

**EVALUATION OF NURSES' KNOWLEDGE AND PREVENTION PRACTICES OF  
VENTILATOR ASSOCIATED MORBIDITIES IN CRITICAL CARE UNIT,  
KENYATTA NATIONAL HOSPITAL**

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REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN  
CRITICAL CARE NURSING OF THE UNIVERSITY OF NAIROBI.**

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## **DECLARATION**

I, Pauline Malombe declare that this proposal on Evaluation of nurses' knowledge and prevention practices of ventilator associated morbidities in Critical care Unit (CCU), Kenyatta National Hospital(KNH) is my original work, and has not been presented anywhere else whatsoever or been used for any other award in any other institution.

Sign.....

Date.....

## **CERTIFICATE OF APPROVAL**

We, the undersigned certify that this research has been submitted for the degree of Master of Science in Nursing (Critical Care) of the University of Nairobi with our approval as supervisors.

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## **DEDICATION**

I dedicate this work to my family; to my spouse Mr. Benedict Malombe Nzovo and son Kenneth Nzovo Malombe for their enduring support, understanding and encouragement throughout the study.

## **ACKNOWLEDGEMENT**

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## OPERATIONAL DEFINITIONS

<b>Daily minimum FiO<sub>2</sub>:</b>	The lowest value of FiO <sub>2</sub> that is set on the ventilator and Maintained for at least 1 hour
<b>Daily minimum PEEP:</b>	The lowest value of PEEP that is set on the ventilator and maintained for at least 1 hour.
<b>Date of event:</b>	The date of onset of worsening oxygenation.
<b>Denominator Data:</b>	Ventilator days, the numbers of patients managed with ventilatory devices for the month
<b>Desaturation:</b>	Oxygen saturation at or below 90%
<b>Episode of mechanical ventilation:</b>	A period of days during which the patient was mechanically ventilated for some portion of each consecutive day.
<b>High frequency ventilation:</b>	Ventilation >60 breaths per minute with small tidal volumes
<b>Location of attribution:</b>	Patients location at the date of event
<b>Morbidity:</b>	Ventilator associated lung infection and/ or complications occurring in a patient within 48 hours or more after intubation with an endotracheal tube or tracheostomy tube and which was not present before. Morbidity be used interchangeably with VAE
<b>National Healthcare Safety Network:</b>	A national standards-setting organization focused on improving healthcare quality
<b>New antimicrobial agent:</b>	Any agent initiated on or after the third day of mechanical ventilation
<b>Numerator Data:</b>	Each VAE that identified during the month selected for surveillance; ventilation and in the VAE Window Period
<b>Patient days:</b>	A count of the number of patients in the patient care location during a time period.

<b>Pneumonia:</b>	Inflammation of the lung parenchyma caused by infection.
<b>Process measures:</b>	Continuous and frequent measurement and feedback on the bundle implementation
<b>The EMV denominator:</b>	Represents the sum of the number of episodes of mechanical ventilation that occurred during the month.
<b>The Hospital:</b>	Kenyatta National Hospital
<b>The knowledge</b>	knowledge on VAE and its prevention measures
<b>The patient:</b>	A Critically ill patient in CCU KNH who is intubated/ tracheostomy and is on Mechanical ventilation
<b>The practice</b>	VAE prevention practice
<b>The unit:</b>	Critical Care Unit, KNH
<b>VAE prevention practice</b>	VAE care bundle guidelines, the practice.
<b>VAE Window Period</b>	The time period when all elements of a definition must be met. It usually includes the 2 days before and the 2 days after the date of event.
<b>Ventilator Associated Event:</b>	Lung infection and or complication occurring in a patient within  48 hours or more after intubation with an endotracheal tube or tracheostomy tube and which was not present before- <i>see morbidity</i>
<b>Ventilator Associated Pneumonia:</b>	Lung infection occurring in a patient within 48 hours or more after intubation with an endotracheal tube or tracheostomy tube and which was not present before
<b>Ventilator:</b>	A device to assist or control respiration through a tracheostomy or by endotracheal intubation.
<b>Wet chest:</b>	Airways filled with secretions leading to difficult breathing
<b>Worsening oxygenation:</b>	The first calendar day in which the daily minimum PEEP $\geq 3$ cm H <sub>2</sub> O or FiO <sub>2</sub> increases $\geq 20\%$ following a $\geq 2$ -day period of stability or improvement on the ventilator

## **LIST OF ABBREVIATIONS AND ACRONYMS**

**AHA:** The American Hospital Association

**APRV:** Airway Pressure Release Ventilation

**CCU:** Critical Care Unit

**CDC:** Center for Disease Control and Prevention

**DVT:** Deep vein thrombosis

**EMV:** Episode of mechanical ventilation

**HRET:** Health research and Educational Trust

**HAI:** Hospital acquired infections

**ICHS:** Institute for Clinical Systems Improvement

**ICU:** Intensive Care Unit

**IHI:** Institute for Healthcare Improvement

**IVAC:** Infection-related Ventilator associated Complication

**NHSN:** National Healthcare Safety Network

**NNIS:** National Nosocomial Infections Surveillance

**NQS:** National Quality Forum

**PVAP:** Possible/Probable Ventilator-associated Pneumonia

**PNEU:** Pneumonia

**RASS:** Richmond Agitation-Sedation Scale

**SAS:** Sedation-Agitation Scale

**SPSS:** Statistical Package for Social Science

**VAC:** Ventilator-associated Condition

**VAE:** Ventilator-associated Event

**VAP:** Ventilator-associated Pneumonia

**VTE:** Venous thrombo embolism

**WBC:** white blood cell



## ABSTRACT

**Background information:** Mechanical ventilation is an essential, life-saving intervention. As it saves life, this treatment may bring forth lung infections and/or complications to the patient hence morbidity. Center for Disease Control and Prevention (CDC) surveillance, terms this morbidity as Ventilator-Associated Events (VAE). VAE increases the length of ventilator support, ICU stay and mortality to the patients.

**Research objective:** To evaluate Nurses' knowledge and prevention practices on VAE in CCU, KNH. **Significance:** To enhance awareness of VAE prevention and encourage its surveillance in the Hospital.

**Methodology:** A descriptive cross sectional design was undertaken where 82 nurses were recruited in the study using convenience method and all patients who were in the unit in the month of April were censured. Statistical package for social sciences (SPSS) version 20 was used and data analyzed using both descriptive and inferential statistics to describe and show the relationship between the variables.

**Results:** The prevalence rate of VAE in the month of April 2015 in CCU KNH was 5.63 per 1000 episodes of mechanical ventilation. 54.9% of nurses had adequate Knowledge of VAE prevention while 68.4% practiced most of the prevention interventions. Knowledge was positively related to the practices with a Pearson's Correlation Coefficient of  $r = 0.729$ . Both knowledge and practice showed a positive association to VAE prevalence with a Pearson's Correlation Coefficient of  $r = 0.685$  and  $0.908$  respectively. The study revealed a strong positive relationship between the independent variables and the prevalence of VAE at a coefficient of determination of 0.825; A unit change in knowledge of VAE prevention will result into a -0.044 change in prevalence of VAE while a unit's change on the practices will result in a -0.709 change. All the variables tested were statistically significant with p-values less than 0.05.

**Conclusion:** The prevalence of VAE in CCU, KNH can be explained by a large percentage that lacked adequate knowledge and omission of some care interventions by the most of the nurses working in the unit. Enhancing knowledge and VAE prevention practices can reduce the VAE prevalence.

**Recommendation:** Review of infection control curriculum, staffs progressive development, development of VAE care bundles and participation in VAE surveillance.

# **CHAPTER ONE: INTRODUCTION**

## **1.1 BACKGROUND INFORMATION**

Ventilator-Associated Events (VAE) are Hospital acquired lung infections (HAI) and/ or complications that occur in patients receiving mechanical ventilation after 48hours when the patient is intubated and ventilated at the time or within 48 hours before the onset of the events. Klompas, Kleinman and Murphy (2014) say that, VAEs are common and morbid and are associated with more days to extubation, hospital discharge and higher hospital mortality risk.

In 2011, an estimated 157,000 healthcare-associated pneumonias occurred in acute care hospitals in United States with mechanically-assisted ventilated patients standing at a higher risk of developing the disease, Center for Disease Control and Prevention [CDC] (2015a) estimates that, more than 300,000 patients receive mechanical ventilation in the United States each year adding that, the overall ventilator use in various hospital unit types ranges from 0.01 to 0.47 per 100 patient days.

Surveillance for hospital acquired pneumonia began in the CDC's National Nosocomial Infections Surveillance (NNIS) system in the 1970s with an aim of dedicating resources to Hospital Acquired Infection (HAI) surveillance and prevention activities. This data was used by the CDC to estimate the burden and national trends of HAIs and the participating hospitals used it for internal quality improvement (Magill et al, 2013).

In 1999, concerns on the specificity of the NNIS pneumonia surveillance definition led to the pneumonia (PNEU) surveillance definitions in 2002. The National Healthcare Safety Network (NHSN) took over this new definition and used it for Ventilator Associated Pneumonia (VAP) surveillance where radiographic, clinical, and laboratory evidence had to be combined in order to be classified as VAP (Magill et al, 2013). This definition surveillance also lacked specificity, credibility and reliability because reliance on chest x-ray and clinical data was highly variable and subjective hence low validity.

In 2008, the National Quality Forum (NQF), requested that the CDC "reconsider case definitions" for VAP to suit for endorsement as national outcome measures for use by federal

and state governments and other entities focused on large-scale improvements in HAI rates (Magill et al, 2013).

In January 2013, the NHSN implemented VAE identification which uses a Three-tiered approach; ventilator-associated conditions (VACs), Infection-related Ventilator-Associated Complication (IVAC) and Possible Ventilator-Associated Pneumonia (PVAP) (Sole &Marinski, 2014).

A study done in a tertiary hospital between January 2006, to December 31, 2011, reviewed 5.6% ventilator-associated condition (VAC) events, 2.1% infection-related ventilator-associated complications (IVACs), 0.7% possible pneumonias, and 0.6% probable pneumonias. It also showed that, the most frequently isolated organisms were *Staphylococcus aureus* 29%, *Pseudomonas aeruginosa* 14%, and *Enterobacter species* 7.9% ( Klompas et al, 2014).

Ventilator associated Pneumonia (VAP) identifies only pneumonia while VAE reports both pneumonia and pulmonary complications to include atelectasis, acute respiratory distress syndrome [ARDS], and pulmonary edema rather than reporting only pneumonia. Wagh and Acharya (2009) say that, VAP is a major nosocomial infection in the intensive care unit (ICU), affecting between 10% and 20% of patients who receive more than 48 hours of mechanical ventilation. Concurring with Wagh and Acharya, Gillespie (2009, p. 45) ranges the infection from 9% to 27% in Europe and America.

In Kenya, study done at the Agakhan University Hospital established high VAP rates in comparison to the NHSN (8.1%) benchmarking used by hospitals in the United Kingdom (Nkirote, 2014, p. 60) as Kinuthia (2013, p. 1) reports that, 39 out of 139 mechanically ventilated patients at KNH had VAP translating an incidence of 28% Kinuthia adds that, 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%).

## **1.2 PROBLEM STATEMENT**

Majority of patients in the Critical Care Unit (CCU) are admitted for Mechanical ventilatory support. This requires a tracheostomy or endotracheal intubation hence vulnerability to Ventilator-Associated Events (VAE). According to Gillespie (2009, p 45), both impaired host immunity and the introduction of an endotracheal tube, contributes to development of lung infection and or complications to the critically ill patient.

VAE's burden is high, according to Military Health System [MHS], (2014, p. 6), VAE is the leading cause of death among hospital-acquired infections, it increases ventilators support and ICU stay by an average of 4.3 days and hospital length of stay by 4 to 9 days. Concurring with MHS, Gillespie (2009, p. 45) says VAE has been estimated to increase mortality by 30% and even two fold in critically ill patients, it is also noted to cost higher than those patients without (Wagh & Acharya, 2009).

A study by Kinuthia (2013, p.1) reports that, 39 out of 139 mechanically ventilated patients at KNH had VAP translating an incidence of 28%. In view that, VAP surveillance is just but part of VAE, a study covering more mechanical ventilation outcomes like VAE and evaluation of prevention practices is necessary in this Unit.

At random, five out of 11 patients records in one wing of the KNH CCU, showed growth of pathogens on the tracheal aspirates and the nurses confirmed that the patients had 'wet chests', often desaturated and were put on antibiotics for the same. The use of Meronem (very strong antibiotic) drug was noted to be on the increase in the unit translating to possible common severe infections. This made the researcher develop desire to study VAE in the unit.

Studying VAEs can help identify causes, potential nursing interventions, and additional prevention efforts needed for prevention of VAEs and nursing has an opportunity to improve these potentially preventable negative outcomes (Sole & Marinski, 2014). In view of the burden and vulnerability of ICU patients to VAE and the fact that VAE is preventable, studying Ventilator Associated Events (VAE) and its prevention practices among nurses working in CCU, KNH is a need.

### **1.3 JUSTIFICATION**

VAE consequences do not only affect the individual patient or family but also the country's economy, these consequences include; increased duration of mechanical ventilation and mortality, intensive care unit and hospital stay, and increased cost of hospitalization.

The Hospital's mission is to offer specialized quality care services to its patients and participate in national health planning and policy making. Assessment of prevalence of VAE, knowledge and practice of its prevention guidelines will give the hospital a foundation to enhance prevention of VAE through including this exercise in health planning and policies both in the hospital and in the ministry of health in the country. This in turn will offer quality services to the hospital and the entire nation.

In view that KNH is the country's national referral and teaching hospital with the largest CCU in East and Central Africa, joining other big hospitals in the world in VAE surveillance and sharing VAEs' prevalence trends through CDC reports is of great importance.

This study will also be undertaken in partial fulfillment for the award of a Master's of Science Nursing Degree; Critical Care Nursing specialty.

