered to the endotracheal suctioning with a sterile techniques.

The association between the adherences to the endotracheal suctioning with a sterile technique and demographic characteristics was evaluated and there were a strong significance regarding to those who were trained in the critical care nursing with the p- Value of 0.01. This means that a procedure of the endotracheal suctioning with sterile techniques was performed by almost only those who were trained in the critical care nursing. There was no significance on other demographic characteristics (the level of education, age or gender).

Logistic regression analysis revealed that the nurses working in ICU who were trained with critical care nursing course were 14.1times more likely to adhere to an endotracheal tube suctioning than the other ICU nurses who had no critical care nursing course. Endotracheal suctioning is a procedure that may predispose the patients to the risk for ventilator associated pneumonia by increasing microbial colonization of the lower airway tract.

A non -sterile endotracheal tube suctioning practices have been observed worldwide during recent years and shown to have the adverse reactions. The health care providers need to take all necessary precautions to ensure patient safety and a high quality of nursing care (Jansson *et al.*,2013,p. 99).

The same was study conducted at University Hospital, Oulu, Finland on the "Evaluation of endotracheal suctioning practices of critical care nurses". The study was done on forty critical care nurses among them 98% were registered nurses with more than 10 years ICU experience. Practices of infection control: Prior hand disinfection to suctioning was 26 (72.2 %); wearing gloves was 40 (100%), wearing apron was 13 (32.5%); face mask worn was 39 (97.5); sterile procedure suctioning maintained was 25 (67.6%), cuff pressure checked was 21(56.8%). hand disinfection post suctioning was 21 (52.5 %). As the implication in the current study, only 14 (46.7%) inserted the catheter into the endotracheal tube gently using aseptic technique which is below compared to the study conducted at University Hospital, Oulu, Finland on the "Evaluation of endotracheal suctioning practices of critical care nurses" where the sterile procedure suctioning was maintained by 25 (67.6%). Lack of materials is the main reason why the endotracheal suctioning sterile procedures were not performed in the current study as 38 (52.8%) of the participants answered.

In study done in Finland by Jansson *et al.*, (2013,p. 216) on critical care nurses' knowledge of adherence to and barriers towards evidence-based guidelines for the prevention of ventilator associated pneumonia with the sample size of 101 participants revealed that an overall self-reported adherence of measures for preventing ventilator associated pneumonia was 84.0%.

The main self-reported barriers towards evidence-based guidelines were inadequate resources. Other barriers against included lack of time (14.3%) and forgetfulness (7.1%).

5.2.3 ORAL CARE

Of 72 participants who responded, only 33 (45.8%) of ICU Nurses answered that they perform oral care two times per shift to the patients who are mechanically ventilated, 13 (18.1%) did not perform because of lack of materials, 9 (12.5%) because of lack of time and 3 (4.2%) because of forgetfulness. Concerning the one who is responsible for making sure that the patients receive appropriate oral hygiene, a large proportion of 58 (80.6%) of participants reported that oral hygiene of the patients who are mechanically ventilated is a nurses' responsibility and the adherence to oral care was only 24 (33.3%).

Of the 30 participants observed, all 30 (100%) of them wore clean gloves before oral hygiene and also all of them [30 (100%)] suctioned secretions as they accumulated but only a small proportion of 19 (63.3%) washed or sanitized their hands before oral hygiene and the adherence to oral care was only 10 (33.3%).

The association between the adherence to oral care and demographic characteristics were evaluated and there were no significant associations as the Chi^2 p- value significant at $p > 0.05$.

Oral hygiene is the use of a sponge or tooth brush three times per day with an oral chlorhexidine gluconate (0.12%) to clean the inside of intubated patients' mouths (Atay and Karabacak, 2014, p. 822). It was published that tooth brushing with chlorhexidine for oral hygiene is important to reduce VAP. It was recommended that to use chlorhexidine gluconate to decrease VAP provide standard quality for the patients on mechanical ventilation. A study conducted in Croatia on oral hygiene by Par, Badovinac and Plancak, (2014, p. 76), states that it is an important factor for prevention of ventilator associated pneumonia and besides VAP prevention, its quality plays another important role in maintaining local health.

The study conducted at Badem School of Health Istanbul Turkey (2014) on "Oral care in patients on mechanical ventilation in intensive care unit" showed that 71% nurses performed an oral assessment before starting oral care but, none could describe what assessment tool was used. In another study by Atay and Karabacak, (2014, p. 827) on oral hygiene in patients on mechanical ventilation in intensive care unit, they mentioned that in ICU patients, oral hygiene is an important practice for preventing VAP. However, there is no standard on oral care tool, no clarity of oral care practice frequency, appropriate solution and materials.

In the study done in Brazil in 2014 on 'Adherence to the items in a bundle for the prevention of ventilator-associated pneumonia'. A total of 198 beds were assessed for 60 days using a checklist that consisted of the following items: bed head elevation to 30 to 45 degree and oral hygiene. Next, an educational lecture was delivered, and 235 beds were assessed for the following 60 days. Data were also collected on the incidence of ventilator acquired pneumonia. Adherence to the following ventilator care bundle items increased: bed head elevation from 18.7% to 34.5% and oral hygiene from 48.5% to77.8% (Amanda *et al.,* 2014, p.355).

