

**NURSES PRACTICES ON CLOSED ENDOTRACHEAL TUBE AIRWAY
SUCTIONING AT KENYATTA NATIONAL HOSPITAL ADULT CRITICAL
CARE UNIT**

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NAIROBI**

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DECLARATION

This thesis is my own personal work and has not been offered in any other institution for examination purposes.

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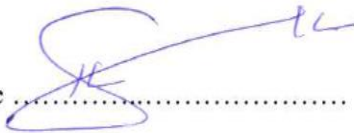
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CERTIFICATE OF APPROVAL

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DEDICATION

This thesis is dedicated to all critical care nurses in the country for their invaluable service in caring for severely ill patients.

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ABBREVIATIONS AND ACRONYMS

AARC	American Association for Respiratory Care
ARCF	American Respiratory Care Foundation
CCNs	Critical Care Nurses
CCU	Critical Care Unit
ETS	Endotracheal Suctioning
HEELP	Hemolysis, Elevated Liver enzymes and Low Platelets
ICP	Intracranial Pressure
KNH	Kenyatta National Hospital
PEEP	Positive End-Expiratory Pressure
SPSS	Statistical Package for Social Sciences
UoN	University of Nairobi
VAP	Ventilator-associated pneumonia
WHO	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Critical care unit - Is a specialized area in a hospital where critically ill patients or patients with life threatening illnesses and injuries are cared for.

Tracheal intubation (or simply intubation) - Is the placement of a flexible plastic tube into the trachea to maintain an open airway or to serve as a conduit through which to administer certain drugs to a patient.

Endotracheal suctioning - Refers to an invasive procedure performed to remove accumulated pulmonary secretions, to maintain airway patency, to optimize oxygenation and ventilation and to prevent atelectasis in mechanically ventilated patients.

Open tracheal suction - Is an endotracheal suctioning technique which involves disconnecting the patient from the ventilator and introducing a single-use suction catheter into the patient's endotracheal tube.

Closed tracheal suction - Is an Endotracheal suctioning technique where the catheter is a part of ventilator circuit with no need to disconnect the ventilator.

Ventilator-associated pneumonia (VAP) - Is a hospital acquired pneumonia that occurs 48 hours or more after mechanical ventilation.

ABSTRACT

Background: In critical care settings, endotracheal tube airway suctioning (ETS) is an important procedure for airway management in patients under mechanical ventilation. It is important that nurses working in critical care settings have the necessary knowledge and skills on ETS because inappropriately or incorrectly performed ETS can cause serious complications.

Objective: To determine the practices on closed endotracheal tube airway suctioning method among nurses at KNH adult critical care unit.

Methods: This was an observational descriptive cross-sectional study conducted among nurses working in adult critical care unit at Kenyatta National Hospital. A hundred and eighty five (185) critical care nurses were recruited as study participants using census method. An observation checklist adopted from the WHO's observational checklist on endotracheal suctioning procedures in critical care settings was used as the study tool. The checklist obtained data on the nurses' practices before, during and after endotracheal suctioning. Nurses' mean adherence scores of $\geq 75\%$ showed desirable practice levels while those of $< 75\%$ denoted sub-optimal practice levels. The data was descriptively analysed using means and normal variation while the study hypothesis was probed using the multiple linear regression analysis at 95% confidence interval. Appropriate ethical principles were adhered to during the study.

Results: The study achieved a response rate of 88.1%. The nurses' pre-suction practices established to be sub-optimal included ascertaining and documenting the need for suctioning (mean = 60.1%); patient preparation - explaining to the patient about the ETS procedure and reassuring the patient (mean = 20.9%); patient's chest auscultation before ETS (mean = 33.1%); offering pre-suctioning hyperoxygenation (mean = 21.5%) and checking the cuff pressure (mean = 28.2%). The nurses' practices during suction established to be sub-optimal included avoiding routine normal saline instillation during endotracheal airway suctioning (mean = 44.8%); limiting the size of suction catheter to not more than half of internal diameter of the endotracheal tube (mean = 57.7%); limiting the number of suction passes to ≤ 2 per ETS procedure (mean = 64.8%); maintaining the duration of suction applied to airway to < 15 seconds (mean = 51.3%); maintaining the level of suction pressure to 80-150mmHg during suctioning (mean = 48.4%) and ensuring humidification by passing saline through the suction catheter (mean = 68.9%). The nurses' post-suction practices established to be sub-optimal included ensuring post-suctioning hyperoxygenation (mean = 65.7%); providing oral care (mean = 27%); patient's chest auscultation after endotracheal suctioning (mean = 52.8%); reassuring of the patient (mean = 37.4%); monitoring of patient's vital signs post-suction (mean = 71.2%); maintaining an optimal cuff pressure post-suctioning (mean = 31.3%) and documentation of outcomes of the ETS procedure (mean = 35%).

Conclusion: There were gaps/deficiencies in the practices on closed endotracheal tube airway suctioning among nurses working in adult critical care unit at KNH.

Recommendations: There is need for regular on-job trainings, inductions and demonstrations on closed endotracheal tube airway suctioning procedures among critical care nurses working at KNH's adult critical care unit so as to sharpen their ETS practice skills and competence.

CHAPTER ONE: INTRODUCTION

1.1 Study background

In critical care units (CCUs), endotracheal airway suctioning (ETS) is a common invasive procedure applied for airway clearance in mechanically ventilated patients (Pasrija & Hall, 2020). The procedure is performed by critical care nurses (CCNs) to remove accumulated pulmonary secretions to ensure airway patency for adequate ventilation and oxygenation, reduce the risk of ventilator-associated pneumonia (VAP) and to prevent atelectasis (Alkubati et al., 2022). Closed endotracheal tube suctioning is a method of airway suctioning that allows the endotracheal tube suction procedure to be performed without disconnecting the patient from the ventilation circuit (Myatra, 2022). The benefits of closed ETS over the open ETS include improved oxygenation; decreased clinical signs of hypoxemia; maintenance of positive end-expiratory pressure with smaller loss of lung volume preventing lung collapse; and limited environmental, personnel and patient contamination; (Blakeman et al., 2022).

Current evidence indicates that as many as half of all critically ill patients admitted in CCUs with difficult airways do experience life-threatening complications associated with ETS. This denotes that endotracheal suctioning is an intervention that requires caution and right clinical decisions (Afenigus et al., 2021). Notable possible serious adverse effects of closed endotracheal airway suctioning if the procedure is not well executed include hypoxemia, pulmonary hemorrhage or bleeding, increased risk of infection and tracheobronchial (or mucosal) trauma. Others include arrhythmias including tachycardia and bradycardia, increased intracranial pressure (ICP), bronchoconstriction, atelectasis, hypertension or hypotension, cardiac and/or respiratory arrest and sudden death (Blakeman et al., 2022; Miller et al., 2019). These physiological complications can also affect the central nervous system, leading to manifestations such as agitation, pain, hallucinations, aggression, delusions, anxiety and the severity of the disease (Gilder et al., 2019).

The recommended guidelines on closed ETS of intubated adult patients include suctioning only when necessary; using a suction catheter occluding up to 50% of the lumen of the endotracheal tube; using the lowest possible suction pressure up to a

maximum of 200 mm Hg whilst exercising caution; inserting the catheter no further than the carina; suctioning no longer than 15 seconds; performing continuous rather than intermittent suctioning; avoiding saline lavage; provide hyper-oxygenation pre and post suction procedure; provide hyperinflation combined with hyper-oxygenation on a non-routine basis and always using aseptic technique using either closed or open suction (Pederson et al., 2019; Blakeman et al., 2022).

Existing evidence shows that critical care nurses' adherence to the evidence based closed ETS practice guidelines leads to better patient care outcomes, fewer complications, shorter length of hospital stays and reduced risk of cross-contamination (Yilmaz et al., 2021). On the contrary, several empirical studies have reported sub-optimal closed ETS practices among critical care nurses in various settings denoting gaps between scientific knowledge/evidence and common practice (Mwakanyanga, et al., 2018; Alkubati et al., 2022; Chen et al., 2021; Pinto et al., 2020). Sub-optimal ETS practice has been attributed to various reasons including resistance to change, little support from managers, lack of CCU training, lack of ease access to the literature, and lack of time to read and understand the literature, competing workload pressures, poor change management process and lack of access to the ETS guidelines (Varghese & Moly, 2021, Myatra, 2022).

Kenyatta National Hospital critical care unit recently adapted closed ETS from the conventional open method practice. Closed ETS was not exclusively practiced according to cursory observations by the researchers probably because change was a gradual process. In addition, according to KNH records, ventilator-associated pneumonia (VAP) was still a challenge among adult patients on mechanical ventilation in CCU. In this light, the current study sought to examine the practices on closed endotracheal tube airway suctioning among nurses working in adult critical care unit of Kenyatta National Hospital.

1.2 Problem statement

Closed ETS is the current recommended practices for removal of lung secretions through suction in mechanical ventilated patients in CCU, a practice that predisposes patients to ventilator-acquired pneumonia among other complications especially if not done well procedurally. Evidence drawn from Kenyatta National Hospital's Critical

Care Unit (CCU) records (Table 1.1) indicated that prevalence of VAP remained a challenge among adult CCU patients on mechanical ventilation.

Table 1.1: Report on ventilator-associated pneumonia in KNH Main CCU, 2022

	Year 2022					
	1st Quarter			2nd Quarter		
	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022
Total number of patients on mechanical ventilation (for more than 48 hours) during the month	82	76	71	79	75	86
VAP events	24	43	28	36	37	46
VAP prevalence (%)	29.3	56.6	39.4	45.6	49.3	53.5

Source: KNH Main CCU Report, 2022

Closed ETS practice was adapted in KNH in July 2022 and there were no existing literature from the search engines used in this study that had evaluated the practice since its adaption in the hospital. Table 1.1 shows a notable decline in VAP prevalence in July then a notable rise in the last quarters of 2022 signaling existence of a gap. Moreover, the researchers observed gaps in the practice to include non-adherence to closed ETS procedure guidelines and occasional tracheal bronchial trauma evidenced by bloody secretions from the ETS tubes.