## **1.4 OBJECTIVES**

### **1.4.1 Broad Objective:**

To evaluate Nurses' knowledge and prevention practices on ventilator associated morbidities in CCU, KNH

### **1.4.2 Specific Objectives:**

1. To determine the prevalence of VAE in CCU, KNH
2. To assess the nurse's knowledge on VAE prevention in CCU, KNH
3. To assess the nurse's practices on VAE prevention in CCU, KNH
4. To find out the relationship between nurse's Knowledge and practices on VAE prevention and its prevalence in CCU, KNH

## **1.5 RESEARCH QUESTIONS**

1. What is the prevalence of VAE in CCU, KNH?
2. Do nurses in CCU, KNH have adequate knowledge on VAE prevention?
3. Do nurses in CCU, KNH practice VAE prevention adequately?
5. Is there relationship between nurse's Knowledge and practices on VAE prevention and its prevalence in CCU, KNH?

## **1.6 HYPOTHESIS**

There is relationship between Knowledge and practices on VAE prevention among nurses and VAEs' prevalence in CCU, KNH

## **1.7 SIGNIFICANCE**

This study will enhance awareness in prevention of VAE in CCU and encourage the Hospital to participate in Ventilator Associated Events (VAE) surveillance to monitor and share the VAE trends with other big hospitals in the world through CDC reporting. This will enhance elimination of these morbidities which in turn will lead to quality specialized care, reduced mortality and morbidity, creation of beds in CCU hence saving more lives for the patients in need of Critical health care. This will in turn lift the image of the Hospital hence become a role model Hospital in the country.

## **CHAPTER TWO: LITERATURE REVIEW**

This chapter covers Ventilator associated event in details to include; definition, algorithm, surveillance eligibility, vulnerability, consequences, strategies for VAE prevention and conclusion. The chapter also includes theoretical and conceptual framework applied in the study.

Knowledge and practice on Ventilator-Associated Events (VAE) prevention interventions plays a vital role in elimination of the events, According to Covell and Sidani (2013) the higher levels of nursing human capital (nurses' knowledge, skills and experience) is associated with higher quality patient care (low hospital-acquired infections).

Nursing human capital includes Academic preparation, specialty certification status, hours of continuing education attended, professional experience and clinical specialty experience (Covell & Sidani, 2013). Covell and Sidani adds that, that the availability of practice guidelines, care maps or protocols have been found to be associated with better quality of patient care.

### **2.1 DEFINITION OF VENTILATOR ASSOCIATED EVENTS**

Ventilator-Associated Events (VAE) is a Hospital acquired lung infection that occurs in patients on mechanical ventilation, who are intubated and ventilated at the time or within 48 hours before the onset of infection (Military Health System [MHS], 2014. p 3; Wagh & Acharya, 2009). According to Center for Disease Control and Prevention [CDC], (2015a) VAEs are identified by using a combination of objective criteria; deterioration in respiratory status after a period of stability or improvement on the ventilator, evidence of infection or inflammation, and laboratory evidence of respiratory infection.

Mechanically ventilated patients suffer many more other adverse reactions other than infections, Abernathy (2013) says that, the CDC's new definitions was expanded to cover a multitude of complications under the umbrella term of "ventilator-associated event" (see appendix V) which aims to make it easier and faster to treat the right diagnosis at the right time and encourage better prevention. VAE surveillance is more objective, assist in a more meaningful benchmarking process and reflect differences in patients and processes of care more clearly.

This new approach, the VAE surveillance was implemented for use by National Healthcare Safety Network (NHSN) in January 2013 (Sole &Marinski, 2014). In comparison to the Ventilator associated Pneumonia (VAP) surveillance system, VAE is simple and focuses on readily available, objective clinical data, does not include chest radiograph findings, detects ventilator-associated conditions and complications, including but not limited to VAP, captures important complications, most cases due to pneumonia to include; Pulmonary edema, Acute Respiratory Distress Syndrome and atelectasis (California Department of Public Health [CDPH], 2013).

This ventilator-associated events' 3 tiered approach is believed to be the most appropriate approach in the current environment. It acknowledges limitations in the ability to accurately identify VAP for surveillance purposes and reduces the likelihood of definition gaming or manipulation that could artificially lower event rates (Magill et al, 2014).

## **2.2. VAE SURVEILLANCE ALGORITHM**

### **I. Ventilator-Associated Condition**

Ventilator-associated condition (VAC) is the first tier; it seeks to identify episodes of sustained respiratory deterioration, both infectious and non-infectious conditions and complications occurring in patients under mechanical ventilation. Focus is on identifying VAC from worsening oxygenation status that necessitates increased ventilator settings for oxygen (FiO<sub>2</sub>), positive end-expiratory pressure (PEEP), or both (Sole & Marinski, 2014). The patient must have had at least 2 days of stability or decreasing daily minimum PEEP or Fio<sub>2</sub> followed by at least 2 days of increased daily minimum PEEP by  $\geq 3$  cm H<sub>2</sub>O or Fio<sub>2</sub> by 20% (Magill et al, 2014).

### **II. Infection-related Ventilator-Associated**

The second tier, Infection-related ventilator-associated (IVAC) attempts to identify the VACs that are potentially related to infection, as evidenced by an abnormal white blood cell (WBC) count or temperature. Sole & Marinski, (2014) stipulates temperature above 38° C or below 36° C and/ or WBC count > 12,000 cells/mm<sup>3</sup> or < 4,000 cells/ mm<sup>3</sup> and initiation of a new antimicrobial agent. VAC identifies pulmonary and extra-pulmonary infections that are severe enough to trigger respiratory deterioration.



### **III. Possible and Probable VAP**

According to Raouf & Baumann (2014), the third tier identifies IVAC patients with respiratory infections manifested by objective evidence of purulent respiratory secretions and/or positive results of microbiological tests performed on respiratory tract specimens. The possible VAP definition is met with the presence of purulent secretions or a positive lower respiratory tract culture (showing any growth) while the probable VAP definition requires purulent secretions in addition to a positive lower respiratory tract culture showing growth. CDC (2015a) adds that, presence of a positive pleural fluid culture, lung tissue with histopathological evidence of infection, or positive tests for *Legionella* or selected respiratory tract viruses, without the concomitant requirement for purulent secretions may also be used to diagnose PVAP.

#### **2.3 VAE SURVEILLANCE ELIGIBILITY**

According to MHS (2014, p.2), this includes; adult locations in acute care hospitals, long term acute care hospitals, and inpatient rehabilitation facilities. According to CDC (2015b), such locations may include critical/intensive care units (ICU), specialty care areas (SCA) and step-down units and wards. Commenting more on eligibility, MHS adds that, the VAE protocol should be used on Persons at or above the age of 18 years of age warning that, those who are receiving high frequency ventilation or extracorporeal life support are excluded from the surveillance.

#### **2.4 VULNERABILITY AND CONSEQUENCES OF VAE**

Mechanical ventilation is an essential, life-saving therapy for patients with critical illness and respiratory failure hence majority of the patients admitted in Critical Care Unit (CCU) are mechanically ventilated in support of their breathing. Explaining why impaired host immunity and displacement of normal oro-pharyngeal flora by pathogens predispose mechanically ventilated patients to VAE, Gillespie (2009, p.45) says that, normal nonspecific host responses, such as the epiglottis, vocal cords, cough reflex, and ciliated epithelium and mucus of the upper airways are bypassed or rendered ineffective during intubation.

According to the Military Health System (2014, p. 5), the National Healthcare Safety Network (NHSN) reports VAE to be the leading cause of death amongst hospital-acquired infections, exceeding the rate of death due to central line infections, severe sepsis, and respiratory tract infections in the non-intubated patient. MHS is concerned with the high hospital mortality of ventilated patients who develop infection pointing it at 46 percent compared to 32 percent for ventilated patients who do not develop.

VAP rates which is part of VAE could be as high as 6.0 per 1000 ventilator days in USA with a crude mortality rate of 24% to 50% (Kiyoshi et al 2014, p. 202 ), Gillespie (2009, p.45) estimates the mortality to increase by 30% and even two fold in critically ill patients. Citing the economic burden, it increases length of ICU stay by 28% (Wagh & Acharya, 2009) costing \$39 828 higher than those patients without VAP while another study in USA found the attributable cost of VAP to be \$11 897 in general hospitals (Gillespie, 2009,p.46).

## **2.5 PREVENTION OF VAE**

Staff education and multidisciplinary approach, development and consistent use of intervention care bundle can reduce or even eliminate VAE. Munro & Ruggiero (2014) defines intervention bundle as a series of evidence based interventions related to ventilator care that, when implemented together, will achieve significantly better outcomes than when implemented individually to prevent VAE.

To prevent VAE, Sole and Marinski (2014) states that, “One-size-fits-all” VAP prevention efforts aren’t adequate for addressing VAE, concurring with Sole and Marinski, Abernathy, (2013) says more interventions should be considered to address other causes of VAE because unlike VAP which covers only infection, VAE captures both lung complication and infections hence the VAP bundle may not adequately cover VAE.

The Institute for Healthcare Improvement launched the VAP bundle in 2005, whose components included; elevation of the head of the bed (HOB), daily sedation vacations and assessment of readiness to wean from mechanical ventilation/ extubate, regular oral care with chlorhexidine, Peptic ulcer disease and Deep vein thrombosis (DVT) prophylaxis (Sole & Marinski, 2014; Munro & Ruggiero, 2014). The same should continue and add other interventions to prevent VAE because VAP is part of VAE

According to Raouf & Baumann (2014), Many hospitals have already developed care bundles to include; Head-of-bed elevation, mouth care with chlorhexidine, lung protective ventilator strategies, early discontinuation of mechanical ventilation, appropriate analgesia and sedation and daily interruption of sedation, early mobilization, DVT and PUD prophylaxis

The Military Treatment facilities in New York focus on three components; staff education, colonization and aspiration reduction and prevention, it has selected a care bundle for implementation and tracks performance through process measure(Observation / Check list for bundle compliance) and outcome measure (VAP rate )(MHS,2014, p. 7)

A Strategy for the Control of Antimicrobial Resistance in Ireland [SARI], 2011, pp. 2-10), concurs with MHS (2014) and adds use of guidelines, adequate staffing, surveillance and restrictive Red blood cell transfusion as ways of keeping VAE at bay. American heart Association [AHA], Partners for patients [PP] & Health research and Educational

Trust [HRET], (2014, p.9) add the ‘ABCDE’ bundle (see appendix VI) to the IHI’s VAP bundle to reduce the risk of over-sedation, immobility, and mental status changes. ABCDE stands for; Awakening trials, Spontaneous Breathing trials (SBT), Coordination to perform SBT, Delirium assessment, and early mobilization of critically ill patients (*see appendix V*).

In this study, prevention of VAE will be grouped into three to include; reduction of aero-digestive tract colonization, Avoidance of unplanned extubation and re-intubation, and reduction of mechanical ventilation duration

### **2.5.1 Reduction of aero-digestive tract colonization**

This includes; prevention of aspiration and airway contamination, reducing normal flora in the digestive tract which may turn pathogen once introduced to the airway. According to SARI (2011, p. 6), use of oro-tracheal over nasal-tracheal intubation is recommended because, nasal-tracheal may cause sinusitis, which increases risk for lung infection due to contamination.

All patients receiving mechanical ventilation or who are at a high risk for aspiration should be nursed in semi recumbent position with head of bed elevated at 30° to 45° unless there are

contraindications or conflicts with other nursing or medical interventions. (Munro & Ruggiero, 2014; Curtin, 2011). SARI (2011, p.7) cautions that, the rate and volume of enteral feeding

should be adjusted to avoid gastric distension and so reduce the risk of aspiration.

To prevent contamination of lower airway from contaminated secretions pooled at the oral pharyngeal region, an Endotracheal tube (ETT) with a cuff at its lower end should be used to seal the airway and minimize aspiration. According to Curtin (2011), the cuff pressure should be maintained above 20 cm H<sub>2</sub>O to prevent the aspiration, but below 30 cm H<sub>2</sub>O to prevent injury to the tracheal mucosa.

The pooled secretions above the ETT cuff are often contaminated with oral microorganisms and may cause lung infection once aspirated to the lower respiratory system. Munro & Ruggiero (2014); SARI (2011,p.7) say that, subglottic suctioning using a specialized ET tube with a separate dorsal lumen designed to suction secretions collected around the ET tube cuff has been recommended by various organizations for inclusion.

The oropharynx is colonized with potential pathogens such as *Staphylococcus aureus* , *Streptococcus pneumoniae* , *Prevotella species*, *Bacteroides fragilis*, among others, which undergo a transformation to predominantly gram-negative virulent microbes in 48hours (Munro & Ruggiero,2014). On aspiration, these microbes may cause lung infection.

According to Abernathy (2013), performing regular oral care on ventilated patients reduces the opportunities for VAE to develop because VAP mainly results from bacterial colonization of the oral Cavity and aspiration of contaminated secretions into the lower respiratory tract. According to Munro and Ruggiero (2014), chlorhexidine oral rinse twice a day reduces the total nosocomial respiratory tract infection rate by 40% in patients who are critically ill. Curtin, (2011); Tescher et al (2011) recommends every 6-8 hours and as needed, using a 0.12% or 2% chlorhexidine solution and application of water-soluble mouth moisturizer and/or lip balm every 6-8 hours.

Several studies suggest that suppressive agents for gastric acid may increase the frequency of hospital acquired infection as compared to agents that do not alter gastric acid (SARI, 2011, p. 8). These drugs should be avoided in patients who are not at high risk for stress ulcer. Drugs that increase pH promotes GI bacterial growth especially gram-negative bacteria

therefore, esophageal reflux and aspiration of gastric content along the ET tube may lead to endobronchial colonization or pneumonia (Munro & Ruggiero, 2014).

Tescher et al (2011) reports a higher mean gastric pH with ranitidine with gram-negative organisms positive cultures significantly higher in the ranitidine group at 75% compared to 33% with Sucralfate. According to AHA et al (2014, p. 8), H<sub>2</sub> blockers are preferred over sucralfate, and proton-pump inhibitors may be efficacious and an alternative to sucralfate or an H<sub>2</sub> antagonist. New York partners for patients [NYPP] (nd) add that, pharmacist should be engaged in daily multi-disciplinary rounds to ensure ICU patients are given appropriate Peptic ulcer disease prophylaxis

Reducing or elimination of airway contamination may also be achieved through maintaining aseptic technique, hand hygiene and use of Personal protective equipments on handling the patient's airway e.g ETT or tracheostomy suctioning and intubation/ tracheostomy. The ventilatory circuits should only be changed when malfunctioning or visibly soiled to avoid contamination. The Center for Disease Control and Prevention recommends that heat and moisture exchangers not be changed more frequently than every 48 hours or when they become visibly soiled or mechanically malfunction (SARI, 2011, p. 4; Tescher et al, 2011).