As implication in the current study, adherence on the oral care was 33.3% lower than the adherence in the study done in the Brazil (48.5%). One of the main reasons in this study, the participants answered that they didn't have materials (18%) while in the study done in the Brazil they found that knowledge and skills about performing the oral care had big impact on the adherence as the pre-training adherence to the oral hygiene was 48.5% and after training it became 77.8%.

5.2.4 PATIENT POSITIONING

Of the 72 participants, 46 (63.9%) answered that they always positioned the patients at angle of 30^0 to 45^0 while 12 (16.7%) did not because of lack of time; 9 (12.5%) because of contraindications and 5 (6.9%) sometimes they forgot. A large proportion of 60 (83.3%) reported that ICU nurses were responsible for making sure that patients were positioned at an angle of 30^0 to 45^0. Only 11 (15.3 %) reported that is shared responsibility between doctors and nurses, 46 (63.9%) of the 72 respondents were adhering on positioning the patients at 30-45 degree. Of the 30 participants observed, a large proportion of 24 (80.0%) positioned the patients at an angle of 30^0 to 45^0 while the remaining 6 (20.0%) were not. A large proportion of 24 (80 %) of the 30 participants observed were adhering to positioning the patients on 30-45 degree.

The association between the adherence to positioning the head of the bed at 30-45 degree and demographic characteristics were evaluated and there were no significant associations as the Chi^2 P- value was at $p > 0.05$. This means that to have an adherence or not to positioning the head of the bed at 30-45 degree does not correlate with the level of education, critical care nursing course, years of experience, age or gender.

Head of bed elevation of gastric-fed patients on mechanical ventilation is significant nursing intervention to reduce gastro esophageal reflux, aspiration and VAP (Li Bassi and Torres, 2011, p. 57). Aspiration of gastric contents is initial channel of bacterial migration to the lungs and is a paramount factor in onset of ventilator associated pneumonia.

Outcomes of pulmonary aspiration depend on the volume and chemical composition of the aspirated material. However, positioning of the head of the bed between 30º and 45º is very important, unless medically contraindicated (Metheny and Frantz, 2013, p. 53).

Worldwide head of bed elevation compliance was 24.0%; and the median angle head of bed elevation was 24^0 (Llaurado-serra *et al.*, 2015, p. 329). In the study done in Brazil in 2014 on adherence to the items in a bundle for the prevention of ventilator-associated pneumonia. 198 beds were assesed pre training and 235 beds after the training then they detected that the adherence to the bed of head elevation at 30 to 45 degree increased from 18.7% to 34.5% respectively (Amanda *et al.*, 2014, pp. 355)

As implication in this study the adherence on the patient position at 30-45 degree was (80%) almost five times higher than the adherence in the study done in the Brazil (18.7%). the reason behind was that the health care providers were not skilled about the positioning of the head of the bed in mechanically ventilated patients because after getting the health care providers trained the adherences were improved to 34.5% compared to the pre training ones. Yet in the current study the reasons were lack of time, contraindications and forgetfulness in the descending order.

5.3 FACTORS PROMOTING PREVENTIVE MEASURES FOR VENTILATOR ASSOCIATED PNEUMONIA

This section discusses findings from data addressing the second objective of this study. The major factors focused on are critical care nursing training course and availability and implementation of policies /guidelines.

5.3.1 CRITICAL CARE NURSING TRAINING COURSE

Of 72 participant responses only 14 (19.4%) went through a critical care nursing training course while out of 30 observed participants, only 5 (16.7%) had a critical care nursing qualification. On further analysis, having a critical care nursing course was statistically significantly associated with adherence to correct measures for endotracheal tube suctioning as a prevention measure of VAP for both self-reported and observed practices (p-value = 0.002 and p-value =0.001 respectively). Jam Gatell *et al.* (2012, p. 290) expressed similar sentiments following their study conducted in Spain on assessment of a training programme for the prevention of ventilator associated pneumonia. Data collection was through a questionnaire completed by 48 (82·7%) professionals in the pre intervention phase and 31 (64·5%) in the post intervention phase. Adherence rate before training on the secretion aspiration was 9.8% and after getting training it increased to 34.1 %. Their results clearly demonstrated that training improved the adherence for prevention of ventilator associated pneumonia.

Another study done in Lebanon by Ismail and Zahran, (2015, p. 42- 48) on the effect of nurses training on VAP prevention guidelines on VAP incidence rate in a critical care unit. It was an experimental study where two groups of patients were sequentially enrolled.

It compared the knowledge and skills related to the ventilator associated pneumonia prevention guidelines of nurses before and after training. With respect to the head elevation of 30-45 degrees, it was found that only 25% of nurses adhered to this practice before the training compared to 91.7% of nurses after training p- value =0.000. This study demonstrated a drastic improvement of nurses' knowledge and skills regarding prevention of ventilator associated pneumonia after the training program. Additionally, the training program on prevention of ventilator associated pneumonia guidelines directed to nurses in ICU dramatically decreased the incidence of ventilator associated pneumonia. With the head of bed elevation of 30-45 degrees, it was that 25% of nurses only were adhered to this practice before the training compared to 91.7% of nurses after training p- value =0.000 (Ismail and Zahran, 2015, pp. 42- 48).