Consequently, this study sought to determine practices on closed endotracheal tube airway suctioning among nurses working in adult critical care. Indeed, studies have shown that good ETS practices optimize patients' outcomes (Yilmaz et al., 2021) while sub-optimal practices (Mwakanyanga, et al., 2018; Alkubati et al., 2022; Chen et al., 2021; Pinto et al., 2020) are detrimental to patients (Blakeman et al., 2022; Gilder et al., 2019; Miller et al., 2019).

1.3 Research questions

1. What are the pre-suction practices among nurses working in adult critical care unit at KNH?

2. What are the practices during suction among nurses working in adult critical care unit at KNH?
3. What are the post-suction practices among nurses working in adult critical care unit at KNH?

1.4 Study objectives

1.4.1 Broad objective

To determine the practices on closed endotracheal tube airway suctioning method among nurses at KNH adult critical care unit.

1.4.2 Specific objectives

1. To determine the pre-suction practices among nurses working in adult critical care unit at KNH
2. To examine the practices during suction among nurses working in adult critical care unit at KNH
3. To examine the post-suction practices among nurses working in adult critical care unit at KNH

1.5 Research hypothesis

Nurses' practices prior to, during and after closed endotracheal suctioning were not influenced by the nurses' socio-demographic attributes

1.6 Justification of the study

A review of nurses' practice of endotracheal suctioning in critical care settings is imperative for several reasons. First, despite ETS being an indispensable critical procedure for a significant proportion of critically ill patients on mechanical ventilation, it can cause serious harm to the patient if incorrectly administered. Indeed, ETS procedure when inappropriately performed, can lead to serious complications such as bleeding, infection, hypoxia, bronchoconstriction, atelectasis, elevated intracranial pressure, cardiac arrest and sudden death (Blakeman et al., 2022). For this reason, it is important therefore that critical care nurses' practice on

ETS is based on current scientific evidence and prevailing guidelines, hence thereby reducing these grave complications and likely risks (Schults et al., 2021).

Secondly, critical care nurses' performance or implementation of ETS procedure based on standard protocols and current evidence-based ETS guidelines is integral in promoting quality patient care outcomes in critical care settings. This may include decreased patient mortality and morbidity rates, reduced length of CCU and hospital stay, reduced hospital costs, safer patient care and better patient prognosis (Myatra, 2022). Further, despite there being scientific evidence for the safe and efficient accomplishment of endotracheal suction, there is evidence that many of these recommendations have not been observed in nurses' clinical practice. A review of critical care nurses' practice on ETS is therefore important in identifying potential areas of knowledge and skills on ETS where improvements can be made as part of efforts of improving nurses' practice on ETS (Mosier et al., 2020).

Considering the high level of physiological, emotional and mental difficulties experienced by mechanically ventilated patients and the importance of such patients' comfort in achieving desired treatment outcomes, the domain of these patients' experience of the ETS procedure should not be treated with indifference (Miller, 2019). Critical care nurses, then, have an important role of ensuring that the ETS process is effectively performed in a manner that safeguards patient's comfort and wellbeing (Pasrija & Hall, 2020).

1.7 Conceptual framework

Independent variables

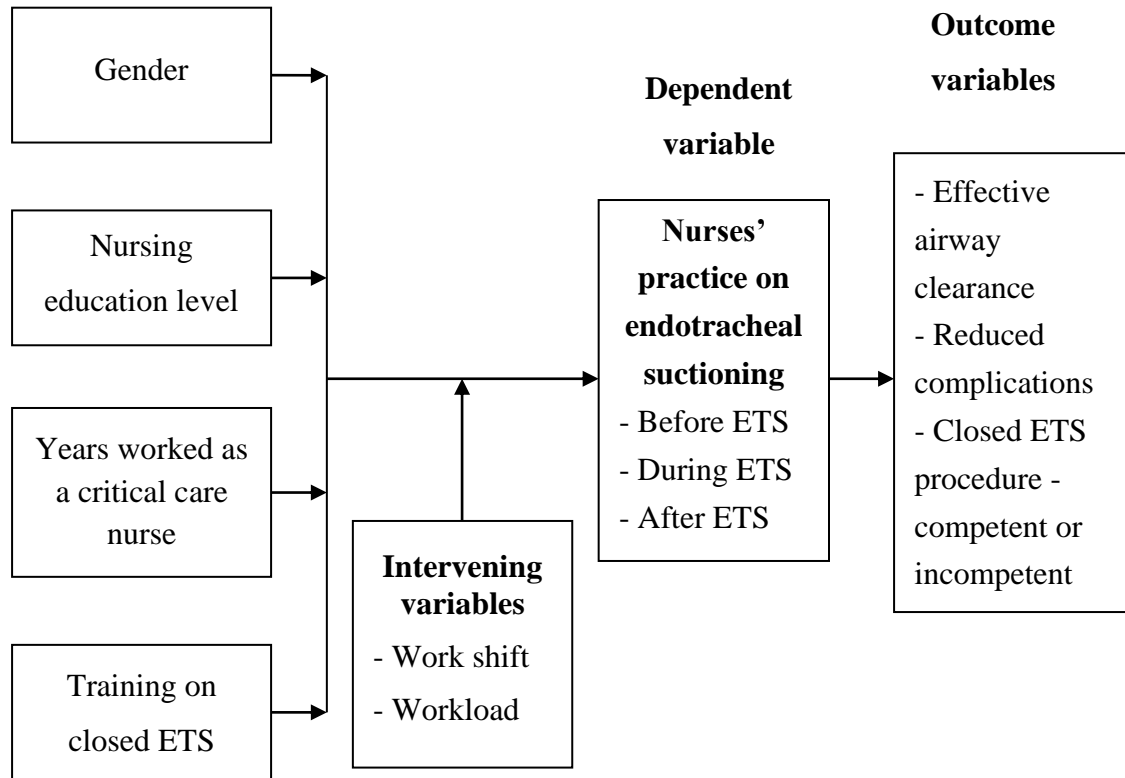


Figure 1.1: Conceptual framework

Source: Researcher, 2023

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter contains an examination of literature in accordance with the objectives of the study. It contains a review of past studies on the research subject on the practices of nurses working in critical care units prior to, during and after endotracheal tube airway suctioning. The chapter also includes a summary of the reviewed empirical literature and also presents the study's theoretical framework. Several keywords which included endotracheal intubation, endotracheal suctioning, mechanical ventilation, suction catheter, critical care nurses and nursing and open and closed suctioning were used in search of relevant literature material. Fifteen (15) studies were reviewed, nine were from the developing countries in Asia and Middle East, four were from the developed countries in Europe and Nordic regions and two were from the sub-Saharan region, though none had been done in Kenya. This constituted this study's empirical literature review.

2.2 Closed endotracheal tube airway suctioning

Endotracheal tube airway suctioning is an important and common procedure performed on critically ill patients requiring mechanical ventilation in critical care settings (Mosier et al., 2020). It is performed to maintain patency of the airway and to remove secretions in patients with an endotracheal tube in situ. Successful removal of secretions helps promote oxygenation and ventilation (Chen et al., 2021). It also helps reduce the risk of ventilator-associated pneumonia incidences and to prevent atelectasis in mechanically ventilated patients (Alkubati et al., 2022). It therefore constitutes an important part of airway management in ventilated critical care unit patients (Gilder et al., 2019). Closed ETS method is a suctioning technique that allows a suction catheter to be inserted into the endotracheal tube through a one-way valve, with no need to disconnect the patient from the ventilator (Elmansoury & Said, 2017).

The indications for closed endotracheal tube airway suctioning include audible or visible secretions in the ET tube, coarse breath sounds, transmitted sounds on auscultation of the chest wall, coughing and especially tactile fremitus and moist, rattling cough, muffling of a patient's voice by secretions; strenuous breathing, oxygen desaturation, and bradycardia (Jansson et al., 2018). There is no absolute

contraindication to suctioning of the airway. Risks associated with ETS exist and should be weighed as per individual patient specific needs as well as against benefits to the patient (Pedersen et al., 2019). The adequacy of suctioning can be assessed by the clearance of secretions, improved breath sounds, improved air entry, good pulse oximetry readings, and improvement in respiratory distress in a patient (Pasrija & Hall, 2020).

Performed correctly, closed suction method is associated with benefits including improved oxygenation; avoids gas exchange impairment during ETS; reduced risk of pulmonary infections; decreased clinical signs of hypoxemia; maintenance of positive end-expiratory pressure (PEEP); limited environmental, health personnel and patient contamination; decreases the loss of lung volume; greater ease of application and can be utilized for multiple ETS procedures. As such, closed ETS is considered safer and is associated with fewer adverse events (Jansson et al., 2018; Afenigus et al., 2021). However, when inappropriately or incorrectly performed, ETS can cause serious complications including hypoxemia, cardiac arrhythmias, bronchospasm, hypotension or hypertension, elevated intracranial pressure, airway mucosal trauma, blood pressure instability, bleeding, atelectasis and infection as well as pain and discomfort on the patient (Pinto et al., 2020; Alkubati et al., 2022). Therefore, it is imperative that CCU nurses' practices on closed ETS adhere to available best practice guidelines (Majeed, 2017).

2.3 Practice of critical care nurses before performing the ETS procedure

An empirical investigation was performed to evaluate the practice of critical care nurses prior to undertaking endotracheal suctioning procedure in select hospitals in Yemen. Data were gathered using an observational checklist and were analyzed using various descriptive and inferential measures. Results indicated that most of the observed critical care nurses had poor scores with respect to their adherence to pre-endotracheal suction practice guidelines while the remaining had moderate scores. According to the findings, none of the nurses got scores denoting desirable adherence to the pre ETS guidelines. Gaps in the nurses' practice were seen in observance of guidelines including auscultating the patient's chest before ETS, explaining the ETS procedure to the patient and failing to offer pre-suctioning hyper-oxygenation. The

study exposed need for continuous training of the CCN on ETS practice guidelines (Alkubati et al., 2022).