Use of the anticoagulants is vital in mechanically ventilated patients because they experience stress inflammatory response resulting in hyper-coagulation and minimal mobility, pulmonary embolism in a patient being treated with mechanical ventilation is a part of the VAE, hence preventive interventions should be implemented. MHS (2014, p. 6) advises Initialization of appropriate Venous thrombo-embolism (VTE) prophylaxis on all mechanically-ventilated patients unless contraindicated advising that, it should be part of the ICU admission and ventilator order sets.

### **2.5.2 Avoiding unplanned extubation and re-intubation**

In view of nature of conditions and care/procedures in CCU, Critically ill patients experience Anxiety, pain and agitation and more so those undergoing mechanical ventilation hence need for analgesia and sedation. Imbalanced sedation can lead to VAE; AHA et al (2014,p. 10),says that, too little sedation can lead to increased anxiety, work of breathing, a drop in blood and tissue oxygenation hence self-extubation while too much can depress respiratory

muscle function, neurological system, leading to inability to wean from mechanical ventilation.

AHA et al (2014, p. 10) recommends use of sedation scales such as the Richmond Agitation-Sedation Scale (RASS) and the Sedation-Agitation Scale (SAS) (see appendix VII), to titrate medications. Sole and Marinski, (2014) add collaboration with team members, including intensivists and pharmacists to determine appropriate medication and need assessment. NYPP, (nd) advice to strive for minimal medication to achieve patient comfort while maximizing patient level of arousal, assess pain, at minimum once every two hours.

Delirium is an acute form of brain dysfunction which remains undetected by both nurses and doctors in more than 65% of ICU patients and up to 81% of mechanically ventilated patients experience delirium (AHA et al 2014, p. 11). It may lead to unplanned extubation and increased oxygen demand. Assessment of delirium is done at least once per shift using assessment scale such as the Confusion Assessment Method for ICU (CAM ICU) or Intensive Care Delirium Screening Checklist (ICDSC).

Progressive mobility of patients improves respiratory, psychological, immune, circulatory status, and muscle strength hence preventing VAP and delirium, it should be done at least twice daily. According to AHA et al (2014, p.11), studies show that early mobilization can decrease delirium

duration by 50%, can decrease ICU length of stay by 25%, and can increase the likelihood of return to independence by the time of discharge by nearly 75%.

### **2.5.3 Reduction of mechanical ventilation duration**

Daily interruption and moderating the use of sedative agents allows assessment of readiness for extubation which plays a vital role in preventing VAE. Munro & Ruggiero (2014) say that extubation eliminates an important factor that contributes to the cascade of events that may lead to VAE. The New York partners for patients (nd) say, strive for sedation vacation at least once daily to assess for readiness to wean, weaning protocols should be established and should be part of the ventilator order set and weaning protocols that call for weaning attempt and Spontaneous breathing trials should be done daily

## **2.6 CONCLUSION**

Mechanical ventilation is an essential, life-saving intervention for patients with compromised respiratory function; this intervention may bring forth lung infections and complications to the patient hence morbidity. During surveillance, this morbidity is termed as Ventilator-Associated Events (VAE) and it is preventable. The combination of high nurses' knowledge, skills and experience is associated with higher quality patient care (low hospital-acquired infections). VAE algorithm is a three tiered approach believed to be the most appropriate approach in the current environment which replaced VAP in 2013, it detects both ventilator-associated infections and complications and it is simple and focuses on readily available, objective clinical data, it does not include chest radiograph findings. VAE is common in CCU set up and it is the leading cause of death amongst hospital-acquired infections. It increases mortality rate, morbidity and economic expenditure. Its prevention measures include; staffing and staff education on VAE, reducing colonization of aero-digestive tract, Avoiding unplanned extubation and re-intubation, and reduction of mechanical ventilation duration.

## **2.7 THEORETICAL FRAMEWORK; NURSING INTELLECTUAL CAPITAL THEORY**

Intellectual capital theory originates from the disciplines of economics and accounting, it is all knowledge within an organization which has the potential to create value when applied in line with the mission, vision and goals of the organization (Bontis, 1999). Intellectual capital is an intangible asset in business and according to Takuldar (2008), Thomas Stewart, a pioneer in the study of such intangible assets, is credited with having coined the term 'Intellectual Capital' to refer to these assets.

Nursing intellectual capital was developed and tested by Christine Covell during her doctoral studies at the University of Toronto in the year 2011. Her objective was to improve the quality of care for hospitalized patients and to build health workforce capacity. Her study uncovered the conditions under which nursing knowledge (knowledge within nurses and knowledge structures) influences patient and cost-related organizational outcomes within hospitals.

The Nursing intellectual capital theory conceptualizes nursing knowledge's influence on patient and organizational outcomes; it proposes that, nursing human capital; nurses' knowledge, skills and experience facilitates the nurses clinical decision-making on nursing care delivery and is related to the quality of patient care (Covell & Sidani, 2013).

Intellectual capital encompasses; human capital, structural capital and relational capital (Bontis 1999; Talukdar, 2008)

### **2.7.1 Human capital**

Covell (2011) defines human capital as the knowledge, talent and experience of employees adding that it is the primary component of intellectual capital. Human capital reflects the work of highly knowledgeable and skilled people caring for those in need of specialized healthcare. According to Covell and Sidani (2013), the higher levels of nursing human capital are associated with better quality patient care. Thus, the combination of the nurses' knowledge, skills and experience is associated with higher quality patient care (low hospital-acquired infections).



### **2.7.2 Structural Capital**

Structural capital is the support structure for human capital and represents the codified knowledge bases that do not exist within the minds of employees (Bontis, 1999). In nursing, these are structural resources that contain nursing knowledge and are used to support nurses in the application of their knowledge and skills in the delivery of patient care. They include practice guidelines, care maps, information systems and technology. Covell and Sidani (2013) says that the availability of practice guidelines, care maps or protocols have been found to be associated with better quality of patient care.

### **2.7.3 Relational Capital**

Relational Capital is the external linkage of the Company with Suppliers and Customers that enables it to procure and sell goods and services in an effortless manner (Talukdar, 2008). It is influenced by the organization's human and structural capital (Bontis, 1999). It will not be featured in the framework because it lacks meaningful conceptualization.

## **2.8 CONCEPTUAL FRAMEWORK**

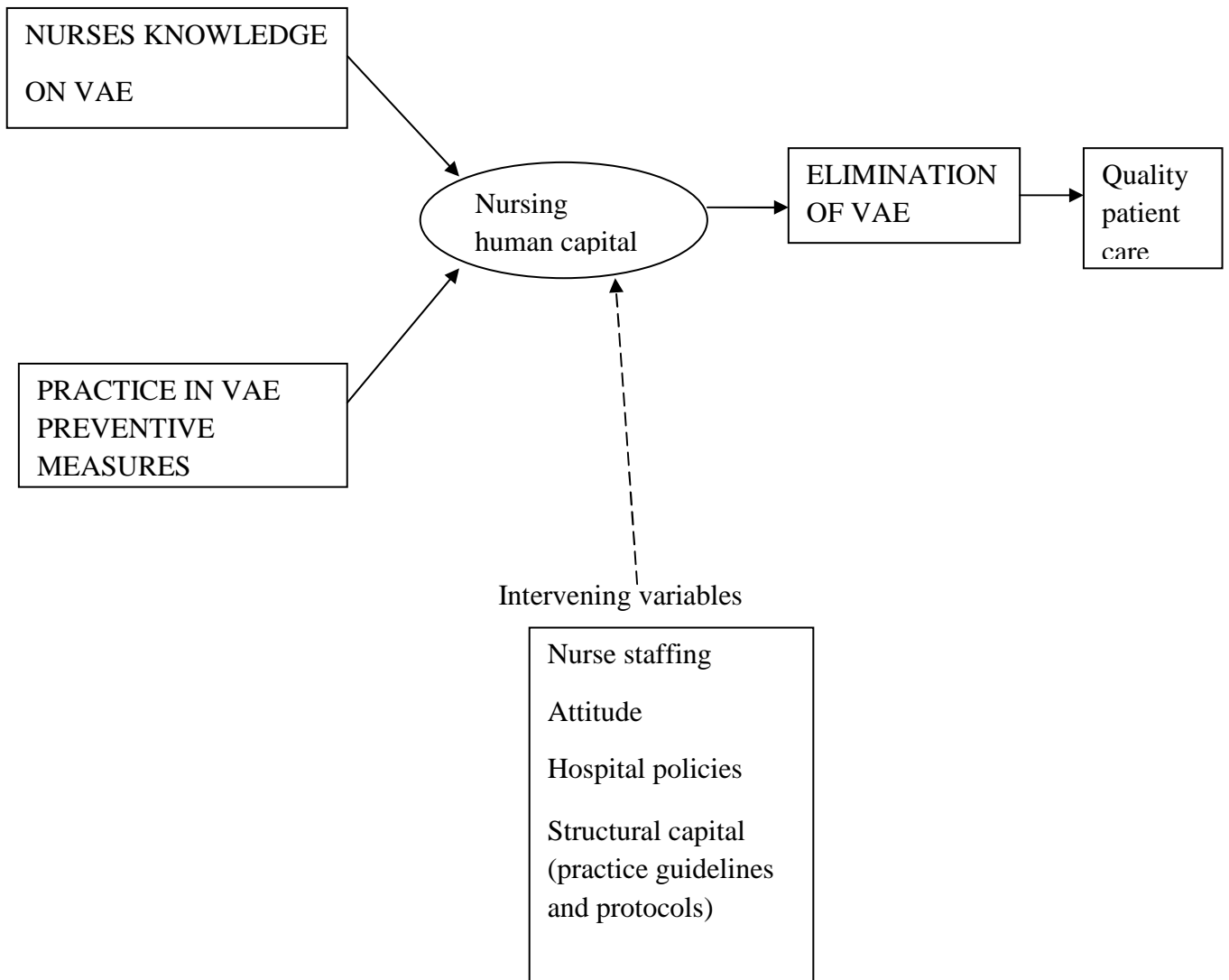
In view of Covell and Sidani (2013) stating that, nursing intellectual capital theory is composed of two interdependent concepts; nursing human capital and nursing structural capital, the nursing intellectual capital theory proposes nursing human capital to be operationalized as nurses' knowledge and practice while nursing structural capital to be operationalized as the availability of practice guidelines for the prevention of VAEs. Covell and Sidani add that, the human capital is directly related to patient outcomes associated with quality of patient hence any influence on the human capital may interfere with the quality of patient care.

The dependant variable in this study is elimination of VAE which is dependent on knowledge and practices on VAE prevention among nurses working in this unit, this account for nursing human capital. It is worth noting that elimination of VAE will give rise to patient quality care as the outcome and variables that may influence knowledge and prevention practices include nurse staffing, structural capital, nurse's attitude and the hospital policies.

Independent variables

Dependant variable

Outcome



## **CHAPTER THREE: METHODOLOGY**

This chapter outlines methodology and procedures that were used to obtain the research data. They include; research design, population, sampling methods, variables, instruments and procedures that were used for data collection, data management and Ethical considerations.

### **3.1 STUDY DESIGN**

This was a descriptive cross sectional study to evaluate nurses' knowledge and prevention practices on Ventilator associated morbidities in CCU, KNH

### **3.2 STUDY AREA**

The study was carried out at the Kenyatta National Hospital, Critical Care Unit. KNH is a national teaching and referral hospital which is about four kilometers from the Nairobi city center. The hospital receives patients referred from other hospitals and institutions in Kenya and outside the country for specialized health care. It provides facilities for medical education and research for University of Nairobi and many other medical schools. The hospital also provides facilities for nursing training and other allied courses. The current bed capacity for the hospital is 1800 and also offers outpatient services in the several specialized clinics within the hospital.

The CCU in KNH is the largest in East and Central Africa with a bed capacity of 21 beds. It is situated on the first floor of the hospital and bordered by the burns unit, main theatres, renal unit and the cardiology departments. The nurses working in this unit also run two satellite CCUs in the hospital whose bed capacity is five each, namely Cardiothoracic and Neurological CCU. The unit is run by a team of staffs to include; Registered nurses among who the majority are Critical Care Nurses, Intensivist, consultants, Registrars and anaesthetists, laboratory technologists, physiotherapists, occupational therapists, nutritionists and supportive staffs among others.

### **3.3 TARGET POPULATION**

The study included all nurses working in CCU and all patients admitted in the unit. According to the hospital records, the unit had a total of 103 nurses and bed capacity of 21.

### 3.4 SAMPLING

#### 3.4.1 Sample Size calculation

The sample size was obtained using Fischer's formular, according to Mugenda and Mugenda, (2003), it is calculated as follows:

$$n = \frac{z^2 pq}{d^2}$$

Where,

n = Desired sample size

z = Standard normal deviation which is 1.96 at 95% confidence interval.

P = The proportion of the target population estimated to have a particular characteristics of interest estimated at 50%=0.5

q = 1 – P=1-0.5=0.5

d = The level of statistical significance set at 0.05

Therefore,

$$n = \frac{z^2 pq}{d^2}$$

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2} = 384$$

For a sample less than 10,000 population size the following Fisher's formula applies;

$$nf = \frac{n}{1 + \frac{n}{N}}$$

nf = Desired sample size of the target population less than 10,000

n = desired sample size when the target population is more than 10,000=384

N = Estimated population size =103

$$nf = \frac{n}{\left(1 + \frac{n}{N}\right)}$$

$$nf = \frac{384}{\left(1 + \frac{384}{103}\right)} = \frac{384}{4.73} = 81.18 \text{ thus } 82 \text{ nurses}$$

nf =82 nurses

### **3.4.2 Sampling Method**

A convenience method of sampling was used. This is a method whereby nurses working at CCU were picked for the study as they become available on duty until the required number (82) was reached. All patients who were in the unit during the month of April were censured in.