5.3.2 AVAILABILITY AND IMPLEMENTATION OF POLICY /GUIDELINES

The current study revealed that of the 72 participants, a large proportion [64 (88.9 %)] agreed to having a hand washing policy/ guideline but among those who had it, only [41 (56.9%)] read it always. Regarding oral hygiene, a small proportion [19 (26.4%)] reported to have had policy/ guideline and only [12 (16.7%)] read it always.

Concerning positioning of the head of the patients at an angle between 30-45 degree, a moderate proportion of 46 (63.9%) reported to have had policy/ guideline and only [30 (41.7%)] read it always. Regarding an endotracheal tube suctioning policy/ guideline, half of the participants [36 (50.0%)] reported to have had it and a small proportion of 17 (23.6%) read it always.

These results imply that, although policies and guidelines are available, nurses do not always read the documents. As shown in the section on barriers to implementation of preventive practices below, the reasons for not always reading the guidelines could be associated with heavy workload, lack of time and forgetfulness.

More evidence on impact of implementation of nursing guidelines on minimizing ventilator associated pneumonia among intensive care patients came from a study done in Saudi Arabia by Ibrahim and Youssef (2015, pp. 41-51). This was a quasi-experimental study design implemented in a medical and surgical intensive care nursing setting at King Fahd Hospital (Saudi Arabia). The study subject composed of two groups, the first group was made of 30 nurses who provided direct nursing care to the patients. In addition 180 patients divided into a control group of 90 and an experimental group of 90 patients admitted to intensive care units that received mechanical ventilation during the study period and were free from any signs of pneumonia.

As patient inclusion criteria, chest X-ray was used to screen for pneumonia before and after admission for both the control and experimental groups of patients.

The control group of 90 patients received ordinary nursing care and the experimental group of 90 patients received their care after applying nursing guidelines by nurses for minimizing ventilator associated pneumonia. The study revealed that 48.9% of studied patients had positive chest radiograph suggestive of ventilator associated pneumonia in pre nursing guidelines and this percentage decreased to 22.2% in post nursing guidelines.

Therefore, implementation of guidelines had an impact in reducing VAP.

5.4 BARRIERS TO IMPLEMENTATION OF MEASURES TO PREVENT VENTILATOR ASSOCIATED PNEUMONIA

This section discusses results on the suggested barriers to implementation of measures to prevent VAP. This study focused on barriers such as lack of materials, lack of time, workload as well as forgetfulness.

5.4.1 LACK OF MATERIAL RESOURCES

Of the 72 participants, 38 (52.8%) reported that they did not perform sterile endotracheal tube suctioning technique because of lack of materials. Also lack of materials was a barrier for performing oral hygiene as it was reported to be a limitation for 13 (18.1%) of participants.

For hand washing or sanitization, lack of water, soap and alcohol rub appeared not to be major barriers as only between 1 (1.4%) and 2 (2.8%) reported that they did not perform hand hygiene because of lack of these materials. Lack of proper resources for endotracheal tube suctioning and oral hygiene instead, appear to be the major barriers. However, resources such as water, soap and alcohol have been reported to be barriers elsewhere.

In a qualitative study conducted in Egypt by by Lohiniva *et al.* (2015, p. 669) on determinants of hand hygiene compliance in Egypt: building blocks for a communication strategy confirmed this assertion**.** Through focus group discussion, the majority of the nurses in both hospitals identified to the lack of hand hygiene due to a shortage of products (soap or alcohol) and sinks as the main constraint to complying with hand hygiene guidelines.

Another quantitative cross-sectional survey done in Finland by Jansson *et al.*, (2013,p.216) on critical care nurses' knowledge of adherence to and barriers towards evidence based guidelines for the prevention of ventilator associated pneumonia with the sample size of 101 participants revealed that an overall self- reported adherence of measures for preventing ventilator associated pneumonia was 84.0%. The main self-reported barriers towards evidence-based guidelines were inadequate resources.

5.4.2 LACK OF TIME / WORKLOAD AND FORGETFULNESS

From the findings of this study, it appears that lack of time; workload issues and forgetfulness are not major barriers in the implementation of preventive measures for VAP. This is because of the 72 participants in the current study, a small proportion [12 (16.7%)] did not perform endotracheal tube suctioning because of lack of time. Concerning oral hygiene 9 (12.5%) did not do it because of lack of time and 3 (4.2%) did not performed it because of forgetfulness. Regarding hand washing/sanitization, only [2 (2.8%)] did not perform it because of forgetfulness and only [1(1.4%)] because of lack of time.

Almost similar findings were reported in a quantitative cross-sectional survey done in Finland by Jansson *et al.*,(2013,p.219) on critical care nurses' knowledge of adherence to and barriers towards evidence-based guidelines for the prevention of ventilator associated pneumonia.