Across-sectional descriptive study was performed to probe the practice of endotracheal suctioning in mechanically ventilated patients among critical care nurses working in tertiary care government hospitals in Pakistan. A total of 80 nurses working in critical care units in 2 selected tertiary government hospitals in the country's capital were observed. Data was collected using a validated questionnaire. Analysis of the data was performed via various statistical measures using SPSS version 21. Results indicated that most of the critical care nurses working in critical care units in the 2 selected hospitals had good practice prior to performing endotracheal suctioning in intubated patients. Further, the difference in practice scores between male and female CCNs was insignificant (Rafiq et al., 2022).

Chen et al. (2021) undertook a cross-sectional multiple site study to probe the practice of evidence-based guidelines on endotracheal suctioning among critical care nurses in China. A total of 310 nurses working in CCUs in Changsha were recruited for the study. They responded to an online questionnaire. Various descriptive non-parametric tests were applied in analyzing the data. Results illustrated that the surveyed nurses lacked adequate knowledge on some of the important evidence-based guidelines needed prior to endotracheal suctioning. The nurses' practices prior to the ETS procedure were also sub-optimal. The prescribed guidelines prior to ETS guidelines to which the nurses performed poorly included providing hyper-oxygenation before the ETS procedure, not routinely using normal saline and adhering to aseptic technique pre-suction. It was also noted that pre-suction practice scores were significantly better among nurses with ETS training compared to their untrained colleagues.

Pinto, D'silva and Sanil (2020) performed a systematic review exploring the practices of endotracheal suctioning among nursing health practitioners. Reviewed articles were identified via a thorough search conducted within leading scholarly electronic databases for the period 2002 - 2016. Both qualitative and quantitative syntheses were performed on the final selected articles. Results indicated that only a small proportion of the nurses undertook assessment of the patient before the suctioning procedure. Further, only few of the nurses were aware of the need to evaluate the size of the suction catheter before the suctioning procedure. Further, less than half of the nurses

had knowledge regarding the appropriate suction pressure that should be used for ETS. In addition, compliance to hand washing guidelines prior to suctioning was observed in only 62% of the nurses. High levels of critical care nurses' non-adherence to the recommended practice guidelines before the ETS procedure were hence observed.

In Finland, an empirical investigation was performed with a view of assessing critical care nurses' observance of current recommendations prior to undertaking ETS procedure in their daily work. A total of 40 nurses were observed during their daily practice with data captured in a structured observation checklist. The critical care nurses' actual pre-ETS performance was compared against current clinical guidelines using the independent t-test. Results indicated that majority of the critical care nurses were not following existing guidelines in their pre-ETS procedure practices. Major gaps in the nurses' practice prior to the ETS procedure were observed in aspects including pre-suctioning hyper-oxygenation, explaining to the patient about the procedure, patient chest auscultation before ETS and infection-control practices related to prevention of cross-infections (Jansson et al., 2018).

A cross-sectional descriptive study was conducted to explore the practice on endotracheal suctioning among nurses working in selected training hospitals in Nepal. A total of 95 nurses that worked in various critical care units of 2 teaching hospitals in Chitwan were recruited using purposive sampling method. They responded to a self-reported semi-structured questionnaire. The data was probed using various inferential and descriptive statistics. Results indicated that most of the surveyed nurses did not have the desired level of practice with respect to adhering to current pre-suction procedures. Deficiencies in the nurses' pre-suction practices related to ascertaining and documenting the need for suctioning, patient preparation by explaining the procedure, avoiding normal saline instillation pre-suctioning, determining the appropriate catheter size and reassuring the patient (Shrestha & Shrestha, 2018).

2.4 Practice of critical care nurses during performing the ETS procedure

Alkubati et al. (2022) undertook an empirical investigation to examine the practice of pre-endotracheal suctioning technique among critical care nurses in select Yemenis hospitals. Data were gathered using an observational checklist and were analyzed

descriptively and inferentially. Results indicated that most of the CCU nurses had poor scores with respect to their adherence to prescribed guidelines during performance of ETS procedure while the remaining had moderate scores. None of the nurses got scores denoting desirable adherence to set guidelines as they performed the ETS procedure. Gaps in the nurses' practice were most evident in observance of guidelines including recommended number of suction passes per ETS procedure, recommended total duration of suction time per ETS procedure, humidification by passing saline through the suction catheter and ensuring adequate resting of the patient in between consecutive suction.

In China, a cross-sectional multiple site study was performed to probe the practice of evidence-based recommendations for endotracheal suctioning among critical care nurses at Changsha. A total of 310 nurses working in critical care units in the study area were enrolled for the study. They responded to an online questionnaire. Various descriptive non-parametric tests were applied in analyzing the data. Results of the study indicated that the surveyed nurses lacked adequate knowledge on some of the important evidence-based endotracheal suctioning practices. Results also showed that there were notable gaps between the nurses' practice of the ETS procedure and prevailing ETS recommendations. It was noted that using 80-120 mmHg suction pressure during endotracheal suctioning and limiting suction catheter insertion length were the most poorly performed during ETS procedure (Chen et al., 2021).

An empirical investigation conducted in India evaluated the practice of endotracheal suctioning among nurses working in critical care units of a local hospital in the city of Kochi. The study applied an exploratory descriptive approach and data were obtained using an observation checklist. Obtained data were descriptively analyzed. Results indicated that despite a significant proportion of the surveyed nurses having adequate knowledge on endotracheal suctioning, most had an unacceptable level of practice during the execution of the endotracheal suctioning procedure. According to the study, only slightly above 50% of the nurses demonstrated an acceptable level of skill in performing the ETS procedure as is recommended. The study concluded that gaps existed in the critical care nurses' practices during the performance of the ETS procedure, hence more training on the aspect was required (Varghese & Moly, 2021).

An empirical investigation assessing the level of adherence to current guidelines during performance of ETS among critical care nurses in France was conducted. A total of 68 critical care units were included for review and nurses working in these units were observed on their implementation of current guidelines while performing endotracheal suctioning in intubated patients. Data was gathered using a structured observation checklist and were analysed descriptively. Results showed that there were notable gaps in critical care nurses' practice during performance of ETS procedure. Guidelines that were poorly performed during ETS procedure by the nurses included shallow suction, monitoring the level of suction negative pressure, performing tracheal suctioning only when necessary and ensuring diameter of the suction catheter does not exceed one-half the diameter of the artificial airway (Beuret et al., 2019).

A cross-sectional descriptive empirical study was undertaken to probe the practise of endotracheal suction technique to intubated patients among critical care nurses in selected hospitals in Tanzania. A total of 103 nurses working in CCUs in several selected hospitals in the country's capital were observed. Obtained data were descriptively analyzed utilizing SPSS version 20. Results indicated that while a significant proportion of the nurses were aware of when ETS should be performed, a large number of them demonstrated an unacceptable level of practice when performing the ETS procedure to intubated patients. Most of the nurses were observed as not following existing guidelines on ETS. The study thus called for training of CCU nurses on ETS, providing clinical guidelines on ETS to these nurses and adequately supporting them in their work (Mwakanyanga et al., 2018).

An empirical investigation was undertaken to assess the level of adherence to current recommendations during performance of ETS procedure among CCU nurses in Finland. A total of 40 nurses were observed during their daily practice with data captured in a structured observation checklist. The critical care nurses' practices during performance of an ETS procedure were compared against current clinical guidelines using the independent samples t-test. Results indicated that majority of the critical care nurses were not adhering to existing guidelines in their practice during performance of ETS procedure. Gaps in the nurses' practice during ETS procedure were seen in aspects including level of suction pressure, number of suction passes, duration of suction applied to airway and instillation with sodium chloride. The study

concluded that ETS related educational interventions and clinical guidelines as well as adequate support to CCNs were needed to better their competence and practice (Jansson et al., 2018).

2.5 Practice of critical care nurses after performing the ETS procedure

A study was performed to evaluate the practice of critical care nurses after undertaking endotracheal suctioning procedure in select hospitals in Yemen. Data were gathered using an observational checklist and were analyzed using various descriptive and inferential measures. Results indicated that most of the observed critical care nurses had poor scores with respect to their adherence to post-endotracheal suction practice guidelines while the remaining had moderate scores. None of the nurses was established to have the desired level of practice of the post ETS guidelines. Gaps in the nurses' practice were seen in observance of guidelines including auscultating the patient's chest after ETS, reassuring of the patient, providing oral care, monitoring of vital signs and offering post-suctioning hyper-oxygenation (Alkubati et al., 2022).

A hospital based cross-sectional descriptive study was performed to evaluate the practice of suctioning adult patients among CCU nurses serving in Ethiopia. A total of 200 nurses working in adult CCUs of public hospitals in the Amhara region were recruited using the census. Research instruments used for collecting the study data included a harmonized self-reporting questionnaire and an observation checklist. Analysis of the data was conducted using SPSS version 25. The data were probed using various descriptive measures while logistic regression analysis was utilized to indicate the connection between the outcome and predictor variables. Results indicated that most of the CCU nurses had poor practice of post-suction procedures. The major factors associated with the inadequate post-suctioning skills among the nurses were unavailability of suctioning guidelines and inadequate knowledge towards artificial airway suctioning (Afenigus et al., 2021).

Khimani et al. (2020) investigated the practice on adherence to endotracheal suctioning policy among nurses working in a local tertiary care hospital in Pakistan. A quantitative observational study design was adopted. A total of 40 nurses working in one of the critical care units of the selected tertiary care hospital were assessed. The

study participants were observed in their routine work in relation to prior to, during and after performing an ETS procedure with data recorded in an observation checklist. The data were probed using various descriptive and inferential measures using SPSS version 19. According to the results, most of the nurses' practices on post-suction procedures were sub-optimal as they did not perform some of the post-suction events in line with current ETS guidelines. The study called for increased emphasis on improving the endotracheal suctioning skills of nurses serving in critical care settings in the country.

An observational empirical study was conducted in Finland to examine the practice of CCU nurses with regard to adhering to current recommendations after an ETS procedure. The study observed 40 nurses in their daily practice with data captured in a structured observation checklist. The critical care nurses' practices after an ETS procedure were compared against current clinical guidelines using the independent samples t-test. Results indicated that a significant proportion of the critical care nurses were not adhering to existing guidelines in their post ETS procedure practices. Gaps in the nurses' practice following an ETS procedure were seen in aspects including patient chest auscultation after suctioning, infection control practices post suctioning, post-suctioning hyper oxygenation, reassuring of the patient and maintaining an optimal cuff pressure post suctioning (Jansson et al., 2018).