## **3.5 INCLUSION AND EXCLUSION CRITERIA**

### **3.5.1 Inclusion criteria**

- All qualified nurses working in CCU, KNH
- All patients intubated/Tracheostomy and on mechanical ventilation for more than 2 days and not less than 5days
- Patients above 18years
- Patients whose location of intubation/ tracheostomy was CCU
- Patients on Airway Pressure Release Ventilation (APRV) or related modes

### **3.5.2 Exclusion criteria**

- Non nursing staffs
- Patients on high frequency ventilation
- Patients on extracorporeal life support

## **3.6 ETHICAL CONSIDERATIONS**

The permission to carry out the study was sought from the Kenyatta National Hospital ethics and research committee, the hospitals research and ethics department and the CCU in charge. Informed consent was obtained from individual staff members and coded numbers used to uphold their confidentiality, the information given was kept confidential and the subjects were allowed to withdraw from the study at any stage without any penalty

### **3.7 DATA COLLECTION INSTRUMENT**

The data was collected using questionnaires and observational check lists. The self structured questionnaires were issued to the participants and collected after filling with help of a qualified research assistant who had been trained. The questionnaire had two parts; Part one was composed of the consent form, Part two had sections A and B and C. Section 2A elicited demographic information, 2B collected information about knowledge on VAE and its prevention practices and Part C collected information about prevention practices on VAE. This data collection took four weeks.

The Checklist included a checklist to assess the nurses' practices towards prevention of VAE to include; Reduction in aero-digestive system colonization, prevention of unplanned extubation and reduction in mechanical ventilation (MV) duration. The research assistant applied participative observation to fill the checklist on whether a specified measure is done or omitted (YES, NO).

Elements data form checklist adapted from CDC (2014) was used to assess prevalence of VAE in that month, information collected included; day of MV, minimum and maximum PEEP, FiO<sub>2</sub>, Temperature and WBC. Specimen obtained, organism identified, new antibiotic started during the event window period and a VAE column showing the type of VAE identified.

### **3.8 RELIABILITY AND VALIDITY OF THE RESEARCH INSTRUMENT**

Pretesting of the study instruments was carried out in Neurological Critical Care Unit situated at fourth floor, ward 4C. Nine qualified nurses participated and advised not to participate in the main exercise of collecting data, files of patients qualifying inclusion were used to collect data on prevalence rate and necessary adjustments were made according to the outcomes of the pre-test.

### **3.9 LIMITATIONS AND DELIMITATIONS OF THE STUDY**

Time, money and the limited number of patients admitted in CCU who met the criteria was a major limitation for this study. Due to limited time, the observations were done only once but the researcher took much more time with the participant to reduce bias in the practices assessed.

### **3.10 DATA MANAGEMENT METHODS AND ANALYSIS**

Data was entered by two people. The data was checked for verification from where cleaning was performed to rid the data of the spoilt questionnaires and clarification in case of need. The data was coded and entered into the computer through the statistical package for social sciences (SPSS) version 20. Descriptive statistics such as the percentages, frequency distributions and means were generated to show the distribution of Nurses by their key background Characteristics. The study further used inferential statistics namely the regression and correlation analysis to show the relationship between the variables. The findings of the study were presented in tables, charts and figures.

### **3.11 VARIABLES**

Dependent variable was Elimination of Ventilator associated Events while the independent variables remained knowledge and VAE prevention practices.

### **3.12 DISSEMINATION OF RESULTS**

Study finding will be presented to members of staffs working in CCU, KNH, school of nursing, Nairobi University and it will also be published.

## CHAPTER FOUR: RESULTS

This chapter is subdivided into five sections; the first section describes the characteristics of the study population, the second one, presents the VAE prevalence in the unit, the nurses' knowledge and practice in VAE prevention and the last section focuses on the association between knowledge and Nurses Prevention Practice towards Ventilator associated events. Cross tabulations have been used to test the association between knowledge and the prevention practices

### 4.1 PREVALENCE OF VENTILATOR ASSOCIATED EVENTS

This data was collected from the patients' files of those admitted in the unit in the month of April from 1<sup>st</sup> to 30<sup>th</sup> day of the said month. All the 67 patients admitted in this unit, plus the 21 patients who were already in the unit by the 1<sup>st</sup> of April totaling 88 patients were censured. Only ten patients met the criteria of inclusion and two episodes of VAE were identified hence making the Numerator.

Case 1 was a case of Ventilator-associated condition where the patients PEEP was increased from 5 to 8mmHg on his 10<sup>th</sup> day of mechanical ventilation and remained so for the following three days. Case 2 was Infection-related ventilator-associated (IVAC) case where the FIO<sub>2</sub> was increased from 30 to 100% on his 12<sup>th</sup> day of mechanical ventilation having been on 30% for the previous 4 days. The patient's temperature rose from 37<sup>0</sup> to 38.8<sup>0</sup> and remained so if not higher for three days that followed, the patient was started on intravenous Amikacin which ran for five days.

The denominator was formed from the Episodes of mechanical ventilation for the month which totaled 355 (All episodes of mechanical ventilation in the unit irrespective of whether the patient met criteria or not)

The rate per 1000 episodes of mechanical ventilation is calculated by dividing the number of VAEs by the number of episodes of mechanical ventilation and multiplying the result by 1000 (CDC, 2015).

Therefore:

Numerator divided by Denominator and multiplied by 1000

$$2/355*1000= 5.63$$

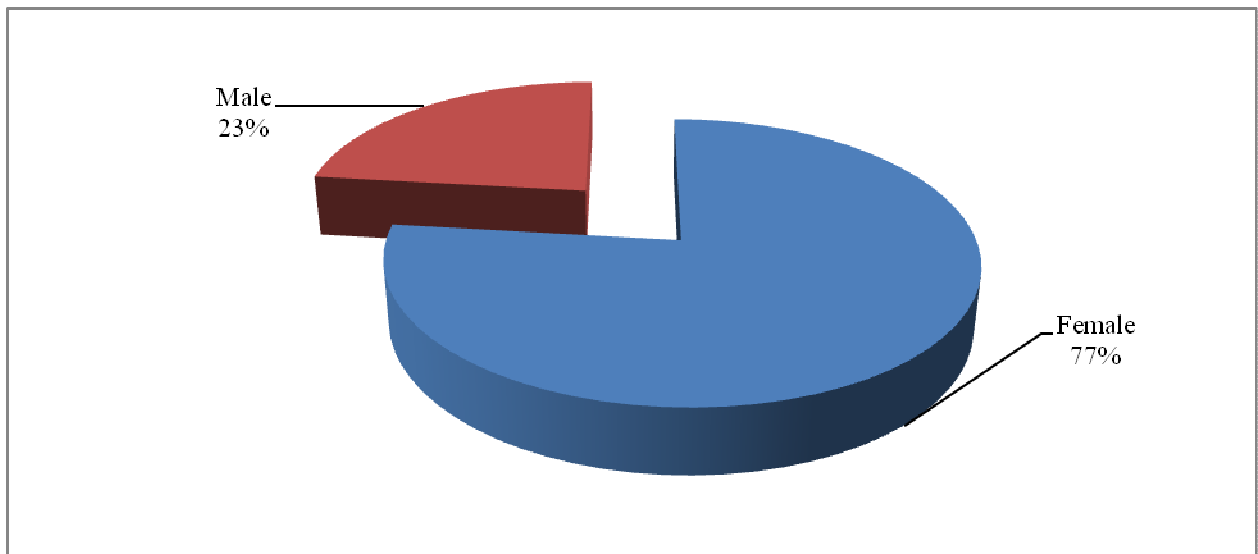


The prevalence rate of VAE in the month of April 2015 in CCU KNH was 5.63 per 1000 episodes of mechanical ventilation.

## 4.2 CHARACTERISTICS OF THE STUDY POPULATION

### 4.2.1 Gender

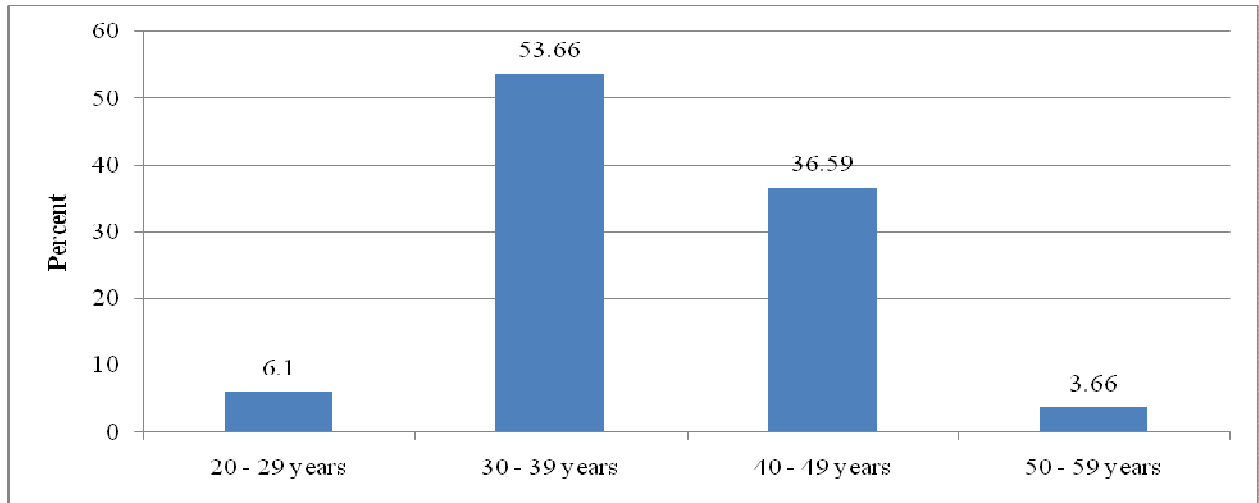
The results from the study found that male had a 23% (n=19) while female had the largest percentage of 77% (n=63) as shown in the chart below.



**figure 1: Distribution of Respondents by Gender**

### 4.2.2 Age group distribution

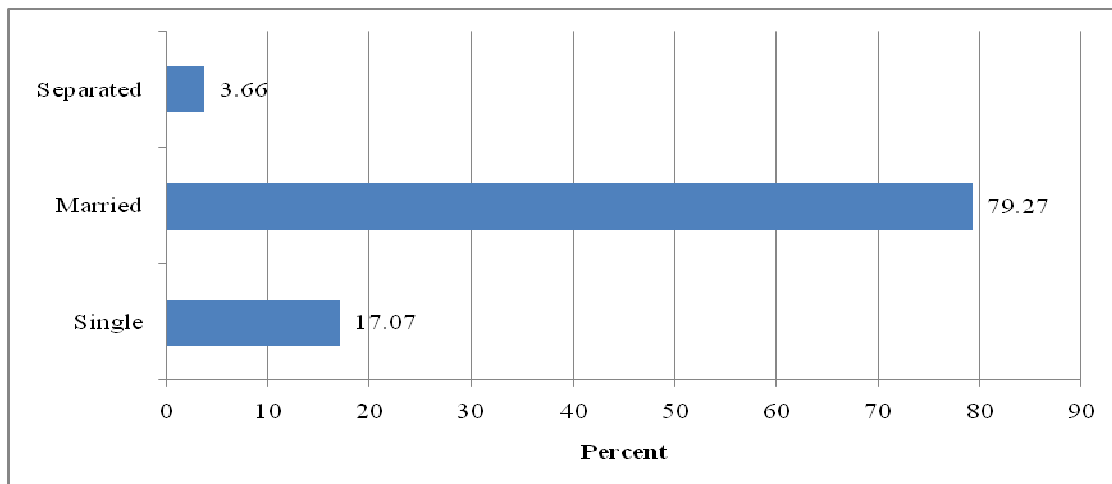
The age group between 50-59 had the lowest percentage of 3.66% (n=3), 20-29 had 6.1% (n=6), 40-49 had a rate of 36.59% (n=30) and finally the age group between 30-39 constituted the largest percentage of the total population with a percentage rate of 53.66% (n=43).



**Figure 2: Distribution by Age group**

#### 4.2.3 Marital Status

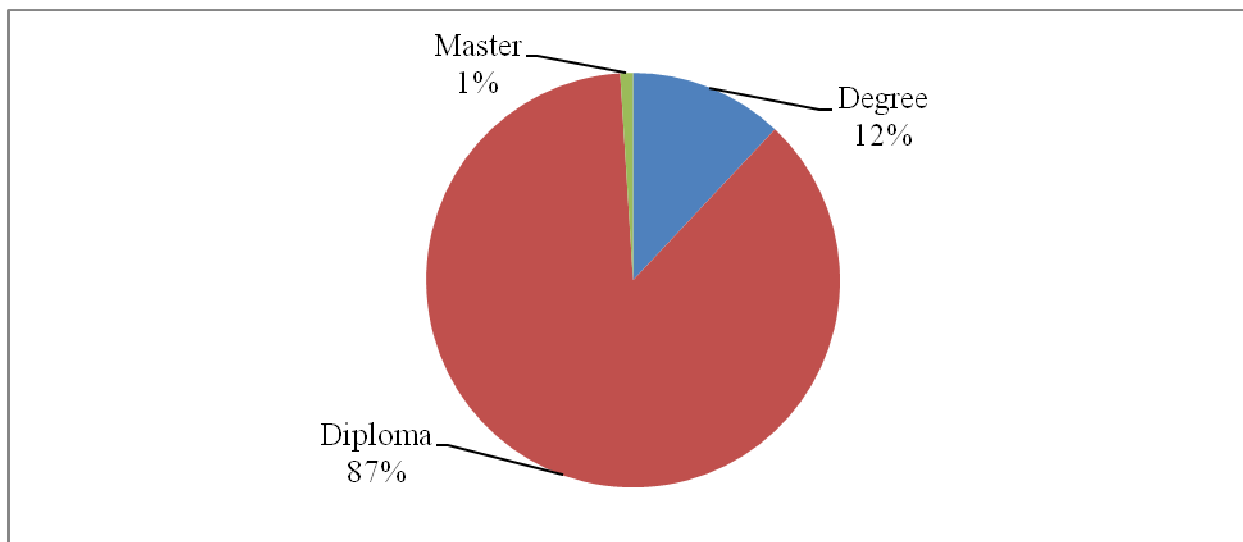
The study showed that, those seperated had a 3.66 % (n=3) , single had a 17.07 % (n=14) and finally the married nurses from the population of study had a largest percentage rate of 79.27 (n=65).