The study sample size was 101critical care nurses. Among barriers which limited the participants to perform procedures related to measures for preventing ventilator associated pneumonia was lack of time reported by 14.3% and forgetfulness by only 7.1%. On the contrary, in Egypt, it was reported that many respondents mentioned that heavy workload prevented them from following hand hygiene policies especially in the evening and night shifts. Others stated that the workload was always high and therefore it always impacted hand hygiene practices (Lohiniva *et al.*, 2015, p. 669). In conclusion, the present study revealed that the possible barriers for all measures for preventing ventilator associated pneumonia are lack of material resources for endotracheal tube suctioning and oral hygiene. Specific suctioning resources were pointed out to be sterile gloves and sterile endotracheal tube catheters.

5.5 STRENGTH AND LIMITATIONS

This section presents strength and limitations which are discussed hereunder.. One of the strengths for this study is the methodology specific on data collection, and research setting.

The method of data collection included both participants' responses and observation. The study observed how measures for the ventilator associated pneumonia prevention were conducted and the results were compared to how research participants responded by self-reporting.

This triangulation of data helped to control desirability bias (Hawthorne effect) where in normal conditions participants would be willing to respond in favor of what researchers need.

Another strength was that the researcher collected data on two referral hospitals. This helped to identify challenges ICU nurses face for preventing ventilator associated pneumonia in a more cross-cutting way rather than facility based challenges.

The calculated sample size for this study was 72. The minimum calculated sample size was maintained because the study achieved 100% response rate. This high response rate became strength because it maintained statistical power for the study. Although the minimum sample size was achieved and maintained, the sample size is still too small to generalize the findings beyond the study settings. Therefore the results of this study are true only for the University Teaching Hospital of Kigali (UTHK) and Rwanda Military Hospital (RMH)

5.6 CONCLUSION

This chapter five discussed the results obtained from the study. The research findings are discussed relating to study objectives, conceptual framework and integrated with findings from the literature. In addition, the strength and limitations were identified.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.0 INTRODUCTION

In the final chapter of this study a conclusion from the main findings are presented based on the objectives and questions of the study. Recommendations for the referral hospitals and for future research are also present.

6. 1 CONCLUSIONS

This study focused on determining adherence to all measures for VAP prevention namely hand washing or sanitization, positioning of patients at an angle of 30-45 degrees, oral hygiene and endotracheal tube suctioning. Adherence was found to be extremely very low and unacceptable among ICU nurses in this study. Only 7 (9.7%) self- reported and 4 (13.3%) observed participants demonstrated acceptable levels of adherence to VAP prevention strategies. The study also sought to assess the factors promoting measures for preventing VAP among nurses working in the intensive care units. Having a critical care nursing course was statistically significantly associated with adherence to correct measures for endotracheal tube suctioning as a preventive measure of VAP for both self- reported and observed practices (p-value = 0.002 and p-value =0.001 respectively).

Simple logistic regression analysis showed that nurses with critical care nursing qualification were 14 and 15.5 times more likely to adhere to endotracheal tube suctioning and to all measures for preventing ventilator associated pneumonia respectively (OR 14.1: CI 3.3 - 58.5 and OR 15.5: CI 2.6 - 92.6 respectively). Although practice guidelines were reported to be available for endotracheal suctioning, hand washing and positioning of the patient, less than 42% of participants reported that they always read the guidelines. Finally, the possible barriers on implementing preventive measures of VAP among nurses working in intensive care units were lack of material resources for endotracheal tube suctioning and oral hygiene.

6.3 RECOMMENDATIONS

This study recommended the following entities:

Referral hospitals

1. Provide the trainings related to the critical care nursing course, so that the ICU nurses can have the essential knowledge and skills to all measures for preventing ventilator associated pneumonia.
2. Consider the critical care nursing course for the recruitment of the new ICU nurses and provide the special continuous professional development (CPD) emphasizing on critical care nursing practices.
3. The authorities need to reconsider the staffing norms compared to international guidelines by sticking to 1:1 nurse patient ratio for mechanically ventilated patients.
4. To make and implement the policies/guidelines related to all measures for preventing ventilator associated pneumonia.
5. To avail all the materials required especially suction catheter and sterile gloves for each ETS procedure and 0.12% chlorhexidine gluconate antiseptic oral rinse to implement measures for preventing ventilator associated pneumonia.

Future researchers

1. The future researchers are recommended to conduct similar study by including a large sample size involving all health care providers in critical care units, not just nurses and extend the study to other referral hospital.

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ANNEXURES

ANNEXURE I

Permission for use of questionnaire

Hiroko Kiyoshi-Teo <kiyoshi@ohsu.edu> 5 September 2016 at 18:06
To: Ruririmbwa Ernest <ernestruri2000@gmail.com>

Dear Ruririmbwa Ernest,

Sorry for the delay in responding to your email. You have my permission to use the instrument from in "Adherence to institution-specific ventilator-associated pneumonia prevention guidelines" article published in AJCC. Please use appropriate citations, and I would appreciate if you can let me know of results of your study. It's very exciting that the instrument will be used in your study in Rwanda. I've visited your country about 10 years ago, and have fond memory of people and beautifully lush vegetation. Dr. Isabelle Soule, who may have been a visiting nurse scholar at your school, is a former colleague of mine at Oregon Health & Science University.