A study was carried out to investigate the practice of endotracheal suctioning among critical care nurses in Turkey. The study involved 72 critical care nurses working in three CCUs in a local tertiary healthcare institution. The research instruments were a self-reporting questionnaire and an observational checklist. Various descriptive measures and correlation analysis were applied in analyzing the data. Results indicated that most of the critical care nurses had good knowledge of the endotracheal suctioning procedure. However, their post endotracheal suctioning practices were sub-optimal. This was particularly in areas of performing patient assessment post suction, monitoring of patient's vital signs post suction, documentation of outcomes of the ETS procedure and dealing with the adverse effects of endotracheal suctioning (Maraş et al., 2017).

Majeed (2017) performed an empirical investigation to explore the practices on endotracheal suctioning of mechanically ventilated adult patients among critical care

unit nurses Iraq. The study involved a total of 50 nurses who served in critical care units of three selected tertiary healthcare institutions in the country's capital. The participants responded to a self-reporting questionnaire and the obtained data were probed using various descriptive measures. Results indicated that most of the nurses failed to demonstrate quality nursing practice in respect of adhering to the recommended post ETS protocols. Nearly 80% of the nurses exhibited poor post endotracheal suctioning practices. A notable association was established between the level of training on ETS and the nurses' practice. The study averred that there was need for continued training of the nurses to better their practice on endotracheal suctioning.

2.6 Summary of literature reviewed

The above reviewed empirical studies pointed to a general consensus that there were gaps in practice on endotracheal suctioning before, during and after the endotracheal suctioning procedure among nurses working in critical care units across the various settings. Notable gaps in the nurses' pre-suction practice related to aspects such as patient assessment and preparation, saline instillation, pre-oxygenation and infection control. Further, notable gaps in the nurses' practice during suctioning related to aspects such as suctioning pressure, suctioning depth and suctioning duration while notable gaps in the nurses' post-suction practice related to aspects such as patient post-suction assessment including monitoring their vital signs, documentation and infection control. Further, out of the 15 studies reviewed, 9 were from the developing countries in Asia and Middle East, 4 were from the developed countries in Europe and Nordic regions and 2 were from the sub-Saharan region. However, none had been done in Kenya. This showed that the reviewed empirical studies were conducted in other countries whose healthcare settings and systems may differ with that of Kenya. It was therefore evident from the empirical literature reviewed that there was paucity of empirical data on endotracheal suctioning practice among critical care nurses in Kenya and hence the need for the current study. Consequently, an empirical study on practice on closed endotracheal tube airway suction method among nurses working in adult critical care unit at KNH was performed.

2.7 Theoretical framework

Evidence-based practice models guide nursing practice to make patient care decisions based on clinical knowledge and the best practices reported in the literature. Adoption of evidence-based practice ensures that all nurses have up to date knowledge and can provide the best clinical interventions in a systematic approach. Hence, improved knowledge constitutes the primary basis for provision of care based on best existing evidence (Mosier et al., 2020). The theoretical model used to guide this study was the self-efficacy theory which was developed in 1977 by Albert Bandura. The theory suggests that all individuals are competent and capable of being successful, provided they have the opportunities and self-efficacy necessary to pursue their goals. Self-efficacy theory explicitly focuses on how individuals and communities can be empowered with a sense of agency that would facilitate goal attainment (Bandura, 1977).

This is important as self-efficacy theory does not presume that individuals who are currently successful are inherently better than those who are not as successful. Rather, self-efficacy theory would suggest that individuals who are currently struggling may not have been provided with opportunities to obtain mastery experiences or modeling necessary to develop high levels of self-efficacy (Resnick, 2018). Self-efficacy theory therefore suggests that it is the responsibility of the government and society to provide everyone with sufficient opportunities to engage in mastery experiences, receive positive social persuasion, and witness positively reinforcing models that will engender a strong sense of self-efficacy (Boswell et al., 2020). Hence, self-efficacy reflects confidence in the ability to exert control over one's own motivation, behavior and social environment (Maddux & Gosselin, 2021).

Self-efficacy is described as the belief that one has the essential capabilities to perform certain activities to generate a designated level of performance to achieve set goals. Perceived self-efficacy impacts how people think, feel, and motivate themselves towards achieving set goals (Bandura, 1977). The theory suggests that a strong sense of self-confidence improves human performance in various ways. In this case, critical care nurses with a strong sense of self-efficacy are more likely to provide high quality endotracheal suctioning care. Bandura espoused the view that individuals with a high level of confidence in their skills approach a problematic task as a

challenge that needs to be mastered, rather than a personal threat that should be avoided. Such a stance promotes inherent interest in participation in various activities (Bandura, 1977).

The self-efficacy theory provides the basis for motivation and reduction of the negative outlooks associated with reiterated failures in carrying out a given task which results in improved personal performance of the said task. The theory maintains that individuals with a strong sense of efficacy sustain strong commitment and heighten their efforts even in the face of poor performance. Such individuals attribute low performance to inadequate knowledge or expertise which is acquirable (Lippke, 2020). Though it is not clearly stated, self-efficacy theory suggests that individuals can determinedly develop, change or control their behavior, an assumption that is based on the proposition that self-efficacy can be improved through education, skill acquisition, and self-influence (Maddux & Gosselin, 2021). This theory was relevant to the current study given its emphasis on training, skill development and self-confidence which constitutes essential tenets in nurses' provision of evidence based nursing care. Based on this theory, it is assumed that critical care nurses at Kenyatta National Hospital may enhance their closed endotracheal tube airway suctioning practices through acquisition of essential knowledge on ETS, sharpening their ETS administration skills and reflective thought.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research materials and methods that were applied in carrying out this study. It thus contains the study design, study area, study population, the criteria for inclusion and exclusion, sample size and sampling technique, the instruments of data collection, procedures for data collection, pretesting, the research tool validity and reliability, data analysis, dissemination of study findings, ethical considerations and study limitations.

3.2 Study design

This was an observational descriptive cross-sectional study. This research design allows the researcher to ‘observe’ a particular attribute concerning the subjects being investigated as they exist at the time of study. The descriptive cross-sectional approach of the observational study design was preferred because it ensures complete and accurate description of a situation, ensuring that there is minimum bias in the collection of data (Kothari, 2010).

3.3 Study area

Kenyatta National Hospital Critical Care Unit (CCU) was where this research study was conducted. Kenyatta National Hospital (KNH) is the oldest and largest teaching and referral hospital in Kenya. It was founded in 1901 with 40 patients with the hospital having grown over the years to its current bed capacity of about 2,000. It is located about four kilometers from the Nairobi city center, off Ngong road on Hospital Road. The facility offers a wide range of specialized in and out-patient health care services. The specialized health-care services provided at KNH include radiotherapy, heart surgery, neurosurgery, oncology, diabetic, renal dialysis and kidney transplant operations, plastic and reconstructive surgery, orthopedic surgery and burns management among others. The hospital also facilitates medical training and research and participates in national healthcare planning.

KNH’s adult CCU serves critically ill patients adult patients referred to KNH from across the country and beyond. KNH’s adult CCUs are located in Ground, first, fourth

and seventh floors of the hospital with an aggregate bed capacity of 40 beds. At the time of the study, hospital records indicated that a total of 185 nurses worked in the adult CCUs at KNH. Common health conditions seen in patients admitted in KNH's adult CCU included diabetes ketoacidosis, polytrauma, acute and chronic kidney failure, HEELP syndrome, severe eclampsia, neuro trauma and poor reversal. Kenyatta National Hospital was an appropriate area of study for this research as it had a wide catchment area from which it drew its clients. The hospital is also a leading centre of care for critically ill patients in the country and beyond. Ventilator acquired pneumonia events also remained an area of concern among patients admitted in the adult CCU with nurses' poor/suboptimal practice on ETS a probable cause. However, the practices on endotracheal suctioning among nurses working in the hospitals' adult CCU had not been explored. Hence, KNH's adult CCU offered an appropriate setting for exploring the study subject.

3.4 Study population

The study population consisted of nurses working in adult critical care unit at Kenyatta National Hospital. Hospital records indicated that there were 185 nurses working in the hospital's adult critical care unit (KNH Critical Care Unit Records, 2023). This constituted the study population.

3.5 Inclusion and exclusion criteria

3.5.1 Inclusion criteria

The study included critical care nurses working in KNH's adult Critical Care Unit who were available at work at the time of the study and who voluntarily consented to take part in the study.

3.5.2 Exclusion criteria

The study excluded critical care nurses working in KNH's adult Critical Care Unit who were unavailable at the time of the study, those not actively involved in performing endotracheal tube airway suctioning procedure such as counselors, managers and student nurses and those who declined to be part of the study.

3.6 Sample size and sampling technique

Granted that the number of critical care nurses in the world was more than 10,000, there was no need for finite population correction. Consequently, all the targeted participants constituting the study's population were selected to constitute the study sample using census technique, in line with Kothari (2004) postulation that an entire study population could be recruited as the study sample if it is not very large. Hospital records indicated that the hospital's adult Critical Care Unit was currently served by 185 nurses (KNH CCU, 2023). The study sample therefore comprised of the 185 nurses working in KNH's adult critical care unit.

3.7 Data collection instruments

The data collection instrument for this study was a structured questionnaire (Appendix 2) and an observation checklist (Appendix 3). The questionnaire was used to capture the participants' demographic information while the observation checklist was used to determine their practices on closed ETS.

The WHO's observational checklist on endotracheal suctioning procedures in critical care settings constituted this study's observation checklist. The observation checklist was structured into 4 parts. Section A captured the participants' demographic characteristics. Section B contained list of procedures that should be performed prior to endotracheal suctioning. Section C contained list of procedures that should be performed during endotracheal suctioning while Section D contained list of procedures that should be performed after endotracheal suctioning. The observation checklist was administered during the nurses' daily routine work sessions within the hospital's adult critical care unit.