**Figure 3: Distribution of Marital Status**

#### 4.2.4 Nursing Education qualification

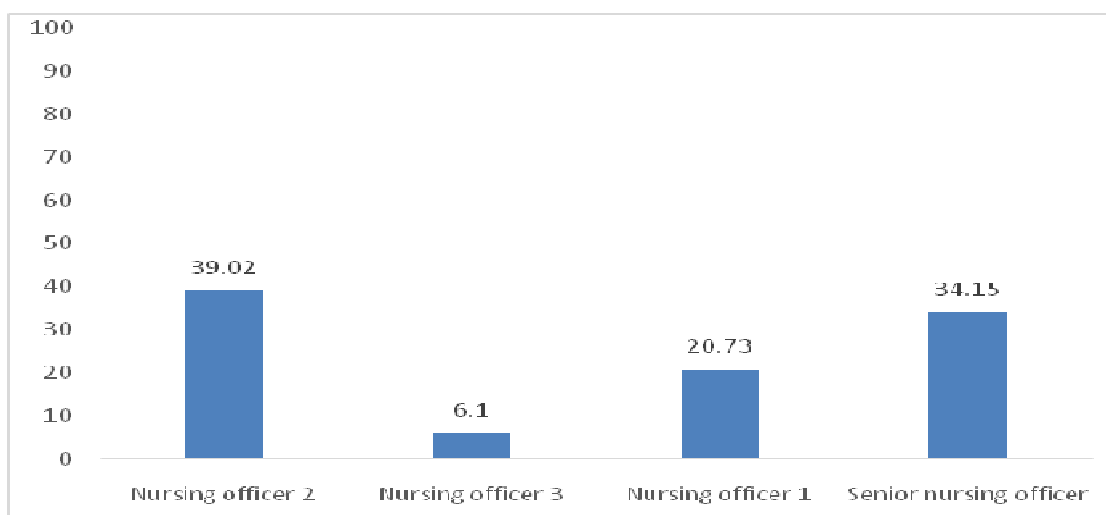
The study showed that, diploma level had the largest percentage of 86.5 (n=70), followed by those with a degree at a 12.2 % (n=11) and the lowest percentage of 1.22 % (n=1) was marked by those with a master's level of nursing education.



**Figure 4: Highest level of nursing education**

#### 4.2.5 Nursing Designation

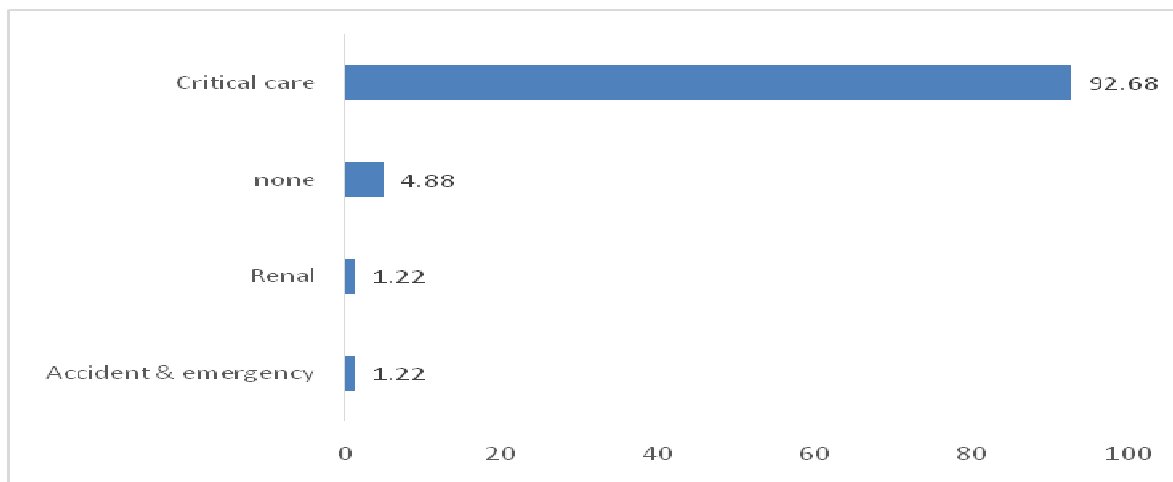
Data obtained on nurses designation showed that the nursing officer II had the largest percentage rate of 39.02 (n=32), Senior nursing officer designation had 34.15 % (n=28) , Nursing officer III had a rate of 6.1 % (n=5), while Nursing officer I had a rate of 20.73 % (n=17).



**Figure 5: Designation of Respondents**

#### 4.2.6 Nursing specialty

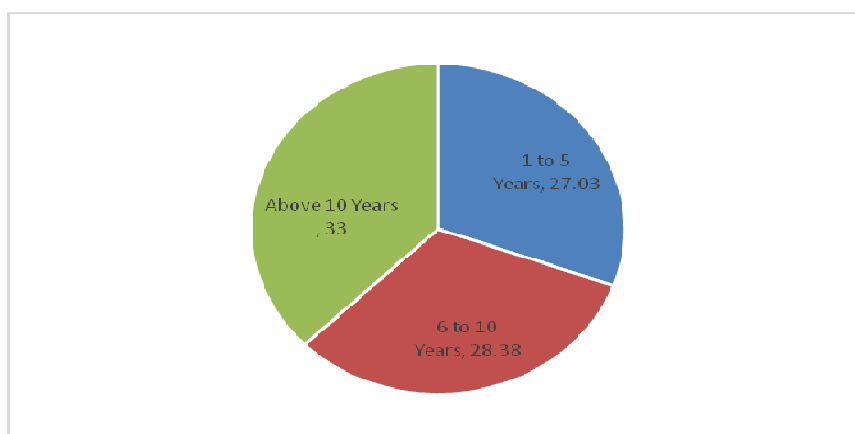
Specialized critical care nursing had the largest percentage of 92.68 (77), nurses with no specialization had a rate of 4.88% (3), those specialized in renal nursing and accident & emergency specialty had a rate of 1.22 % (1) each.



**Figure 6: Distribution by nursing specialty**

#### 4.2.7 Years of nursing experience in the intensive care unit

Nurses with CCU nursing experience between 1 to 5 years had a rate of 27.03 % those whose duration was between 6 to 10 years had a rate of 28.38% and finally those with duration above 10 years had the largest rate of 33%

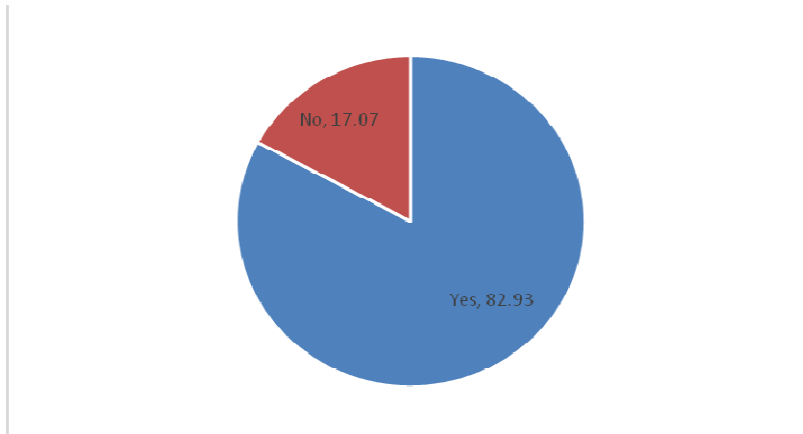


**Figure 7**

**Figure 7: Years of experience in the CCU**

#### 4.2.8 Training on Infection Control

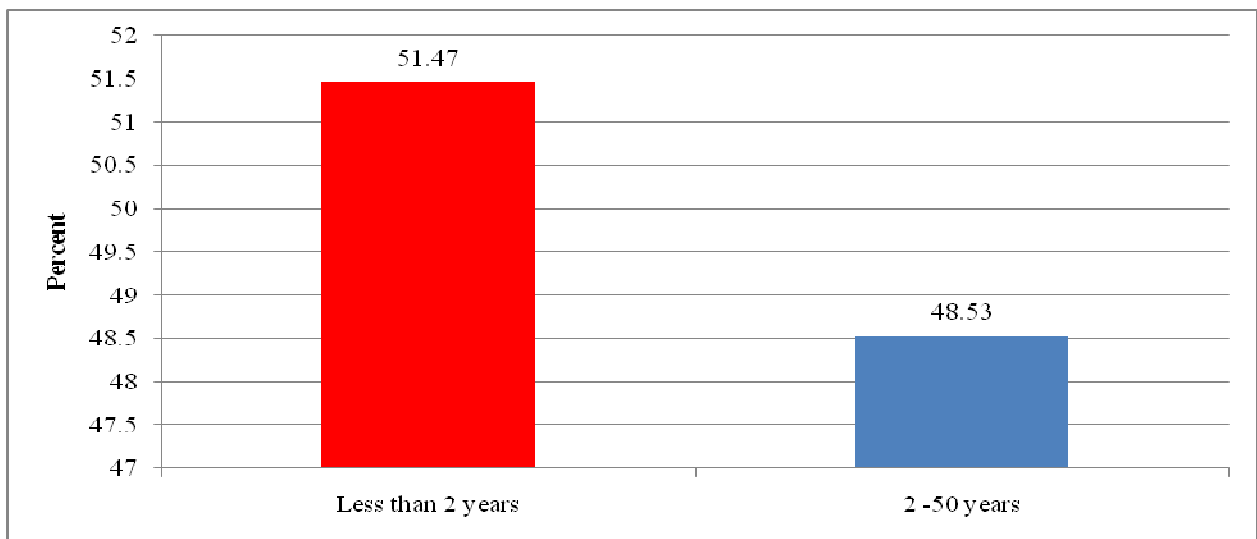
The study showed that nurses who had trained on infection control had a rate of 82.93 % (n=68) while those who had not trained on the same had a rate of 17.07 % (n=14).



**Figure 8: Attainment of infection control training**

#### 4.2.9 Duration lapsed after training infection control

The results obtained from the study showed that nurses with duration of 2 to 5 years after training had a rate of 48.53% (n=33) while those with duration of less than 2 years after training had a rate of 51.47% (n=35).



**Figure 9: Time Span Lapsed after training in infection control**

### 4.3 KNOWLEDGE

#### 4.3.1 Awareness of Ventilator Associated Events

On the analysis of the enquiry whether the nurses were aware of ventilator associated events, 91.5% (n=75) were aware while 8.5% (n=7) were not aware.

**Table 1: Showing awareness of ventilator associated events among nurses working in CCU, KNH**

Responses	Frequency	Percent
Yes	75	91.5
No	7	8.5
<b>Total</b>	<b>82</b>	<b>100.0</b>

#### 4.3.2 Difference between ventilator associated pneumonia and ventilator associated events

70.7 % (n=58) said there was no difference between ventilator associated pneumonia and ventilator associated events, while 29.3 % (n= 24) felt there was a difference.

**Table 2: Showing the results on whether there is difference between ventilator associated pneumonia and ventilator associated events.**

Responses	Frequency	Percent
No	58	70.7
Yes	24	29.3
<b>Total</b>	<b>82</b>	<b>100.0</b>

#### 4.3.3 Preferred route of endotracheal intubation

14.6% (n=12) preferred nasal route for endotracheal intubation while 85.4% (n=70) preferred oral route.

**Table 3: Showing the most preferred route of endotracheal intubation.**

Responses	Frequency	Percent
Nasal	12	14.6
Oral	70	85.4
<b>Total</b>	<b>82</b>	<b>100.0</b>

#### 4.3.4 Recommended position on mechanically ventilated patient

The respondents who said that, Semi recumbent position is the recommended position for nursing a mechanically ventilated patient were 36 making 43.9%, 39 respondents (47.6%) recommended supine position and 7 respondents (8.5%) were not sure on the recommended position for mechanically ventilated patients.

**Table 4: Showing the results of the recommended position of mechanically ventilated patient**

Responses	Frequency	Percent
Semi recumbent	36	43.9
Not sure	7	8.5
Supine	39	47.6
<b>Total</b>	<b>82</b>	<b>100.0</b>

#### 4.3.5 ETT Cuff pressure to be maintained

The study interviewing ETT Cuff pressure to be maintained, showed that, 70.7% (n=58) said it should be between 10-20 mmHg, 25.6% (n=21) said 20-30mmHg and those who felt it should be 30-40mmHg pressure were only 3 giving a percentage of 3.7%.

**Table 5: Showing ETT Cuff pressures to be maintained**

Responses	Frequency	Percent
10 to 20	58	70.7
20 to 30	21	25.6
30 to 40	3	3.7
<b>Total</b>	<b>82</b>	<b>100.0</b>

**Table 6: showing a grouped statements on knowledge assessment**

Statements	Yes		No	
	N	%	N	%
Head of bed elevation prevents lung infections in mechanically ventilated patients	73	89.0	9	11.0
Subglottic suctioning reduce the risk of VAE	55	67.1	27	32.9
DVT prophylaxis has no role in preventing lung complications	22	26.8	60	73.2
PUD prophylaxis plays a role in preventing lung infections	45	54.9	37	45.1
2% Chlohexidine is the recommended antiseptic for oral care on mechanically ventilated patients	64	78.0	18	22.0
Delirium is very common in mechanically ventilated patients	41	50.0	41	50.0
Exercise and mobilization can decrease delirium	39	47.6	43	52.4

The knowledge was scored out of seven. The ranking of the scores was done whereby; to be knowledgeable the nurse had to score 4 and above while scoring below 4 was termed less knowledgeable. The study findings show that that 54.9% of the respondents scored more than 4 hence were knowledgeable.