Best of luck with your study.

Kind regards,

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ANNEXURE II: QUESTIONNAIRE

Introduction

I am **RURIRIMBWA Ernest,** a student in the master of science in nursing, critical care and Trauma track at the University of Rwanda, college of medicine and health sciences, school of nursing and midwifery. In order to accomplish my studies, a final dissertation has to be written. My research project is entitled "**Assessing Measures For Preventing Ventilator Associated Pneumonia Among Nurses Working In Intensive Care Units: A Case Of Two Selected Referral Hospitals In Kigali".** Therefore I kindly request you to give me the required information on this questionnaire. Any information provided from you is purely for academic purposes and all responses will be treated with confidence. Your cooperation is most valued and appreciated.

Instructions:

1. Questionnaire is anonymous, so please don't mention your name
2. Please give answers to all questions except where skipping is required
3. Select the appropriate response by using a tick (√) and specify if needed.
4. Your contribution is highly appreciated for the success of this study

Section 1: Demographic information of respondents Each item has many options. Please tick one (√) which you find as appropriate for you and specify if needed.		
1.1	Age	1. 20 - 29 ☐ 2. 30 - 39 ☐ 3. 40 and above ☐
1.2	Gender	1. Female ☐ 2. Male ☐
1.3	What is your education level in nursing?	1. A2 ☐ 2. Advanced diploma (A1) ☐ 3. Bachelor's degree (A0) ☐ 4. Other (specify:….....) ☐
1.4	How long have you been working in the Intensive care units?	1. 6 Months -1 Year ☐ 2. 1year and 1month - 3years ☐ 3. 3years and 1month - 5years ☐ 4. 5years and above ☐

Section 2 : Questions related to the factors promoting measures for preventing ventilator associated pneumonia Please tick (√) which you find as appropriate for you and specify if any	
Have you ever had the critical care nursing course?	1.Yes ☐ 2.No ☐
What is your critical care nursing course certification?	1. No critical care nursing course ☐ 2. Certificate in critical care nursing ☐ 3. Diploma in critical care nursing ☐ 4. Other (specify…….) ☐
Do you have the hand washing policy /guideline at your unit?	1. Yes ☐ 2. No ☐
If yes, how often do you read it?	1. Always ☐ 2. Sometimes ☐ 3. Not read at all ☐
Do you have the oral hygiene policy/guideline at your unit?	1. Yes ☐ 2. No ☐
If yes, how often do you read it?	1. Always ☐ 2. Sometimes ☐ 3. Not read at all ☐
Do you have the position policy/guideline for mechanically ventilated patients at your unit?	1. Yes ☐ 2. No ☐
If yes, how often do you read it?	1. Always ☐ 2. Sometimes ☐ 3. Not read at all
Do you have an endotracheal tube suctioning policy/guideline at your unit?	1. Yes ☐ 2. No ☐
If yes, how often do you read it?	1. Always ☐ 2. Sometimes ☐ 3. Not read at all ☐

Section3: Questions related to the measures of hand washing or sanitization and its barriers Please tick (√) which you find as appropriate for you, specify if any and skip where is required		
Q3.1	Do you always wash or sanitize your hands before entering in intensive care units? If no, what are the reasons?	1.Yes ☐ 2. No (lack of water) ☐ 3. No (lack of soap) ☐ 4. No (lack of alcohol rub) ☐ 5. No (lack of time/ workload) ☐ 6. No (forgetfulness) ☐ 7. Other (specify:.....) ☐
Q3.2	Do you always wash or sanitize your hands before touching a patient? If no, what are the reasons?	1.Yes ☐ 2. No (lack of water) ☐ 3. No (lack of soap) ☐ 4. No (lack of alcohol rub) ☐ 5. No (lack of time/ workload) ☐ 6. No (forgetfulness) ☐ 7. Other (specify:.....) ☐
Q3.3	Do you always wash or sanitize your hands after touching a patient? If no, what are the reasons?	1.Yes ☐ 2. No (lack of water) ☐ 3. No (lack of soap) ☐ 4. No (lack of alcohol rub) ☐ 5. No (lack of time/ workload) ☐ 6. No (forgetfulness) ☐ 7. Other (specify:.....) ☐
Q3.4	Do you always wash or sanitize your hands after touching different patients? If no, what are the reasons?	1.Yes ☐ 2. No (lack of water) ☐ 3. No (lack of soap) ☐ 4. No (lack of alcohol rub) ☐ 5. No (lack of time/ workload) ☐ 6. No (forgetfulness) ☐ 7. Other (specify:.....) ☐
Q3.5	Do you always wash or sanitize your hands after contact with a source of microorganisms? If no, what are the reasons?	1.Yes ☐ 2. No (lack of water) ☐ 3. No (lack of soap) ☐ 4. No (lack of alcohol rub) ☐ 5. No (lack of time/ workload) ☐ 6. No (forgetfulness) ☐ 7. Other (specify:…...) ☐ **Please skip to Q 4.1**
Q3.6	**Note: This question is to be filled by the researcher** Is the respondent qualified to fulfill the conditions of adhering to measures of hand washing or sanitization for preventing ventilator associated pneumonia?	Yes ☐ No ☐