No pretesting and validation of the study tool was performed as the WHO observational checklist on ETS procedures in critical care settings was already a validated data collection tool that has been applied in several studies (Jansson et al., 2018; Haghghat & Yazdannik, 2019; Afenigus et al., 2021; Alkubati et al., 2022). Additional nurse-patient ratio and workload status data were however included to represent the study's intervening variables and which could affect the nurses' practice on ETS.

3.8 Data collection procedures

The principal investigator was assisted by two trained research assistants to collect the study data. The two research assistants, drawn from the final year Higher Diploma in Critical Care nursing class at KNH School of Nursing, were adequately trained by the principal investigator on the study objectives and on how to collect the data using the observation checklist. The participants were required to offer their informed consent before administration of the study tools.

Administration of the observation checklist entailed the observers checking on whether the participants followed recommended closed ETS guidelines before, during and after the ETS procedures in their routine nursing care activities in the adult CCU of KNH. Observed or adhered to ETS guidelines were denoted by a mark on the ‘Yes’ column of the observation checklist while unobserved or non-adhered to ETS guidelines were denoted by a mark on the ‘No’ column of the observation checklist. Further, given that observation as a data collection method was susceptible to the “Hawthorne effect,” where people usually performed better when they knew they were being observed, the Hawthorne’s effect was minimized by observing the study participants on multiple times (3 times). Each checklist item was scored as 1 point for a correct practice and a 0 for an incorrect or a non-performed one then the average of scores, for three (3) observations, was converted to percentages. The data collection exercise took 4 weeks.

3.9 Data analysis

Data cleaning and entry preceded analysis. The participants’ practices on closed endotracheal tube airway suctioning were classified into two (2) categories namely desirable for adherence scores of 75% and above and undesirable for adherence scores below 75%. The study data was analyzed using descriptive statistics which included means and normal variations. The study hypothesis on the association between the participants’ demographic characteristics and their endotracheal tube airway suctioning practice scores was assessed using the multiple linear regression analysis at 95% confidence interval. Study results were presented in tables. The analysis was conducted using the Statistical Package for Social Sciences (SPSS v. 25.0).

A summary of the study variables and how they were measured appears in Table 3.1.

Table 3.1: Study variables and how they were measured

Variables		Measures	Type of analysis
Independent variables	Gender	- Male - Female	Descriptive Multiple linear regression analysis
	Nursing education level	- Certificate - Diploma - Higher diploma - Bachelors - Masters	Descriptive Multiple linear regression analysis
	Years worked as a critical care nurse	- < 5 years - 5 - 10 years - Over 10 years	Descriptive Multiple linear regression analysis
	Training on ETS	- Yes - No	Descriptive Multiple linear regression analysis
Dependent variable	Nurses' practices on closed ETS	- Before ETS - During ETS - After ETS	Descriptive Multiple linear regression analysis

Association between the independent variables and the dependent variable will be assessed using multiple linear regression analysis at 95% CI

Regression coefficients p values < 0.05 will denote that the association is significant

3.10 Ethical considerations

Ethical approval for the study was issued by the KNH-UoN ERC [Ref: KNH-ERC/A/418]. The researcher also sought permit to collect data among the targeted participants from the Head of the Critical Care Unit of KNH. All participants were required to give written consent before taking part in the study. Confidentiality was maintained throughout the study for all information obtained. Anonymity was observed by coding the questionnaires. No names or any other form of personal identification was written on the questionnaires. Participants took part in the study voluntarily and were free to withdraw from the study at any time without victimization. No inducements or rewards were given to the participants to join the

study. The study posed no harm to the participants for participating. Dissemination of the study's findings shall be done as per the University's guidelines and anonymity and confidentiality of the participants shall also be safeguarded during the findings dissemination. All filled questionnaires were kept safely under lock and key prior to and after data analysis and reporting. Ministry of Health's COVID-19 prevention guidelines were followed during data collection.

3.11 Study limitations

The study was based on results gathered from a single hospital in the country. Thus, the findings cannot be generalized. To ease generalization of results established, a broader empirical investigation involving a larger set of critical care nurses drawn from hospitals across the country has been recommended.

Observation as a data collection method is susceptible to observer bias. To mitigate this limitation, three observers were utilized to undertake observations of the participants' practice at the same time.

Further, observation as a data collection method is susceptible to the "Hawthorne effect," where people usually perform better when they know they are being observed. Hawthorne's Effect was addressed by observing the study participants multiple times. Hawthorne's Effect was also reduced because the participants were already informed about the study through the questionnaire.

Further, this study did not focus on assessing the effectiveness of the closed ETS procedure and it was not able to establish the complications of closed ETS procedure. Causal inferences to the study population could also not be drawn due to the research design applied. Other scholars may focus on these aspects of closed ETS procedure in their investigations.

3.12 Study findings dissemination plan

The study findings shall be disseminated through forwarding a copy of the final research thesis report to the University of Nairobi's Department of Nursing Sciences, to UoN Library and to Kenyatta National Hospital. The final research thesis report will also be uploaded to UoN's repository. The researcher shall also endeavor to

present the findings in appropriate academic and scientific forums, workshops and conventions. The work will also be published in a relevant peer-reviewed journal.

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presents results of the study as outlined in the research methodology. The results relate to nurses practices on closed endotracheal tube airway suctioning at Kenyatta National Hospital adult critical care unit. The chapter begins with highlighting the response rate. It then provides results on the participants' demographic characteristics before outlining the findings based on the research objectives.

4.1.1 Response rate

An aggregate of 185 nurses working in KNH's adult critical care unit were targeted as study participants. From the data collection process, the researcher was able to obtain adequate responses from 163 of the participants translating into a response rate of 88.1%. The remaining 22 participants were excluded from the final analysis on account of providing incomplete data. The response rate was in conformity to Mugenda and Mugenda (2003) provision that feedback rates of 50% are adequate for statistical evaluation and reporting, while rates of 70% and above are exceptional.

4.2 Demographic characteristics of the participants

The study sought to establish the demographic profile of the study participants. The demographic attributes considered were gender, age, highest nursing education level, whether they had received critical care training, marital status, religion, duration worked in the critical care units, whether they had received training on ETS procedure and their workload.

Regarding the participants' gender distribution, most (79.1%, n = 129) of the participants were female while 20.9% (n = 34) were male, denoting that the study participants were both male and female nurses working in KNH's adult critical care unit, though female nurses were prevalent.

On the participants' age distribution, a significant proportion (57.7%, n = 94) of the participants were aged 40 - 49 years; 21.5% (n = 35) were aged 30 - 39 years while 17.2% (n = 28) were aged 50 years and above. Very few (3.7%, n = 6) were aged

under 30 years. This denotes that majority of the study participants were middle-aged adults.

Regarding the participants' highest nursing education level, above half (58.9% n = 96) of the participants were Bachelors holders, 19% (n = 31) were Diploma holders, 11.7% (n = 19) were Masters holders while 10.4% (n = 17) were Higher Diploma holders, illustrating that the study participants were largely well educated.

All the study participants also indicated that they had received critical care training, majority (88.3%, n = 144) at post basic diploma level and the rest (11.7%, n = 19) at post graduate level.

With respect to the participants' marital status, most (85.3%, n = 139) of the participants were married while 14.7% (n = 24) were not married. This denoted that the largest proportion of the participants was married.

As to the participants' religious faith, majority (87.1%, n = 142) were of Christian faith while 9.2% (n = 15) professed Islam. This showed that a significant proportion of the participants were Christians religion wise.

On duration worked in the critical care units, most (60.7%, n = 99) said they had worked in the critical care units for over 10 years, a third (33.1%, n = 54) had worked in the critical care units for 5-10 years while the remaining (6.1%, n = 10) had worked in the critical care units for below 5 years, denoting that majority of the study participants had worked in the critical care units for considerable duration.

Further, most (82.2%, n = 134) of the participants acknowledged that they had received training on endotracheal tube airway suctioning procedure while the remaining (17.8%, n = 29) said they had not received training on the ETS procedure.

On workload, majority (77.9%, n = 127) of the participants rated their workload at the workplace as being high while 22.1% (n = 36) rated it as being average, denoting that majority of the study participants were of the view that the work load was overwhelming. The results are demonstrated in Table 4.1.

Table 4.1: Participants' demographic characteristics

Demographic attributes		Frequency	Percent
Gender	Male	34	20.9
	Female	129	79.1
	Total	163	100.0
Age	18 - 29 years	6	3.7
	30 - 39 years	35	21.5
	40 - 49 years	94	57.7
	50 years & above	28	17.2
	Total	49	100.0
Highest nursing education level	Diploma	31	19.0
	Higher Diploma	17	10.4
	Bachelors	96	58.9
	Masters	19	11.7
	Total	163	100.0
Critical care training level	Post basic diploma level	144	88.3
	Post graduate level	19	11.7
	Total	163	100.0
Marital status	Married	139	85.3
	Not married	24	14.7
	Total	163	100.0
Religion	Christianity	142	87.1
	Islam	15	9.2
	Others	6	3.7
	Total	163	100.0
Duration worked in the critical care units	< 5 years	10	6.1
	5 - 10 years	54	33.1
	Over 10 years	99	60.7
	Total	49	100.0
Received training on ETS procedure	Yes	134	82.2
	No	29	17.8
	Total	163	100.0
Workload	High	127	77.9
	Average	36	22.1
	Total	163	100.0

4.3 Pre-suction practices among the participants

The first objective of the study sought to determine the pre-suction practices among nurses working in adult critical care unit at KNH.

To achieve this objective, the nurses' practices prior to a closed endotracheal tube airway suctioning event were observed against a set of predefined guidelines on activities that nurses are required to perform prior to an ETS event/procedure. 'Yes' response denoted that the nurse performed the specific practice while the 'No' response denoted that the nurse did not perform the specific practice.

Further, each checklist item was scored as 1 point for a correct practice and a 0 for an incorrect or a non-performed one then the average of scores, for three (3) observations, was converted to percentages. Consequently, mean adherence scores of 75% and above denoted desirable practice level while mean adherence scores of below 75% denoted undesirable practice level, for the respective pre-suction checklist items.