**Table 7: Ranking of Knowledge**

<b>Score</b>	<b>Frequency</b>	<b>Percent</b>
Score 7	39	47.6
Score 6	6	7.3
Score 5	0	0.0
Score 4	0	0.0
Score 3	10	12.2
Score 2	5	6.1
Score 1	13	15.9
Score 0	9	11.0
<b>Total</b>	<b>82</b>	<b>100.0</b>

#### **4.3.6 Head of bed elevation**

Majority of the respondents 89.0% (n= 73) respondents agreed that, Head of bed elevation prevents lung infections in mechanically ventilated patients

#### **4.3.7 Subglottic suctioning reduce the risk of VAE**

The nurses were also interviewed on whether Subglottic suctioning reduces the risk of VAE and 67.1% (n=55) respondents agreed that it reduces the risk of VAE

#### **4.3.8 DVT prophylaxis role in preventing lung complications**

26.8% (n=22) nurses said that DVT prophylaxis has no role in preventing lung complications

#### **4.3.9 PUD prophylaxis role in preventing lung infections**

54.9% n=45) nurses agreed with the statement that, PUD prophylaxis plays a role in preventing lung infections

#### **4.3.10 Use of 2% Chlorhexidine for oral care**

78.0% (n=64) agreed to the fact that, 2% Chlorhexidine is the recommended antiseptic for oral care on mechanically ventilated patients.

#### **4.3.11 Delirium mechanically ventilated patients**

The study also sought to establish whether the nurses knew that Delirium is very common in mechanically ventilated patients and 50% (n=41) agreed that Delirium is very common in mechanically ventilated patients.



#### **4.3.12 Exercise and mobilization can decrease delirium episodes**

Only 47.6% (n=39) respondents agreed with the statement that Exercise and mobilization can decrease delirium in the patients under mechanical ventilation.

### **4.4 NURSES PREVENTION PRACTICES ON VAE**

#### **4.4.1 Frequency of oral care to mechanically ventilated patients**

The study established that, 46 respondents (56.1%) practiced oral care to patients, once in 24hrs. The rest (43.9% (n=36) performed twice and more times in 24 hours.

**Table 8: Showing the Frequency of oral care practice to mechanically ventilated patients**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
Once	46	56.1
Twice and more times	36	43.9
<b>Total</b>	<b>82</b>	<b>100.0</b>

#### **4.4.2 Assessment of patients' sedation level**

The results from the study whether the nurses assess patients' sedation level on sedated patient shows that, 30.5% (n=25) did not but 68.3% n=56) performed the assessment.

**Table 9: Showing assessment of patients' sedation level on mechanically ventilated patients**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
No	25	30.5
Yes	57	69.5
<b>Total</b>	<b>82</b>	<b>100.0</b>

**Table 10: showing statement analysis on grouped prevention practices**

Statements	Once daily		Each shift		Hardly		Never	
	N	%	N	%	N	%	N	%
How often do you assess patients for pain	3	3.7	75	91.5	3	3.7	1	1.2
How often do you give sedation vacations (interruptions) to the sedated patients	22	26.8	24	29.3	34	41.5	2	2.4
How often do you give Spontaneous breathing Trials where applicable	29	35.4	30	36.6	23	28.0	0	0
How often do you assess patients for weaning from mechanical ventilator	21	25.6	59	72.5	2	2.4	0	0

**4.4.3 Patient's assessment for pain**

From the above table it was found that the nurses who assessed the patients pain once daily gave a rate of 3.7% (n=3), each shift 91.5% (n=75), 3.7% (n=3) hardly assessed the patients pain and were and 1.2% (n=1)) never assessed patients for pain

**4.4.4 Sedation vacations (interruptions) to the sedated patients**

From the results obtained it was established that the nurses who often gave sedation vacations (interruptions) to the sedated patients once daily gave a percentage of 26.8% (n=22), each shift 25.6 % (n=24), 41.5 % (n=34) hardly gave sedation vacations and only 2.4%(n=2) who never gave the sedation interruptions to the sedated patients.

**4.4.5 Spontaneous breathing Trials**

35.4% (n=29) gave Spontaneous breathing trials to the ventilated patients once daily, 36.6% (n=30) gave at each shift while 28% (n=23) hardly did.

**4.4.6 Assessment for weaning from mechanical ventilator**

Among the respondents interviewed it was established that those nurses who often assessed patients for weaning from mechanical ventilator once daily were 21 translating to 25.6%, those who assessed the patients at each shift were 59 (72.5 %) those who hardly did were 2(2.4%) and none never assessed.

**Table 11: VAE prevention practices checklist analysis**

Statements	Yes		No	
	N	%	N	%
Head of bed elevated between 30-45 <sup>0</sup>	76	92.7	6	7.3
Cuffed endotracheal tube used	71	86.6	11	13.4
Endotracheal tube cuff pressure maintained	52	63.4	30	36.6
Oral care done	78	95.1	4	4.9
Oral care done with povidone to HI patient and chlohexidine to other patients	30	36.6	52	63.4
Subglottic suctioning done	35	42.7	47	57.3
Hand hygiene done prior suctioning	40	48.8	42	51.2
Use of face mask during suctioning	79	96.3	3	3.7
Aseptic technique during suctioning	78	95.1	4	4.9
Hand hygiene after ETT suctioning	16	19.5	66	80.5
Delirium risk assessed	1	1.2	81	98.8
Activity and early mobilization done on patient	71	86.6	11	13.4
Administration of DVT prophylaxis	55	67.1	27	32.9

The researcher further scored the practices to determine how the respondents fared in the prevention practices. Each practice was given a score of one in a total of 13 points. The findings were presented in Table 11.

**Table 12: Ranking of VAE Practices**

<b>Score</b>	<b>Frequency</b>	<b>Percent</b>
Score 13	1	1.2
Score 12	15	18.3
Score 11	15	18.3
Score 10	5	6.1
Score 9	5	6.1
Score 8	12	14.6
Score 7	3	3.7
Score 6	16	19.5
Score 5	0	0.0
Score 4	5	6.1
Score 3	2	2.4
Score 2	0	0.0
Score 1	1	1.2
Score 0	3	3.7
<b>Total</b>	<b>82</b>	<b>100</b>

The study shows that most of the nurses 68.4% (n= 56) scored 7 and above and only one nurse (1.2%) scored 13. This shows that, Most of the nurses practiced most of VAE prevention practices but only one nurse practiced all.

Among the 13 VAE prevention practices observed as the nurses worked on mechanically ventilated patients, a rate of 92.7%(n=76) nurses, nursed their patients with head of bed elevated between 30-45<sup>0</sup>, 86.6%(n= 71) respondents had their patients' endotracheal tube cuffed and 63.4%(n=52) respondents maintained cuff pressures on their patients' endotracheal tube. 95.1 % (n=78) respondents were observed to give their patients oral care and only a rate of 36.6% (n=30) thus 28 nurses who nursed head injury patients used povidone and 2 nurses used chlorhexidine on other patients. Lastly, a rate of 42.7%= (35) nurses practiced subglottic suctioning.

A rate of 48.8% (40) respondents performed hand hygiene prior suctioning while only 19.5% (n=16) respondents performed hand hygiene after suctioning. 95.1 % ( n=78) respondents practiced aseptic technique and 96.3% (n=79) nurses used face masks during suctioning. 86.6 % (n=71) nurses practiced activity and early mobilization while only 1.2 % (n=1) respondent performed delirium risk assessment and 8.1% (n=55) nurses nursed their patients under DVT prophylaxis.

## 4.5 ASSOCIATIONS OF VARIABLES

### 4.5.1 Correlation

The study conducted correlation analysis to test the strength of association between the research variables. Correlation is the measure of the relationship or association between two continuous variables. The findings of the study are presented in Table 11.

**Table 13: Correlation**

		Knowledge of VAE prevention	Practices of VAE prevention	Prevalence of VAE
Knowledge of VAE prevention	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	82		
Practices of VAE prevention	Pearson Correlation	.729**	1	
	Sig. (2-tailed)	.000		
	N	82	82	
Prevalence of VAE	Pearson Correlation	.685**	.908**	1
	Sig. (2-tailed)	.000	.000	
	N	82	82	82

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The results showed a positive significant correlation between knowledge of VAE prevention and the practices of VAE prevention (Pearson's Correlation Coefficient  $r = 0.729$ ,  $P=0.00$ ). The results further showed a positive association between knowledge of VAE prevention and prevalence of VAE ( $r = 0.685$ ,  $P=0.00$ ) and also between practices of VAE prevention and prevalence of VAE ( $r = 0.908$ ,  $P= 0.00$ ).

### 4.5.2 Regression

The study further carried out regression analysis to establish the statistical significance relationship between the independent variables, knowledge of VAE prevention and practices of VAE prevention and the dependent variable, prevalence of VAE. The regression analysis results were presented using regression model summary tables, analysis of variance (ANOVA) table and beta coefficient tables.

**Table 14: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.908 <sup>a</sup>	.825	.821	.483

a. Predictors: (Constant), Practices of VAE prevention, Knowledge of VAE prevention

Table 13 shows high R square and adjusted R meaning that there is a high variation that can be explained by the model. There existed a strong positive relationship between the independent variables and the prevalence of VAE (coefficient of determination = 0.825); This implied that, 82.5% The variation in the prevalence of VAE was explained by the knowledge and practices of VAE prevention and the remaining 17.5% can be explained by other variables not included in the study.

**Table 15: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	87.119	2	43.559	186.594	.000 <sup>b</sup>
Residual	18.442	79	.233		
Total	105.561	81			

a. Dependent Variable: Prevalence of VAE

b. Predictors: (Constant), Practices of VAE prevention, Knowledge of VAE prevention

The ANOVA results for regression coefficients on Table 13 showed significant relationship between the knowledge of VAE prevention and practices of VAE prevention and the prevalence of VAE significance (F = 0.00).

**Table 16: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.879	.162		5.430	.000
Knowledge of VAE prevention	-.044	.061	-.050	-.725	.040
Practices of VAE prevention	-.709	.056	-.871	-12.682	.000

a. Dependent Variable: Prevalence of VAE

The results can be presented as:

$$\text{Prevalence of VAE} = 0.879 - 0.044 \text{ Knowledge of VAE prevention} - 0.709 \text{ Practices of VAE prevention}$$

The interpretation is that a unit change in knowledge of VAE prevention will result into a -0.044 change in prevalence of VAE. The results also show that a unit change on practices of VAE prevention will result in a -0.709 change in prevalence of VAE. The findings show that all the variables tested were statistically significant with p-values less than 0.05.



## **CHAPTER FIVE: DISCUSSION CONCLUSION AND RECOMMENDATIONS**

### **5.1 DISCUSSION**

#### **5.1.1 Characteristics of the respondents**

This study established that the majority of nurses working in CCU, KNH were females aged 30 -49years and married. The majority had diploma as their highest level of education which could be explained by the high percentage 93% (n=77) of nursing specialization in critical care nursing. The fact that majority of nurses had worked in CCU for more than 5 years, with the highest percentage having over 10years of experience yet degree level nurses constituted 13.4 % (n=11) and only 1.2% (n=1) had masters level of nursing education could mean that, the majority were not motivated to further their nursing studies.

Majority of the nurses working in this unit 54.9%(n=45) were ranked Nursing officer I and Senior nursing officers hence team leaders, This fact plus high percentage of nursing specialization and degree level nurses 13.4 % (n=11) explains why majority of the interventions were carried out by a large percentage of nurses proving that, they implemented what they knew hence need to teach the omitted or poorly practiced interventions. In view of the specialty, seniority and long term experience in CCU, this population stands the most ideal for practicing prevention measures once sensitized.

#### **5.1.2 VAE Prevalence**

Concurring with Klompas, Kleinman and Murphy (2014) saying that, VAEs are common in mechanically ventilated patients, the prevalence rate of VAE in the month of April 2015 in CCU KNH was found to be 5.63 per 1000 episodes of mechanical ventilation. Currently there are no benchmark rates and researchers are encouraged to report VAE to yield up a benchmark. In view of the study findings showing that, 82.5% of the variation in the prevalence of VAE was explained by the knowledge of VAE prevention and practices of VAE prevention, it can be explained by lack of knowledge on almost half of the population on VAE and its prevention measures and omission of practice of some care bundle interventions by the most of the nurses working in CCU, KNH.

KNH is a National referral hospital so, the majority of the patients admitted in the unit are often managed elsewhere before getting a bed in this unit, depending on the length of time taken prior or without health care service, the quality of the service given and the seriousness of the condition warranting referral predispose these patients to long term stay in the unit which in turn predisposes them to VAE.

### **5.1.3 Knowledge on VAE**

The study findings show that, most of the nurses 54.9% had adequate knowledge on VAE and its prevention. This shows that quite a large percentage (45.1%) was less knowledgeable and this could lead to prevalence of VAE in the unit.

Most of the nurses 82.93 % (n=68) had undergone infection prevention and control training, among them, the highest percentage 51.47% (n=35) had trained within the last 2years and the rest 48.53% (n=33) had trained within the last 5 years, this correlates with the 100% knowledge on VAP compared to 75% those who were aware of the VAE. VAE is a new concept that was implemented in the year 2013 meaning that 48.53% (n=33) nurses who trained 2-5 years ago may have not covered VAE in their infection prevention and control training. This explains the omission in some VAE prevention practices in the unit.

Contrary to Abernathy, (2013) stating that, VAE captures both lung complication and infections and that, the VAP bundle may not adequately cover VAE, out of the 91.5 % (n=75) nurses who responded that they were aware of VAE, only a few 29.3% (n=24) knew the difference between ventilator associated pneumonia and ventilator associated events. This could mean that, most of the nurses lacked knowledge on VAE hence confusing VAE and VAP to be the same thing, it could also mean that, the infection control training concentrates on VAP and does not cover VAE well or it is not covered at all.

Use of oro-tracheal over naso-tracheal intubation is recommended because it may cause sinusitis, which increases risk for lung infection due to contamination hence VAE (SARI 2011, p. 6). Most of the nurses lacked knowledge on this rationale because most of them preferred oral over nasal route for ETT and most of them did not relate it to prevention of VAE, many said oral route was more comfortable for the patient

According to Munro and Ruggiero, (2014), all patients receiving mechanical ventilation or... should be nursed in semi recumbent position with head of bed elevated at 30° to 45° to prevent aspiration. Contrary to Munro and Ruggiero, only 43 % (n=36) respondents knew

that semi recumbent is the recommended position for nursing these patients, a few chose supine position and some were not sure of the recommended position. This may promote VAE prevalence in the unit.