Section 4 : Questions related to the measures of oral hygiene; and its barriers Please tick (√) which you find as appropriate for you, specify if any and skip where is required		
Q4.1	Do you always provide oral hygiene for mechanically ventilated patients at least two times per shift? If no, what are the reasons?	1. Yes two times per shift ☐ 2. Yes once per shift ☐ 3. No (lack of materials) ☐ 4. No (lack of time/ workload) ☐ 5. No (forgetfulness) ☐ 6. Other (specify: .....) ☐
Q4.2	Who is responsible for making sure that patients receive appropriate oral hygiene?	1. Nurses' responsibility ☐ 2. ICU Nurse unit manager ☐ 3. Shared responsibility between doctors and nurses ☐ 4. Don't know ☐ **Please skip to Q 5.1**
Q4.3	**Note: This question is to be filled by the researcher** Is the respondent qualified to fulfill the conditions of adhering to the measures of oral hygiene for preventing ventilator associated pneumonia?	Yes ☐ No ☐
Section 5 : Questions related to the measures of patient positioning ; and its barriers Please tick (√) which you find as appropriate for you, specify if any and skip where is required		
Q5.1	Do you always position mechanically ventilated patients at angle of 30^0 to 45^0? If no, what are the reasons?	1. Yes ☐ 2. No (lack of time/ workload) ☐ 3. No (forgetfulness) ☐ 4. No (contraindications) ☐ 5. Other (specify: .....) ☐
Q5.2	Who is responsible for making sure that patients are positioned appropriately at an angle of 30^0 to 45^0 ?	1. Nurses' responsibility ☐ 2. ICU nurse unit manager ☐ 3. Shared responsibility between doctors and nurses ☐ 4. Don't know ☐ **Please skip to Q 6.1**
Q5.3	**Note: This question is to be filled by the researcher** Is the respondent qualified to fulfill the conditions of adhering to measures of patient positioning at an angle of 30^0 to 45^0 for preventing Ventilator associated pneumonia?	Yes ☐ No ☐

Section 6 : Questions related to the measures of an endotracheal tube suctioning; and its barriers Please tick (√) which you find as appropriate for you and specify if any		
Q6.1	Do you always perform an endotracheal tube suctioning with sterile technique? If no, what are the reasons?	1. Yes ☐ 2. No (lack of time/ workload) ☐ 3. No (forgetfulness) ☐ 4. No (contraindications) ☐ 5. Other (specify: .....) ☐
Q6.2	Who is responsible for making sure that an endotracheal tube suctioning is to be performed with sterile technique?	1. Nurses' responsibility ☐ 2. ICU nurse unit manager ☐ 3. Shared responsibility between doctors and nurse ☐ 4. Don't know ☐
This is the end of the questionnaire, the rest questions will be completed by the researcher. Thank you very much for your time to complete this form		
Q6.3	Is the respondent qualified to fulfill the conditions of adhering to measures of an endotracheal tube suctioning with sterile technique for preventing ventilator associated pneumonia?	Yes ☐ No ☐
Section 7 : Adherence to the all measures for preventing ventilator associated pneumonia (To be completed by the researcher)		
Q7.1	Is the respondent qualified to fulfill the conditions of adhering to the measures of hand washing, oral hygiene, position of the patient and endotracheal suctioning for preventing ventilator associated pneumonia?	Yes ☐ No ☐

ANNEXURE III : OBSERVATION CHECKLIST

Ticket √ will be used in the box provided

Start time of observations_____ End time of observations_____

Section 1: Personal information / Each item have many options. Please tick one (√) which you find as appropriate for you and specify if needed.		
1.1	Age	1. 20 - 29 ☐ 2. 30 - 39 ☐ 3. 40 and above ☐
1.2	Gender	1. Female ☐ 2. Male ☐
1.3	Education level	1. A2 ☐ 2. Advanced diploma (A1) ☐ 3. Bachelor's degree (A0) ☐ 4. Other (Specify:….....) ☐
1.4	Intensive care training	1. Yes ☐ 2. No ☐
1.5	Years of work experience as a critical care nurse	1. 6 Month -1 Year ☐ 2. 1year and 1month - 3years ☐ 3. 3years and 1month - 5years ☐ 4. 5years and above ☐