From the findings, the nurses working in the adult critical care unit of KNH were found to have desirable adherence level with the following pre-suction practices: putting the patient in a suitable position as denoted by an aggregate mean value of 84.7%; ensuring that the analgesic is administered as denoted by an aggregate mean value of 86.5% and several of the infection control measures including hand disinfection/washing prior to suctioning as denoted by an aggregate mean value of 81.6%; having gloves on as denoted by an aggregate mean value of 95.7%; wearing of apron as denoted by an aggregate mean value of 79.8%; wearing of the face mask/shield as denoted by an aggregate mean value of 84.7% and maintaining the sterility of suction catheter until insertion into airway as denoted by an aggregate mean value of 88.3%.

However, the nurses' adherence to the following pre-suction practices was found to be sub-optimal. These included ascertaining and documenting the need for suctioning as denoted by an aggregate mean value of 60.1%; patient preparation - explaining to the patient about the ETS procedure and reassuring the patient as denoted by an aggregate mean value of 20.9%; patient's chest auscultation before ETS as denoted by an aggregate mean value of 33.1%; offering pre-suctioning hyperoxygenation as

denoted by an aggregate mean value of 21.5%; checking the cuff pressure as denoted by an aggregate mean value of 28.2% and having goggles on as an infection control measure as denoted by an aggregate mean value of 39.3%. This demonstrated that there were gaps in pre-suction practices among nurses working at KNH's adult critical care unit. Results are presented in Table 4.2.

Table 4.2: Pre-suction practices among the participants

	N	Nurses' pre-suction practice adherence scores	
		Mean score (%)	SD
Practices prior to ETS event			
Ascertaining and documenting the need for suctioning	163	60.1	1.170
Patient preparation: Explaining to the patient about the ETS procedure and reassuring the patient	163	20.9	1.632
Patient assessment: Patient's chest auscultation before ETS?	163	33.1	0.918
Putting the patient in a suitable position	163	84.7	0.847
Offered pre-suctioning hyperoxygenation	163	21.5	1.039
Cuff pressure checked	163	28.2	2.162
Analgesic is administered	163	86.5	0.766
Infection control measures			
Hand disinfection/washing prior to suctioning	163	81.6	1.023
Gloves worn	163	95.7	0.405
Apron worn	163	79.8	0.881
Face mask/shield worn	163	84.7	1.379
Goggles worn	163	39.3	2.056
The sterility of suction catheter maintained until insertion into airway	163	88.3	1.175

*Desirable adherence level - $\geq 75\%$; undesirable/sub-optimal adherence level - $< 75\%$

4.4 Practices during suction among the participants

The second objective of the study sought to examine the practices during suction among nurses working in adult critical care unit at KNH.

To achieve this objective, the nurses' practices during a closed endotracheal tube airway suctioning event were observed against a set of predefined guidelines on activities that nurses are required to perform during an ETS event/procedure. 'Yes' response denoted that the nurse performed the specific practice while the 'No' response denoted that the nurse did not perform the specific practice.

Further, each checklist item was scored as 1 point for a correct practice and a 0 for an incorrect or a non-performed one then the average of scores, for three (3) observations, was converted to percentages. Consequently, mean adherence scores of 75% and above denoted desirable practice level while mean adherence scores of below 75% denoted undesirable practice level, for the respective during suction checklist items.

From the findings, the nurses' adherence level to the various recommended practices during suction was found to be sub-optimal, as their aggregate mean scores for each of the practices were below 75%. The respective practices included avoiding routine normal saline instillation during endotracheal airway suctioning as denoted by an aggregate mean value of 44.8%; limiting the size of suction catheter to not more than half of internal diameter of the endotracheal tube as denoted by an aggregate mean value of 57.7%; limiting the number of suction passes to 2 or less per ETS procedure as denoted by an aggregate mean value of 64.8%; maintaining the duration of suction applied to airway to less than 15 seconds as denoted by an aggregate mean value of 51.3%; maintaining the level of suction pressure to 80-150mmHg during endotracheal airway suctioning as denoted by an aggregate mean value of 48.4%; ensuring humidification by passing saline through the suction catheter as denoted by an aggregate mean value of 68.9% and resting of the patient for 30 - 60 seconds in between consecutive suction as denoted by an aggregate mean value of 61.3%. This denoted that there were gaps in practices during suction among the nurses working at KNH's adult critical care unit. Results are illustrated in Table 4.3.

Table 4.3: Participants' practices during suction

	N	Nurses' in suction practice adherence scores	
		Mean score (%)	SD
Practices during ETS event			
Avoiding routine normal saline instillation during endotracheal airway suctioning	163	44.8	1.911
Limiting the size of suction catheter (\leq half of internal diameter of ETT)	163	57.7	0.846
Limiting the number of suction passes \leq 2 per ETS procedure	163	64.8	1.225
Maintaining the duration of suction applied to airway (< 15 seconds)	163	51.3	0.727
Maintaining the level of suction pressure to 80-150mmHg during endotracheal airway suctioning	163	48.4	0.581
Ensuring humidification by passing saline through the suction catheter	163	68.9	1.049
Resting of the patient for 30 - 60 seconds in between consecutive suction	163	61.3	0.823

*Desirable adherence level - \geq 75%; undesirable/sub-optimal adherence level - < 75%

4.5 Post-suction practices among the participants

The third objective of the study sought to examine the post-suction practices among nurses working in adult critical care unit at KNH.

To achieve this objective, the nurses' practices after performing a closed endotracheal tube airway suctioning event were observed against a set of predefined guidelines on activities that nurses are required to perform after an ETS event/procedure. 'Yes' response denoted that the nurse performed the specific practice while the 'No' response denoted that the nurse did not perform the specific practice.

Further, each checklist item was scored as 1 point for a correct practice and a 0 for an incorrect or a non-performed one then the average of scores, for three (3) observations, was converted to percentages. Consequently, mean adherence scores of 75% and above denoted desirable practice level while mean adherence scores of below 75% denoted undesirable practice level, for the respective post-suction checklist items.

From the findings, nurses working in the adult critical care unit of KNH were found to have desirable adherence level with only three out of the ten listed recommended post-suction practices which were patient reconnection to oxygen post suctioning as denoted by an aggregate mean value of 82.6%; hand disinfection post suctioning as denoted by an aggregate mean value of 89.2% and ensuring that used catheter and gloves were disposed of in a manner that prevented contamination from secretions as denoted by an aggregate mean value of 96.8%.

However, the nurses' adherence to the remaining post-suction practices was found to be sub-optimal. These post-suction practices included ensuring post-suctioning hyperoxygenation as denoted by an aggregate mean value of 65.7%; providing oral care as denoted by an aggregate mean value of 27%; patient's chest auscultation after endotracheal suctioning as denoted by an aggregate mean value of 52.8%; reassuring of the patient as denoted by an aggregate mean value of 37.4%; monitoring of patient's vital signs post-suction as denoted by an aggregate mean value of 71.2%; maintaining an optimal cuff pressure post-suctioning as denoted by an aggregate mean value of 31.3% and documentation of outcomes of the endotracheal suctioning procedure as denoted by an aggregate mean value of 35%. This demonstrated that there were gaps or deficiencies in post-suction practices among nurses working in adult critical care unit at KNH. Results are outlined in Table 4.4.

Table 4.4: Post-suction practices among the participants

	N	Nurses' pre-suction practice adherence scores	
		Mean score (%)	SD
Practices after an ETS event			
Patient reconnected to oxygen post suctioning	163	82.6	0.837
Post-suctioning hyperoxygenation	163	65.7	1.414
Providing oral care	163	27.0	2.116
Patient's chest auscultation after endotracheal suctioning	163	52.8	0.810
Reassuring of the patient	163	37.4	0.951
Monitoring of patient's vital signs post-suction	163	71.2	1.576
Hand disinfection post suctioning	163	89.2	0.732
Used catheter and gloves disposed of in a manner that prevents contamination from secretions	163	96.8	0.149
Maintaining an optimal cuff pressure post-suctioning	163	31.3	1.712
Documentation of outcomes of the ETS procedure	163	35.0	1.808

*Desirable adherence level - $\geq 75\%$; undesirable/sub-optimal adherence level - $< 75\%$

4.6 Association between the nurses' socio-demographic attributes and their closed ETS practices

The study tested the null hypothesis that nurses' practices prior to, during and after closed endotracheal suctioning were not influenced by their socio-demographic attributes. Multiple linear regression analysis, at 5% significance level, was applied in evaluation of the relationship between the nurses' endotracheal airway suctioning practices and the predictor variables which included four socio-demographic attributes namely gender, nursing education level, duration worked as a critical care nurse and training on ETS.

From the findings, a statistically significant association was established between the nurses' practices of closed endotracheal airway suctioning ($\beta = 0.491$; $p = 0.012$) and the duration they had worked as a critical care nurse as well as training on ETS ($\beta =$

0.631; $p = 0.007$), denoting that, in this study, duration worked as a critical care nurse and training on ETS were positive predictors of the nurses' practices on closed endotracheal tube airway suctioning at KNH's adult critical care unit. Hence, the study's null hypothesis fails to hold in relation to these two nurses socio-demographic attributes.

However, no statistically significant relationship was established between the nurses' practices on closed endotracheal tube airway suctioning and their gender ($p = 0.271$) and their nursing education level ($p = 0.119$), denoting that the nurses' practices on closed endotracheal tube airway suctioning were not significantly influenced by their gender and their nursing education level. Hence, the study's null hypothesis holds in relation to these two nurses socio-demographic attributes. Table 4.5 contains the findings.

Table 4.5: Association of nurses' socio-demographic attributes with their ETS practices

Socio-demographic attributes	β coefficients	<i>P</i> value
Gender	0.178	0.271
Nursing education level	0.246	0.119
Duration worked as a critical care nurse	0.491	0.012
Training on ETS	0.631	0.007
Constant - 6.012		
R - 0.677; R square - 0.458; adjusted R square - 0.444;		
Std. error of the estimate - 0.5404		
F statistic - 33.37; Sig. - .000		

CHAPTER FIVE: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents discussion of findings, conclusions and recommendations of the study in line with the study objectives. The study examined nurses' practices on closed endotracheal tube airway suctioning at Kenyatta National Hospital adult critical care unit.