Very few nurses 25.6% (n=21) knew the recommended cuff pressures to be maintained; most of the nurses said it should be lower and a few said it should be higher than 30mmHg. This could definitely contribute to prevalence of VAE as supported by Curtin (2011) saying that, the cuff pressure should be maintained above 20 cm H<sub>2</sub>O to prevent the aspiration, but below 30 cm H<sub>2</sub>O to prevent injury to the tracheal mucosa.

The study also showed that, most of the nurses had knowledge that the following statements prevents VAE; Head of bed elevation, use of 2% Chlorhexidine in oral care, Subglottic suctioning, use of PUD and DVT prophylaxis. 50% (n=41) lacked knowledge on the fact that, delirium is very common in mechanically ventilated patients and 52.4% (n=43) did not know the importance of exercise and mobility in prevention of VAE. This could mean most of the nurses do not have adequate knowledge in VAE.

#### **5.1.4 VAE Prevention practices**

According to Munro and Ruggiero, (2014), intervention bundle is a series of evidence based interventions related to ventilator care that, when implemented together, will achieve significantly better outcomes than when implemented individually to prevent VAE. The study shows that most of the interventions were practiced by most of the nurses 68.4 % (n=56) and only one nurse (1.2 %) practiced all the 13 interventions. This omission of some VAE preventive practices could contribute to VAE prevalence in the unit.

Most of the nurses 95% (n=78) and 56.1% (n=46) respectively assessed pain and patients' sedation level on sedated patients though the majority did not give the appropriate methods that should be used to assess the two, some of the responses included Glasgow coma scale meaning that the nurses may have been confusing coma with pain and sedation assessment. Pain management is a key factor in CCU and sedation is often administered in the unit, this could be the reason why it was well done rather than relating it to prevention of VAE. Most of the respondents gave sedation vacations (interruptions) to the sedated patients with most of them doing it once each shift and 41.5% (n=34) hardly gave sedation vacations. This number that hardly gave the interruptions is large enough to contribute the prevalence of VAE in the unit.

It was recommendable to find out that, some interventions had very high percentages; assessing patients to wean them off mechanical ventilation was the most well performed intervention 98.1% (n=78) followed by maintaining head of bed elevated between 30-45° 92.7% (n=76) others included; giving oral care to the patients 95.1% (n=78), practicing or ensuring activity and early mobilization 86.6% (n=71), Spontaneous breathing trials 72% (n=59), maintaining cuff pressures on the patients' Endotracheal tubes 63.4% (n=52). This could be explained by the high percentage (92.7%) of Critical care specialized nurses in the unit and long CCU experience in the unit by the majority of nurses (Figure 7).

Most of the nurses 95.1(n=79) practiced aseptic technique during the ETT/tracheostomy suctioning and 96.3(n=79) used face masks during the procedure which contradicted with the low percentage 48.8% (n=40) of those who performed hand hygiene prior suctioning and the lowest percentage 19.5% (n=16) on the respondents who performed hand hygiene after the procedure. This could be explained by ignorance or attitude on hand washing procedures because hand washing is well covered in infection control training and it is one of the key observations in CCU. Many studies have been done on this topic and it is a topic often discussed in the unit because of its consequences to both health care workers and patients.

The study also showed that the majority 95.1% (n=78) gave oral care though most of them 56.1% (n=46) gave it only once in 24 hours contrary to Abernathy (2013), recommending regular oral care on ventilated patients to reduce the opportunities for VAE, Concurring with Abernathy, Munro and Ruggiero (2014); Curtin, (2011) adds that the frequency of twice a day and every 6-8 hours respectively reduce the total hospital acquired respiratory tract infection rate by 40% in patients who are critically ill,

Despite the high percentage of those who gave oral care, the majority did not use the recommended antiseptic and only 36.9% (n=30) did; 28 nurses nursing head injury patients used povidone and only 2 nurses used chlorhexidine on other patients. It was further noted that the chlorhexidine used during this time was patients own property having been transferred in with it from other hospitals. This could be explained by hospitals policy on the choice of available antiseptic for oral care. It can be supported by the fact that the majority 78% (n=64) knew that 2% chlorhexidine is the recommended antiseptic for oral care of these patients but only a few practiced it.

The most of the nurses 58.3% (n=47) did not perform subglottic suctioning contrary to SARI (2011,p.7) who recommends use of subglottic suctioning because pooled secretions

above the ETT cuff are often contaminated with oral microorganisms and may cause lung infection once aspirated. This could be as a result of hospitals policies on the availability of ETT tubes that supports subglottic suctioning.

98.8% (n=81) did not assess the patients for delirium risk yet 50% (n=41) knew it was important to assess. This could be due to lack of knowledge on how to assess the same or lack of knowledge on the role played by delirium in causing VAE. AHA et al (2014, p. 11) states that, up to 81% of mechanically ventilated patients experience delirium but it remains undetected by both nurses and doctors in more than 65% of ICU patients. AHA et al warns that delirium may lead to unplanned extubation and increased oxygen demand hence VAE, they recommend delirium assessment of delirium be done at least once per shift.

### **5.1.5 Association between variables**

According to the study findings, the results of the correlation analysis revealed that knowledge of VAE prevention was positively related to the practices of VAE prevention with a Pearson's Correlation Coefficient of  $r = 0.729$  and was statistically significant at 0.000 (the p-value is less than 0.05). This could be explained by the fact that the most of the nurses had acquired knowledge and skills in nursing critically ill patients because the majority working in this unit were critical care nurses 92.7% (n=76), had undergone infection control course 82.9% (n=68) and 61.4 % (n=50) had above 6years of experience in CCU.

Most of the nurses lacked knowledge on the difference between VAP and VAE 70.7% (n=58). This explains why the majority of the nurses had knowledge and performed the VAP care bundles well to include head of bed elevation, sedation assessment and weaning, DVT and PUD prophylaxis and most of the nurses lacked knowledge and performed low on some interventions associated with VAE to include; cuff pressure maintenance, delirium assessment and the importance of exercise and mobility, recommended positions.

The study findings showed that, there existed a strong positive relationship between the independent variables and the prevalence of VAE. Explaining further that a unit change in knowledge of VAE prevention will result into a -0.044 change in prevalence of VAE while a unit changes on practices of VAE prevention will result in a -0.709 change in prevalence of VAE. This can be explained by the prevalence of VAE in CCU, KNH and the areas where the majority and also the minority of nurses lacked knowledge and omitted or did not follow set protocols in performing the VAE prevention interventions.

Concurring with the study findings that, 82.5% of the variation in the prevalence of VAE was explained by the knowledge of VAE and practices of VAE prevention, the remaining 17.5% can be explained by other variables not included in the study to include; lack of VAE preventive practices guidelines, protocols, the recommended facilities, lack of skills and negative attitude towards practicing the procedures. This can be explained by a few isolated cases where the nurses scored high in knowledge and performed low in the same; 78%(n=64) who knew on use of 2% Chlohexidine as a recommended oral care antiseptic but only 36.9%(n=30) practiced it, 67%(n=55) knew importance of subglottic suctioning but only 42.7%( n=35), 50%(n=41) knew that delirium is common to ventilated patients but only 1.2 %(n=1) assessed the patient on delirium risk.

In comparison between knowledge and practice, a few basic interventions scored slightly higher than the knowledge to include importance of exercise and mobility, maintenance of ETT cuff pressures and elevation of head of bed. This could explained by the fact that in view of most of the nurse being senior nurses with authority, long CCU experience above 6yrs with the largest percentage above 10 years of experience could bring forth lack of evidence based nursing hence practicing traditions, authority, clinical experience and role modeling as sources of knowledge for practice.

## **5.2 CONCLUSION**

The study reveals that, there were cases of Ventilator associated events (morbidity) at the CCU KNH. Most of the nurses working in the unit had knowledge on prevention of VAE though most of them lacked knowledge on; VAE, endotracheal tube cuff pressures to be maintained, recommended position for the patients, delirium and the importance of early mobility and exercise in mechanically ventilated patients

Most of the nurses working in CCU, KNH practiced most of the recommended VAE prevention practices but not all. The interventions that were not well performed included; recommended frequency of oral care and use of 2% chlohexidine for oral care, subglottic suctioning, hand hygiene and assessment of delirium in mechanically ventilated patients.

This study also shows that, there existed a strong positive relationship between knowledge and VAE prevention practices and also the prevalence of VAE in the unit. It implied that, the

variation in the prevalence of VAE was mainly explained by the knowledge and practices of VAE prevention.

### **5.3 RECOMMENDATIONS**

Based on the findings of this study, the following recommendations were made;

In view of KNH being a National hospital with the largest CCU in East and Central Africa, the hospital management team in collaboration with the infection prevention and control department should participate in VAE surveillance to monitor and share the VAE trends with other big hospitals in the world through CDC reporting.

In view of VAE being relatively a new concept (implemented 2013), The Infection prevention and control curriculum should be reviewed to include VAE. Fresh training on infection prevention and control and frequent continuous progressive development to include both VAP and VAE will be of great help in CCU in enhancing awareness on the preventive measures of the same.

The hospital in collaboration with the infection prevention and control department, Quality assurance and CCU team should come up with a checklist of the intervention care bundles to enhance daily implementation of the interventions.

The unit's administration should ensure the completeness of the care bundle checklists through supervision and compile monthly reports on VAE prevalence in the unit (internal audits) to aid evaluation.

The hospital management team has a big role to play in the availability of the recommended facilities needed to practice preventive measures to include; easily adjustable beds for recommended position, 2% chlohexidine oral care antiseptic, Subglottic suctioning tubes among others.

The hospital should motivate more nurses to further their studies to degree level and master in Critical care nursing specialty to enhance quality services in this specialized unit.

Further study on other factors contributing to prevalence of VAE is recommended.

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## **APPENDIX I PART 1: CONSENT INFORMATION FORM**

My name is Pauline Mbithe Malombe, a student at The Nairobi University undertaking Masters in Nursing, Critical Care specialty. I take this opportunity to invite you to participate in this study entitled 'Evaluation of nurses' prevention practices on Ventilator Associated Morbidity in CCU, KNH'

**Significance:** This study will enhance awareness in prevention of Ventilator Associated Morbidities in Critical Care Unit (CCU) and encourage the Hospital to participate in Ventilator associated events (VAE) surveillance to monitor and share its trends with other big hospitals in the world through CDC reporting. This will enhance elimination of these morbidities which in turn will lead to quality specialized care, reduced mortality and morbidity, creation of beds in CCU hence saving more lives for the patients in need of Critical health care.

### **Procedures:**

You will be given a questionnaire to fill by the researcher/ research assistant which will take you approximately 10 minutes to fill and the filled questionnaire form will be collected; He will then proceed to observe you as you take care of your patients and fill in an observational checklist.

### **Risks:**

There are minimal risks for your participation in this study. There is a possibility that, you may feel uncomfortable to be observed as you work or that some questions may make you uncomfortable. Should this occur, just inform the researcher or omit the question.

**Benefits:** There may be no direct benefits like monetary gains, tokens or gifts but the information given will aid enhance elimination of lung infections and complications following mechanical ventilation. This will reduce mortality and morbidity of patients nursed under mechanical ventilation hence quality specialized care to the patients.

### **Voluntary Participation and Withdrawal:**

Your participation is entirely voluntary and you have the right to withdraw participation at any time.

**Confidentiality:**

The information given will be kept confidential; you will neither write any of your identification information in the questionnaire nor will the researcher identify you or use any information that would make it possible for anyone to identify you in any written reports about this study. After analysis the questionnaires will be kept under lock and key. Electronic files will be saved on password and fire-wall protected computers.

**Contact Persons:**

In case of questions or concerns about the content of this study or about your rights as a participant, please feel free to contact the following;

- The Principal Investigator- Pauline Malombe, Box 2141-00202 Nairobi, Mobile number 0722617910
- The lead Supervisor, Dr. James Mwaura, Senior lecturer, School of Nursing , University of Nairobi through Box 196-00202, telephone no (254-020) 2726300 ext 44355
- Kenyatta National Hospital/ University of Nairobi Ethics and Research committee secretariat, Box 20723-00202, Nairobi, telephone number 726300-9

## **APPENDIX II CERTIFICATE OF CONSENT FOR THE PARTICIPANT**

I have read the foregoing information and had the opportunity to ask questions about it and any concerns that I have asked have been addressed to my satisfaction. I am thus willing to participate voluntarily in this study titled ‘Evaluation of nurses’ prevention practices on Ventilator Associated Morbidity in CCU, KNH’

Participants signature.....Date.....

Researcher signature.....Date.....

### **Contacts**

- The Principal Investigator- Pauline Malombe, Box 2141-00202 Nairobi, Mobile number 0722617910
- The lead Supervisor, Dr. James Mwaura, Senior lecturer, School of Nursing , University of Nairobi through Box 196-00202, telephone no (254-020) 2726300 ext 44355
- Kenyatta National Hospital/ University of Nairobi Ethics and Research committee secretariat, Box 20723-00202, Nairobi, telephone number 726300-9

**EVALUATION OF NURSES' KNOWLEDGE AND PREVENTION PRACTICES ON VENTILATOR ASSOCIATED MORBIDITIES IN CCU, KNH**

**Instructions**

1. Do not write your name(s) or any identification on the Questionnaire
2. Kindly answer all questions as appropriate
3. Answer by ticking (✓) in the boxes or filling the spaces provided

**PART 2A Socio-demographic Information**

1. What is your gender? Female  Male

2. What is your age bracket?

20-29 yrs.

30-39 yrs.

40-49 yrs.

50-59 yrs.

Above 59 yrs.

3. What is your marital status

Married

Separated

Divorced

Widowed

Single

4. What is your highest attained level of nursing education?

Certificate

Diploma

Degree

Masters



5. What is your designation?

Senior Nursing officer

Nursing officer I

Nursing officer II

Nursing officer III

Others

Specify.....