Section 2: Practice		1.YES	2.NO
2. Hand washing or sanitization			
2.1	Before entering in intensive care unit		
2.2	Before patient touching		
2.3	After patient touching		
2.4	After touching different patient		
2.5	After contact with a source of microorganisms		
3. Suctioning from the ETT/tracheotomy			
3.1	Wash or sanitize hands before suctioning		
3.2	Explaining to patient about the procedure		
3.3	Apron worn		
3.4	Face mask worn		
3.5	Prepare sterile equipments required during suctioning		
3.6	Ensuring environmental cleanness		
3.7	Wear sterile gloves		
3.8	Insert the catheter into the ETT gently by using aseptic technique		
3.9	Discard suction tube immediately after one single use		
3.10	Cuff pressure checked		
3.11	Wash or sanitize hands after suctioning		
3.12	Documentation		
4. Patient position			
4.1	Head of the bed elevated at angle of 30^0 to 45^0		
Oral care			
5.1	Wash or sanitize hands before oral care		
5.2	Explaining to patient about the procedure		
5.3	Wear clean gloves		
5.4	Clean mouth using toothbrush or gauze moistened with water		
5.5	Rinse mouth with a clean swab		
5.6	Suction secretions as they accumulate, if necessary		
5.7	Clean equipment and return it to its proper place		
5.8	Wash or sanitize hands after oral care		
5.9	Documentation		

ANNEXURE IV: INFORMATION DOCUMENT

Project title:	Assessing measures for preventing ventilator associated pneumonia among nurses working in intensive care units: A case of two selected referral hospitals in Kigali
Study Principal Investigator:	**RURIRIMBWA ERNEST** University of Rwanda, College of Medicine and Health Sciences School of Nursing and Midwifery. E-mail Address: ernestruri2000@gmail .com Cell : +250788477863 Kigali, Rwanda.
Supervisor :	**Prof. BUSISIWE ROSE MARY BHENGU** University of KwaZulu –Natal School of Nursing and Public health: Discipline of Nursing E-mail Address: Bhengub2@ukzn.ac.za Bhengub2@gmail.com Cell:+27836615563/+250782333732 Fax No: +27312601543

1. INTRODUCTION.

This research project assesses measures for preventing ventilator associated pneumonia among nurses working in intensive care units in selected two referral hospitals in Kigali, Rwanda. Those referral hospitals are Rwanda Military Hospital (RMH) and University Teaching Hospital of Kigali (UTHK) with the aim of assessing measures for preventing ventilator associated pneumonia (VAP) among nurses working in intensive care units. While focusing on a number of variables such as independent variables and dependent variables. With independent variables being presented in four categories (1) demographic characteristics such as age, gender, education level and years of experience, (2) promoting factors that includes critical care nursing course, availability of policy/guideline and use of policy/guideline, (3) possible barriers like lack of materials, lack of time, workload and forgetfulness.

(4) dependent variables such as hand washing, oral hygiene**,** positioning of the patient and endotracheal suctioning. The study is being conducted by researcher while making continuous interactions with nurses working in intensive care units. The information in this document is made to help you decide whether or not to take part in this study since it is voluntarily to participate, but first there a few things to note.

1. You are being asked to participate in this research because you are nurses working in the intensive care units of the above referral hospitals, and an adult of legal consenting age.
2. You will be offered a questionnaire to fill in during your free time.
3. You will be observed during your practice
4. Please feel free to ask if you have any questions or concerns at any time before the start or during the period of carrying out this research.

2. WHY IS THIS RESEARCH BEING CONDUCTED?

The aim of this collaborative research project is to assess measures for preventing ventilator associated pneumonia among nurses working in intensive care units. We will do this by improving measures of ICU nurses on ventilator associated pneumonia prevention. Also this can guide hospital policy makers to come up with prevention and control protocols to enhance the existing measures with an intention of shortening patients' length of stay in ICUs and decrease the risk of morbidity and mortality rate.

3. HOW WILL THE STUDY BE CONDUCTED?

The researcher will approach nursing staff according to their shifts of work (day and/or night shifts). Those who agree to participate in the study will sign a consent form, and will be informed about the use of code number instead of participants' name. The questionnaires will be in English and French since these are languages of education and working as far as care given to patients is concerned. The respondents will complete the questionnaire in their free time such that it does not interrupt their work. Each respondent will read and respond to the questions and the researcher will be available to answer any question from respondents though he will keep away from close proximity to the participants while filling in the forms for anonymity. The researcher will also conduct observation on implementation measures for preventing

ventilator associated pneumonia in critical settings among referral hospitals. An appointment for data collection will be booked in collaboration with the head of the department of ICUs in each health facility.

4. POSSIBLE RISKS TO YOU:

We anticipate that your participation in the study/research presents no risk to you as an individual. However, participation in this study might in some way interfere with your work if you are required to participate in study activities during working hours.

5. POSSIBLE BENEFITS TO YOU.

There will be no direct benefit to you from participating in this study and there is no promise of gaining any material or financial benefit from the project currently or in the future. Your participation in the study could contribute to improving measures of VAP prevention that aimed at improving ICUs patients' outcomes, decreasing mortality and morbidity, hospital length of stay and decreasing treatment costs.

6. COST TO THE PARTICIPANT.

You will incur no cost whatsoever other than time as a result of taking part in the study.

7. COMPENSATION.

You will not gain any form of compensation, monetary or otherwise for participating in the study this is due to fact that the study is not being funded.