5.2 Discussion of Findings

5.2.1 Pre-suction practices among the participants

The study examined the nurses' pre-suction practices. The nurses were found to have an appropriate level of adherence to several pre-suction practices which included putting the patient in a suitable position; ensuring that the analgesic is administered and several of the infection control measures including hand disinfection/washing prior to suctioning; having gloves on; wearing of apron; wearing of the face mask/shield and maintaining the sterility of suction catheter until insertion into airway. However, the nurses' adherence to other recommended pre-suction practices which included ascertaining and documenting the need for suctioning; patient preparation - explaining to the patient about the ETS procedure and reassuring the patient; patient's chest auscultation before ETS; offering pre-suctioning hyperoxygenation; checking the cuff pressure and having goggles on as an infection control measure was sub-optimal or below the desirable level. This clearly demonstrated that there were deficiencies in pre-suction practices among nurses working in adult critical care unit at KNH.

Similarly, in an empirical investigation conducted among Yemen's critical care nurses, a significant proportion of the surveyed nurses scored poorly with respect to adhering to prescribed pre-suction practice guidelines. Gaps in the nurses' pre-suction practices were observed in aspects such as auscultating the patient's chest before ETS, offering explanations about the ETS procedure to the patient and failing to offer pre-suctioning hyper-oxygenation as were reported by Alkubati et al. (2022). In another empirical study performed by Chen et al. (2021), the surveyed nurses' practices prior

to the ETS procedure were found to be sub-optimal with deficiencies noted in their pre-suction practices including providing hyper-oxygenation before the ETS procedure, not routinely using normal saline and adhering to aseptic technique pre-suction.

In their study, Jansson et al. (2018) also reported sub-optimal adherence to existing pre-suction procedure guidelines. Major gaps in the nurses' practice prior to the ETS procedure were observed in aspects including pre-suctioning hyper-oxygenation, explaining to the patient about the procedure, patient chest auscultation before ETS and infection-control practices related to prevention of cross-infections. Results in an empirical study by Shrestha and Shrestha (2018) also indicated that most of the surveyed nurses did not have the desired level of practice with respect to adhering to current pre-suction procedures. They observed deficiencies in the nurses' pre-suction practices in relation to ascertaining and documenting the need for suctioning, patient preparation by explaining the procedure, avoiding normal saline instillation pre-suctioning, determining the appropriate catheter size and reassuring the patient.

5.2.2 Practices during suction among the participants

The study also examined the nurses' practices during endotracheal suctioning. This study established that the nurses' practices during suction were sub-optimal as they did not fully adhere to the various recommended guidelines in relation to administration of the closed endotracheal tube airway suctioning. Deficiencies were noted in the nurses' adherence to the various practices during closed ETS which included avoiding routine normal saline instillation during endotracheal airway suctioning; limiting the size of suction catheter to not more than half of internal diameter of the endotracheal tube; limiting the number of suction passes to 2 or less per ETS procedure; maintaining the duration of suction applied to airway to less than 15 seconds; maintaining the level of suction pressure to 80-150mmHg during endotracheal airway suctioning; ensuring humidification by passing saline through the suction catheter and resting of the patient for 30 - 60 seconds in between consecutive suction. This clearly illustrated that there were gaps in practices during suction among the nurses working at KNH's adult critical care unit.

Similarly, in an empirical study conducted by Varghese and Moly (2021) among critical care nurses in India, results indicated that most of the nurses' practices during administration of closed endotracheal suctioning procedure were below the desired level. The study noted that only slightly above 50% of the nurses demonstrated an acceptable level of skill in performing the ETS procedure as is recommended with the sub-optimal ETS performance attributed to inadequate training on the ETS procedure. Equally, results in an empirical study by Beuret et al. (2019), demonstrated that there were notable gaps in surveyed nurses' practice during performance of the closed ETS procedure. The nurses' practices during ETS procedure were especially poor in aspects including shallow suctioning, monitoring the level of suction negative pressure, performing tracheal suctioning only when necessary and ensuring diameter of the suction catheter does not exceed one-half the diameter of the artificial airway. Similarly, in a cross-sectional study undertaken among critical care nurses in select hospitals in Tanzania, a large number of the nurses demonstrated a sub-par level of practice when performing the closed ETS procedure to intubated patients with Most of the nurses observed as not following existing guidelines during the ETS procedure as reported by Mwakanyanga et al. (2018).

Jansson et al. (2018) in an empirical study undertaken among CCU nurses in Finland also established that majority of the critical care nurses did not adhere to existing guidelines in their practice during performance of ETS procedure. Gaps in the nurses' practice during ETS procedure were seen in aspects including level of suction pressure, number of suction passes, duration of suction applied to airway and instillation with sodium chloride. Alkubati et al. (2022) in an empirical investigation performed among critical care nurses in select Yemenis hospitals also reported that most of the nurses had poor scores with respect to their adherence to prescribed guidelines during performance of ETS procedure. Gaps in the nurses' practice were most evident in observance of guidelines including recommended number of suction passes per ETS procedure, recommended total duration of suction time per ETS procedure, humidification by passing saline through the suction catheter and ensuring adequate resting of the patient in between consecutive suction. In China, Chen et al. (2021) also identified notable gaps between the nurses' practices during the ETS procedure and prevailing ETS performance recommendations with the most poorly performed practices during ETS procedure being maintaining the right suction

pressure during endotracheal suctioning and limiting the insertion length of the suction catheter as appropriate.

5.2.3 Post-suction practices among the participants

The study also examined the post-suction practices among the nurses. From the findings, nurses working in the adult critical care unit of KNH were found to have desirable adherence level with few of the post-suction practices which included patient reconnection to oxygen post suctioning; hand disinfection post suctioning and ensuring that used catheter and gloves were disposed of in a manner that prevented contamination from secretions. However, the nurses' post-suction practices in aspects which included ensuring post-suctioning hyperoxygenation; providing oral care; patient's chest auscultation after endotracheal suctioning; reassuring of the patient; monitoring of patient's vital signs post-suction; maintaining an optimal cuff pressure post-suctioning and documentation of outcomes of the endotracheal suctioning procedure were found to be sub-optimal. This demonstrated that there were gaps or deficiencies in post-suction practices among nurses working in adult critical care unit at KNH.

The findings concurred with those of Afenigus et al. (2021) who in a study carried out among critical care nurses in Ethiopia established that most of the surveyed nurses had poor practice of post-suction procedures and which they attributed to unavailability of endotracheal tube airway suctioning guidelines and the nurses' inadequate knowledge with relation to artificial airway suctioning. Likewise, in another empirical study investigating post-suction practices among nurses working in a local hospital in Pakistan, Khimani et al. (2020) observed that most of the nurses' practices on post-suction procedures were sub-optimal as they did not perform some of the post-suction events in line with current ETS guidelines. The study therefore called for increased emphasis on enhancing the nurses ETS skills. Equally, Alkubati et al. (2022) in an empirical assessment of post-suction practices among critical care nurses in select hospitals in Yemen, A significant proportion of the observed critical care nurses had poor scores with respect to their adherence to post-endotracheal suction practice guidelines. Gaps in the nurses' post-suction practices were seen in aspects including auscultating the patient's chest after ETS, reassuring of the patient,

providing oral care, monitoring of vital signs and offering post-suctioning hyperoxygenation.

Similar observations were made in a study by Maraş et al. (2017) in which most of the critical care nurses post endotracheal suctioning practices were found to be sub-optimal. This was particularly in areas of performing patient assessment post suction, monitoring of patient's vital signs post suction, documentation of outcomes of the ETS procedure and dealing with the adverse effects of endotracheal suctioning. Majeed (2017) in an empirical enquiry examining closed endotracheal suctioning practices among critical care unit nurses in Iraq reported that majority of the nurses exhibited poor post endotracheal suctioning practices. The study averred that there was need for continued training of the nurses to better their practice on endotracheal suctioning. Results in a study by Jansson et al. (2018) indicated that a significant proportion of the surveyed critical care nurses were not adhering to existing guidelines in their post ETS procedure practices. Gaps in the nurses' practice following an ETS procedure were seen in aspects including patient chest auscultation after suctioning, infection control practices post suctioning, post-suctioning hyperoxygenation, reassuring of the patient and maintaining an optimal cuff pressure post suctioning.

5.3 Conclusions

Based on the findings of the study, the following conclusions can be drawn:

There were gaps or deficiencies in pre-suction practices among nurses working in adult critical care unit at KNH in aspects including ascertaining and documenting the need for suctioning; patient preparation - explaining to the patient about the ETS procedure and reassuring the patient; patient's chest auscultation before ETS; offering pre-suctioning hyperoxygenation; checking the cuff pressure and wearing of goggles as an infection control measure.

The nurses practices during suction were sub-optimal in aspects which included avoiding routine normal saline instillation during endotracheal airway suctioning; limiting the size of suction catheter to not more than half of internal diameter of the endotracheal tube; limiting the number of suction passes to 2 or less per ETS procedure; maintaining the duration of suction applied to airway to less than 15

seconds; maintaining the level of suction pressure to 80-150mmHg during endotracheal airway suctioning; ensuring humidification by passing saline through the suction catheter and resting of the patient for 30 - 60 seconds in between consecutive suctionings.

The nurses' post-suction practices were also sub-optimal in aspects which included ensuring post-suctioning hyperoxygenation; providing oral care; patient's chest auscultation after endotracheal suctioning; reassuring of the patient; monitoring of patient's vital signs post-suction; maintaining an optimal cuff pressure post-suctioning and documentation of outcomes of the endotracheal suctioning procedure.

5.4 Recommendations

1. There is need for regular on-job trainings, inductions and demonstrations on closed endotracheal tube airway suctioning procedures among critical care nurses working at KNH's adult critical care unit so as to sharpen their ETS practice skills and competence.
2. Efforts are required to increase awareness of existing clinical guidelines on closed endotracheal tube airway suctioning technique among nurses working in adult critical care unit at KNH.
3. There is need for regular monitoring and audits of nurses' practices on closed endotracheal tube airway suctioning at KNH's adult critical care unit to allow for timely detection of gaps or deficiencies in their closed ETS practices in turn leading to timely action to remedy the situation.