6. What is your specialty in nursing?

a. Critical care

b. Accident and Emergency

c. Renal

d. None

e. Any  other,  
specify.....

7. State the number of years of service in Critical care unit.....

**PART 2B**      Knowledge on Ventilator Associated Events

1. Have you undergone training on infection control?

YES

NO

How long ago?

a) Less than 2 years

More than 2 years but less than 5years

2. Do you know what Ventilator Associated Pneumonia is?

YES

NO

Are you aware of Ventilator Associated Events?

YES

NO

Is there difference between Ventilator Associated Events and Ventilator Associated Pneumonia?

YES

NO

b) Please give reasons to your response

.....

.....

5. Which route of endotracheal intubation would you prefer?

Oral

Nasal

b) Please give reasons to your response

.....

.....

6. Which position is recommended on a mechanically ventilated patient (if no contraindications)

b) Supine

c) Semi-recumbent

d) Not sure

7. ETT Cuff pressure should be maintained within the following range of pressures in cmH<sub>2</sub>O

a) 10 to 20

b) 20 to 30

c) 30 to 40

d) Above 40

Please tick (✓) where applicable against the statement given for Q 8 to 14

	Statement	TRUE	FALSE
8.	Head of bed elevation prevents lung infections in mechanically ventilated patients		
9.	Subglottic suctioning reduce the risk of VAE		
10.	DVT prophylaxis has no role in preventing lung complications		
11.	PUD prophylaxis plays a role in prevention lung infections		
12.	2% Chlohexidine is the recommended antiseptic for oral care on mechanically ventilated patients		
13.	Delirium is very common in mechanically ventilated patients		
14.	Exercise and mobilization can decrease delirium		

## 2C Nurses prevention practices on ventilator associated events

1. How often do you give oral care to patients under mechanical ventilation in 24 hours

- a) Hardly
- b) Once
- c) Twice and more times

2. a) Do you assess patients' sedation level on sedated patients YES  NO

If your response is YES continue to answer 2b

b) Which sedation scale do you use.....

Kindly tick the appropriate response against the given statements for Question 3 to 6

	Statement	Once daily	Each shift	Hardly	Never
3.	How often do you assess patients for pain				
4.	How often do you give sedation vacations (interruptions) to the sedated patients				
5.	How often do you give Spontaneous breathing Trials where applicable				
6.	How often do you assess patients for weaning From mechanical ventilator				

**APPENDIX III: CHECKLIST FOR VAE INCIDENCE-VAE DATA ELEMENTS**

PATIENT NAME

DATE OF ADMISSION

IP/NO

AGE

DIAGNOSIS

DATE OF EVENT

LOCATION OF INTUBATION

TYPE OF EVENT

MV Day	PEEP min	FiO <sub>2</sub> min	Temp min	Temp max	WBC min	WBC max	Abx	Specimen	Polys / Epis	Organism	VAE

**Key**

**MV** - Mechanical ventilation.

**PEEPmin** - Daily minimum PEEP.

**FiO<sub>2</sub>min** - Daily minimum FiO<sub>2</sub>.

**Temp min** - Daily minimum temperature.

**Temp max**- Daily maximum temperature.

**WBCmin** - Daily minimum white blood cell count.

**WBCmax** - Daily maximum white blood cell count.

**Abx** - Antimicrobial agents.

**Polys/epis**- Polymorphonuclear leukocytes and squamous epithelial cells from respiratory specimen.

**APPENDIX IV: CHECKLIST FOR NURSES PREVENTION PRACTICES ON VAE**

- |  |     |                          |    |                          |
|--|-----|--------------------------|----|--------------------------|
| 1. Head of the bed elevated to between 30 to 45 <sup>0</sup> | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 2. Cuffed Endotracheal tube used                             | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 3. Endotracheal tube cuff pressure maintained                | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 4. Oral care done  | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 5. Done with chlohexidine/povidone if HI patient             | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 6. Subglottic suctioning done                                | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 7. Hand hygiene done prior ETT/tracheostomy suctioning       | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 8. Use of facemask during suctioning                         | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 9. Aseptic technique during ETT/tracheostomy suctioning      | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 10. Hand hygiene after ETT/tracheostomy suctioning           | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 11. Delirium risk assessed                                   | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 12. Activity and early mobilization done on patient          | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |
| 13. Administration of DVT prophylaxis                        | YES | <input type="checkbox"/> | NO | <input type="checkbox"/> |

## APPENDIX V: KNH/UON-ERC LETTER OF APPROVAL



UNIVERSITY OF NAIROBI  
COLLEGE OF HEALTH SCIENCES  
P O BOX 19676 Code 00202  
Telegrams: varsity  
(254-020) 2726300 Ext 44355



KNH/UON-ERC  
Email: [uonknh\\_erc@uonbi.ac.ke](mailto:uonknh_erc@uonbi.ac.ke)  
Website: <http://erc.uonbi.ac.ke>  
Facebook: [https://www.facebook.com/uonknh\\_erc](https://www.facebook.com/uonknh_erc)  
Twitter: @UONKNH\_ERC [https://twitter.com/UONKNH\\_ERC](https://twitter.com/UONKNH_ERC)



KENYATTA NATIONAL HOSPITAL  
P O BOX 20723 Code 00202  
Tel: 726300-9  
Fax: 725272  
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/216

12<sup>th</sup> May, 2015

Pauline Mbithe Malombe  
School of Nursing  
University of Nairobi

Dear Pauline

**Research Proposal : Evaluation of Nurses' Prevention Practices of Ventilator associated Morbidities in Critical Care Unit, Kenyatta National Hospital (P125/03/2015)**

This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and **approved** your above proposal. The approval periods are 12<sup>th</sup> May 2015 to 11<sup>th</sup> May 2016.

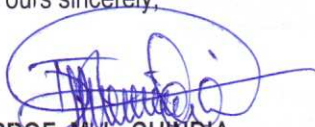
This approval is subject to compliance with the following requirements:

- a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH/UoN ERC before implementation.
- c) Death and life threatening problems and severe adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH/UoN ERC within 72 hours of notification.
- d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH/UoN ERC within 72 hours.
- e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
- f) Clearance for export of biological specimens must be obtained from KNH/UoN-Ethics & Research Committee for each batch of shipment.
- g) Submission of an *executive summary* report within 90 days upon completion of the study  
This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

For more details consult the KNH/UoN ERC website [www.erc.uonbi.ac.ke](http://www.erc.uonbi.ac.ke)

ETUS YAM S I

Yours sincerely,



**PROF. M. L. CHINDIA**  
**SECRETARY, KNH/UON-ERC**

- c.c. The Principal, College of Health Sciences, UoN  
The Deputy Director CS, KNH  
The Chair, KNH/UoN-ERC  
The Director, School of Nursing  
Supervisors: Dr. James Mwaura, Mrs. Theresa Odera

# APPENDIX VI; KNH A&E DEPARTMENT APPROVAL LETTER

KNH/R&P/FORM/01



**KENYATTA NATIONAL HOSPITAL**  
P.O. Box 20723-00202 Nairobi

Tel.: 2726300/2726450/2726565  
Research & Programs: Ext. 44705  
Fax: 2725272  
Email: [knhresearch@gmail.com](mailto:knhresearch@gmail.com)

## Study Registration Certificate

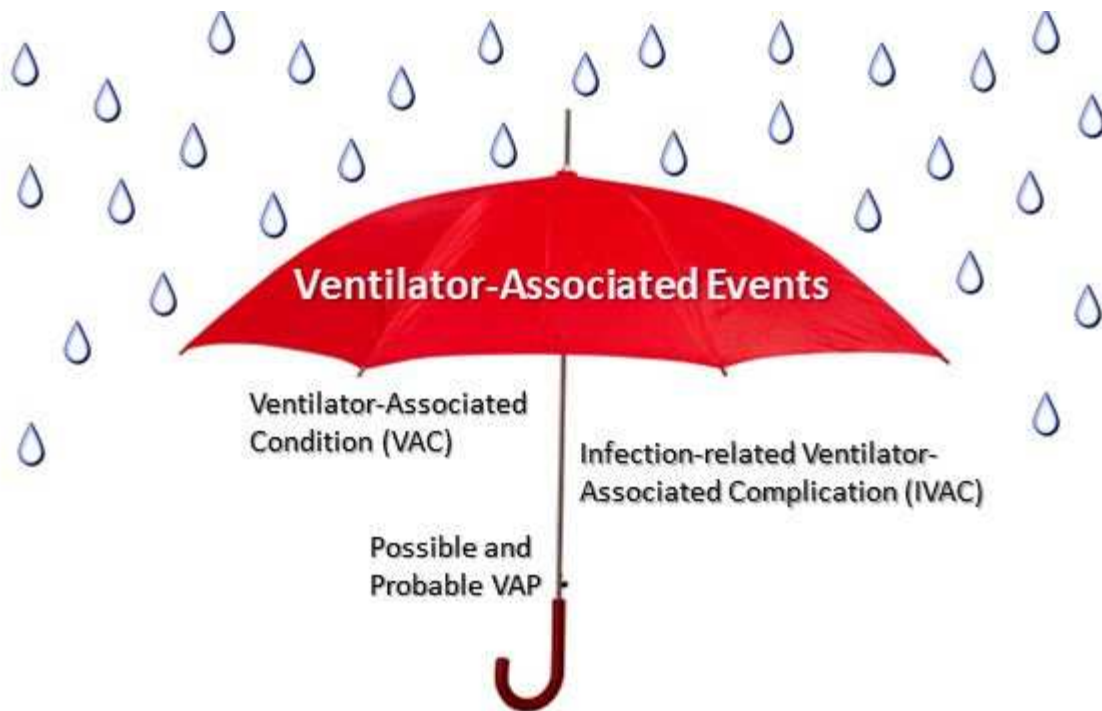
1. Name of the Principal Investigator/Researcher  
PAULINE MBIHE MALOMBE
2. Email address: pmalombe@yaho.com Tel No. 07 22 617 910
3. Contact person (if different from PI).....
4. Email address: ..... Tel No. ....
5. Study Title  
EVALUATION OF NURSES PREVENTION PRACTICES OF VENTILATOR ASSOCIATED MORBIDITIES IN CRITICAL CARE UNIT, KENYATTA NATIONAL HOSPITAL
6. Department where the study will be conducted ANAESTHESIA  
(Please attach copy of Abstract)
7. Endorsed by Research Coordinator of the Department where the study will be conducted.  
Name: ..... Signature ..... Date.....
8. Endorsed by Head of Department where study will be conducted.  
Name: DR. HEZLA O. ODEH Signature [Signature] Date 19/05/2015
9. KNH UoN Ethics Research Committee approval number P125/03/2015  
(Please attach copy of ERC approval)
10. I PAULINE MBIHE MALOMBE commit to submit a report of my study findings to the Department where the study will be conducted and to the Department of Research and Programs.  
Signature [Signature] Date 19th May 2015
11. Study Registration number (Dept/Number/Year) ANAESTHESIA 10/2015  
(To be completed by Research and Programs Department)
12. Research and Program Stamp \_\_\_\_\_

All studies conducted at Kenyatta National Hospital **must** be registered with the Department of Research and Programs and investigators **must commit** to share results with the hospital.





## APPENDIX VII: VAE UMBRELLA



The three tiers housed under ventilator-associated events are: Ventilator-Associated Condition (VAC), Infection-related Ventilator-Associated Complication (IVAC), and Possible or Probable VAP Retrieved from Abernathy, D. (2013). Proper Oral Care Treatment Leads to more Positive Patient Outcomes. *Medline Clinical blog*, [Online] June 18<sup>th</sup>. Medline. Available at <http://mkt.medline.com/clinical>. (Accessed 6<sup>th</sup> February, 2015)

## **APPENDIX VIII: ABCDE BUNDLE COMPONENTS**

**A** – Awakening trials for ventilated patients

**B** – Spontaneous Breathing trials

**C** – RN and respiratory therapist Coordination to perform spontaneous breathing trials by reducing or stopping sedation so as to awaken the patient

**D** – Standard Deliriumassessment program, including treatment and prevention options

**E** – Early mobilization and ambulation of critically ill

ABCDE bundle components retrieved from, American Hospital Association , Partners for patients & Health research and Educational Trust. (2014, p. 9). *Ventilator associated events change Package; preventing harm from VAE*. Available at <http://www.hret.hen.org/index.php> . (Accessed 6<sup>th</sup> February, 2015)

## APPENDIX IX: RICHMOND AGITATION-SEDATION SCALE (RASS)

### THE RASS SCORE:

### THE RASS SCORE TERM DEFINITION

<b>+4 Combative:</b>	Combative, violent, immediate danger to self
<b>+3 Very agitated:</b>	Pulls or removes tube(s) or catheter(s); aggressive
<b>+2 Agitated:</b>	Frequent non-purposeful movement, fights ventilator
<b>+1 Restless:</b>	Anxious and/or apprehensive but movements are not aggressive or vigorous
<b>0 Alert and calm</b>	
<b>-1 Drowsy:</b>	Not fully alert, but has sustained awakening to voice (eye opening & contact < 10 sec)
<b>-2 Light sedation:</b>	Briefly awakens to voice (eye opening and contact <10 sec)
<b>-3 Moderate sedation:</b>	Movement or eye opening to voice (but no eye contact)
<b>-4 Deep sedation:</b>	No response to voice, but movement or eye opening to physical stimulation
<b>-5 Un-arousable:</b>	No response to voice or physical stimulation

### PROCEDURE FOR RASS ASSESSMENT

1. Observe patient
  - Patient is alert, restless, or agitated (score 0 to +4)
2. If the patient is not alert, state the patient's name and ask him or her to open eyes and look at speaker.
  - Patient awakens with sustained eye opening and contact (score -1)
  - Patient awakens with eye opening and eye contact, but not sustained (score -2)
  - Patient has any movement in response to voice but no eye contact (score -3)
3. When no response to verbal stimulation, physically stimulate the patient by shaking the shoulder and/or rubbing the sternum.
  - Patient has any movement to physical stimulation (score -4)
  - Patient has no response to any stimulation (score-5)

Richmond Agitation-Sedation Scale (RASS) retrieved from, American Hospital Association, Partners for patients & Health research and Educational Trust, (2014, p. 23).