8. CONFIDENTIALITY.

The information you give during the conduct of this research will be kept confidential in accordance to the ethical standards agreed upon by the local and international organizations governing the conduct of research involving human participants. Any information resulting from this study, if published in scientific journals or presented at scientific meetings, will not reveal your identity.

9. RIGHT TO REFUSE/WITHDRAW.

Your participation in this research is purely voluntary and you are free to decline to take part or withdraw at anytime without any repercussions.

10. QUESTIONS ABOUT THE RESEARCH

In case of any further questions, please contact Mr. RURIRIMBWA Ernest , the Principal Investigator at University of Rwanda College of Medicine and Health Sciences, School of Nursing and Midwifery, Kigali Rwanda: Tel: +250788477863

In case of questions in regards to research ethics, you may contact Prof. GAHUTU Jean Bosco, Director for Research, Innovation and Postgraduate studies, College of Medicine and Health Sciences, Kigali Rwanda: Tel: +250783340040

ANNEXURE V: INFORMED CONSENT FORM

I**……..**consent /accept to participant in this research project entitled : **Assessing measures for preventing ventilator associated pneumonia among nurses working in intensive care units: A case of two selected referral hospitals in Kigali**. Conducted by RURIRIMBWA Ernest, UR/CMHS/ Nyarugenge Campus.

The information about this study has been availed and explained to me and all my questions have been answered. I have read this form and I feel that I have had enough information and time to consider my decision to join the study. I fully understand that by signing this form, I do not waive any of my legal rights, nor does it relieve the study investigators their duty (liability), but merely indicates that I have been informed about the research study in which I am voluntarily agreeing to take part. Having understood all the information pertaining to this study I therefore agree to my participation in this study by appending my signature and name below.

Research Participant

Name: Signature:

_____ _____

Date: Tel number:

_____ _____

ANNEXURE VI: ETHICAL CLEARANCE APPROVAL

UNIVERSITY OF RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 09/01/2017
Ref: CMHS/IRB/004/2017

RURIRIMBWA Ernest
School of Nursing and Midwifery , CMHS, UR

Dear RURIRIMBWA Ernest

RE: ETHICAL CLEARANCE

Reference is made to your application for ethical clearance for the study entitled ***"Assessing Measures For Preventing Ventilator Associated Pneumonia Among Nurses Working In Intensive Care Units: A Case Of Two Selected Referral Hospitals In Kigali"***

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.

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

IRB CMHS-UR

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

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

ANNEXURE VII: REQUEST LETTER TO COLLECT DATA

UNIVERSITY OF RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

Kigali, on 30 / 01 /2017

Ref. No: ...74.../ 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 **RURIRIMBWA ERNEST** a final year student in the Masters of Science in Nursing at the University of Rwanda/College of Medicine and Health Science to collect data for his/her research dissertation entitled **"Assessing Measures For Preventing Ventilator Associated Pneumonia Among Nurses Working In Intensive Care Unit: A Case Of Two Selected Referral Hospital In Kigali"**
This exercise that is going to take a period of 2 months starting from 13th February 2017 to 12th April 2017 will be done at the **University Teaching Hospital of Kigali and Rwanda Military Hospital.**

We are looking forward for your usual cooperation.

Sincerely,

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

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

ANNEXURE VIII: APPROVAL NOTICE FROM UNIVERSITY TEACHING HOSPITAL OF KIGALI

C.H.U.
Quality Health Care
Training & Research

CENTRE HOSPITALIER UNIVERSITAIRE
UNIVERSITY TEACHING HOSPITAL

Ethics Committee / Comité d'éthique

February 10th, 2017 **Ref.: EC/CHUK/269/2017**

Review Approval Notice

Dear Ruririmbwa Ernest,

Your research project: ***"Assessing measures for preventing ventilator associated pneumonia among nurses working in intensive care units."***

During the meeting of the Ethics Committee of University Teaching Hospital of Kigali (CHUK) that was held on 10/02/2017 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,

DR. STEPHEN RULISA
HEAD - DEPARTMENT OF CLINICAL RESEARCH
CHUK

Dr Stephen Rulisa
The President, 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 Tél. Fax : 00 (250) 576638 E-mail :chuk.hospital@chukigali.rw

Q

ANNEXURE IX: APPROVAL NOTICE FROM RWANDA MILITARY HOSPITAL

REPUBLIC OF RWANDA
RWANDA MILITARY HOSPITAL
Website: www.rwandamilitaryhospital.rw
P.O. Box: 3377 Kigali, Tel: (+250)252586420, Hotline: 4060
E-mail: info@rwandamilitaryhospital.rw

February 3rd, 2017 **Ref.: EC/ RMH/ 106/ 2017**

REVIEW APPROVAL NOTICE

Dear **RURIRIMBWA Ernest**
UNIVERSITY OF RWANDA

Your research project: **"Assessing Measures for Preventing Ventilator Associated Pneumonia among Nurses Working in Intensive Care Units: A case of Two Selected Referral Hospitals in Kigali".**

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

Email: Info@rwandamilitaryhospital.rw
Tel: 0252586420
P.o Box: 3377RWANDA MILITARY HOSPITAL