5.5 Suggested Areas for Further Studies

1. This was a single hospital study that examined nurses' practices on closed endotracheal tube airway suctioning at Kenyatta National Hospital adult critical care unit. Therefore, to facilitate a broader comparison and generalization of the study findings, a broader empirical investigation involving a larger set of critical care nurses drawn from hospitals across the country is hereby recommended.

2. Further, a comparative empirical investigation on patient care outcomes between open versus closed endotracheal tube airway suctioning at KNH's adult critical care unit would be informative.
3. A review of factors influencing nurses' practices on closed endotracheal tube airway suctioning at KNH's adult critical care unit would equally be illuminating.

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APPENDICES

Appendix 1: Informed Consent Form

Title of Study: Nurses practices on closed endotracheal tube airway suctioning at Kenyatta National Hospital adult critical care unit

Principal Investigator\and institutional affiliation: Shallet Amutalla, University of Nairobi

Supervisors: Dr. Samuel Kimani & Dr. Lilian Omondi, University of Nairobi

Introduction

My name is Shallet Amutallaa student at the University of Nairobi pursuing a Masters of Science Degree in Critical Care Nursing. I am carrying out a research study entitled: Nurses practices on closed endotracheal tube airway suctioning at Kenyatta National Hospital adult critical care unit.

Purpose of the study

The purpose of this study is to determine the practices on closed endotracheal tube airway suctioning method among nurses working in adult critical care unit at Kenyatta National Hospital.

Background of the study

In critical care settings, endotracheal suctioning (ETS) is an important procedure of airway management in patients under mechanical ventilation. It is performed to remove accumulated pulmonary secretions, ensure airway patency for adequate ventilation and oxygenation, to reduce the risk of ventilator-associated pneumonia (VAP) and to prevent atelectasis in mechanically ventilated patients. It is critical that nurses working in intensive care settings have the necessary knowledge and skills on ETS as when inappropriately or incorrectly performed, ETS can cause serious potentially harmful complications. However, locally, the practices on ETS among critical care nurses have not been probed, necessitating this study. Consequently, I'm requesting your participation in this study. If you consent to participate, you will be

recruited to be part of the participants whose practices, prior to, during and after closed endotracheal suctioning procedures will be observed.

Confidentiality

All information provided will be handled and processed with utmost confidentiality. All information given herein will only be used for purposes of the research study. Your name or anything else that may identify you will not appear anywhere in the study.

Voluntary participation

Your participation in this study is voluntary i.e., on your own free will and without any coercion.

Right of withdrawal

Should you feel/wish to terminate your participation in this study, you have the right to do so at any time without facing any consequences/penalties.

Benefit

This research work is for academic purposes only and if you agree to participate, the information that you will provide will be of great importance to the success of this study. It's hoped that the study findings will inform policy review through shining light on existing endotracheal tube airway suctioning guidelines and procedures in KNH's critical care units. This may in turn lead to formulation of strategies and interventions aimed at enhancing nurses' practices on closed ETS in the hospital through greater emphasis on use of current evidenced-based endotracheal tube airway suctioning guidelines.

Risks

There is no any intended health risk or any other harm to you for participating in this study. However, in the event that you suffer emotional or psychological distress for participating in this study, the researcher will refer you to a counselor for appropriate help.

Compensation

There will be no monetary gains or any other form of payment to you for participating in this study.

Contacts

For any queries regarding this research study, kindly contact;

Principal researcher		Lead supervisor		Secretary
Shallet Amutalla		Dr. Samuel Kimani		KNH-UoN ERC
Cell: 0725 555 963		Cell: 0722384917		Telephone: 020-2726300
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				P.O. Box 19676 – 00202 Nairobi

Respondent's Declaration

I have been fully informed about the nature of the study, I know the benefits, and understand that there are no risks involved. I hereby give my consent to participate in this study.

Signature Date

Researcher's Declaration

I have fully disclosed all the relevant information concerning this study to the study respondent.

Signature of researcher Date

Appendix 2: Questionnaire

Study title: Nurses practices on closed endotracheal tube airway suctioning at
Kenyatta National Hospital adult critical care unit

Code

Date

Section A: Demographic information of the participants [to be responded to by the participant]

1. What is your gender?

Male () Female ()

2. What is your age (in completed years)?

3.

a. What is your highest level of nursing education?

Certificate () Diploma () Higher Diploma ()

Bachelors () Masters ()

Others (specify)

b. Have you undergone/received critical care training?

Yes () No ()

c. If Yes in (b) above, at what level did you receive the critical care training?

Post basic diploma level () Post graduate level ()

4. What is your marital status?

Married () Not married ()

5.

a. What is your religion? Christian () Islam () Hindu () Others ()

b. Do your religious beliefs affect your nursing practice?

Yes () No ()

If Yes, in which ways (kindly elaborate)

.....
.....
.....

6. For how long have you worked in the critical care units?

Less than 5 years () 5 - 10 years () Over 10 years ()

7. Have you ever received training on endotracheal tube airway suctioning procedure?

Yes () No ()

8. On work load, how many patients do you take care of in every shift on average?

.....

End

Thank you for taking part

Appendix 3: Observation Checklist

Study title: Nurses practices on closed endotracheal tube airway suctioning at Kenyatta National Hospital adult critical care unit

Code **Date**

Nurse's shift Morning () Afternoon () Night ()

Section A: Nurses' practices prior to endotracheal suctioning event

Clearly observe whether the nurse performs each of the following practices prior to an ETS event/procedure. If the practice is performed, tick on the 'Yes' column and if it is not performed tick on the 'No' column.

Practices prior to ETS event	Yes	No
Patient preparation: Explaining to patient about the ETS procedure		
Patient assessment: Patient' chest auscultation before ETS?		
Putting the patient in a suitable position		
Pre suctioning hyperoxygenation		
Cuff pressure checked		
Analgesic administered		
Infection control practices Hand disinfection/washing prior to suctioning Gloves worn Apron worn Face mask/shield worn Goggles worn Sterility of suction catheter maintained until inserted into airway		

Source: Adopted from WHO Observational Checklist on ETS procedures (2023)

Section B: Nurses' practices during endotracheal suctioning event

Clearly observe whether the nurse performs each of the following practices during an ETS event/procedure. If the practice is performed, tick on the 'Yes' column and if it is not performed tick on the 'No' column.

Practices during ETS event	Yes	No
Sodium chloride (normal saline) instillation		
Size of suction catheter (\leq Half of internal diameter of ETT)		
Number of suction passes \leq 2		
Duration of suction applied to airway ($<$ 15 seconds)		
Level of suction pressure 80-150mmHg		
Humidification by passing saline through the suction catheter		
Resting of the patient for 30 - 60 seconds in between consecutive suction		

Source: Adopted from WHO Observational Checklist on ETS procedures (2023)

Section C: Nurses' post endotracheal suctioning practices

Clearly observe whether the nurse performs each of the following practices after an ETS event/procedure. If the practice is performed, tick on the 'Yes' column and if it is not performed tick on the 'No' column.

Post ETS event practices	Yes	No
Patient reconnected to oxygen post suctioning		
Post-suctioning hyperoxygenation		
Giving oral care		
Post-ETS assessments: Patients' chest auscultation after suctioning		
Patient reassured		
Monitoring vital signs		
Hand disinfection post suctioning		
Used catheter and gloves disposed of in a manner that prevents contamination from secretions		
Cuff pressure checked		

Source: Adopted from WHO Observational Checklist on ETS procedures (2023)

End

Appendix 4: Letter to KNH-UoN Ethics and Research Committee

Shallet Amutalla,
Reg. No.: H56/39156/2021,
Department of Nursing Sciences,
Faculty of Health Sciences,
University of Nairobi.

The Secretary,
KNH/UoN - Ethics and Research Committee,
P.O. Box 20723-00202,
Nairobi.

Dear Sir/Madam,

RE: Approval to Conduct a Research Study

My name is Shallet Amutallaa student at the University of Nairobi's Department of Nursing Sciences undertaking a Masters of Science Degree in Critical Care Nursing. I am hereby requesting for your approval to carry out a research study entitled "Nurses practices on closed endotracheal tube airway suctioning at Kenyatta National Hospital adult critical care unit", as a requirement in partial fulfillment for the award of the said degree.

Thank you in advance.

Yours faithfully,

Shallet Amutalla

Appendix 5: Letter to the Head of Department - Critical Care Unit, KNH

Shallet Amutalla,

Reg. No.: H56/39156/2021,

Department of Nursing Sciences,

Faculty of Health Sciences,

University of Nairobi.

The Head of Department,

Critical Care Unit - KNH,

Nairobi.

Dear Sir/Madam,

RE: Authority to Carry out A Research Study at KNH Adult CCU



My name is Shallet Amutallaa student at the University of Nairobi's Department of Nursing Sciences undertaking a Masters of Science Degree in Critical Care Nursing. I am undertaking a research study entitled "Nurses practices on closed endotracheal tube airway suctioning at Kenyatta National Hospital adult critical care unit", as a requirement in partial fulfillment for the award of the said degree.

I am therefore hereby requesting for your authorization to conduct data collection on nurses' practices on closed endotracheal tube airway suctioning method in the adult Critical Care Unit of KNH. I look forward to your positive feedback.

Yours faithfully,

Shallet Amutalla

Appendix 6: Approval Letter from KNH-UoN ERC



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Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/418

Shallet Amutalla
Reg.No.H56/39156/2021
Dept. of Nursing Sciences
Faculty of Health Sciences
University of Nairobi

5th August, 2023



Dear Shallet,

ETHICAL APPROVAL-RESEARCH PROPOSAL: NURSES PRACTICES ON CLOSED ENDOTRACHEAL TUBE AIRWAY SUCTIONING AT KENYATTA NATIONAL HOSPITAL ADULTS CRITICAL CARE UNIT (P325/03/2023)

This is to inform you that KNH-UoN ERC has reviewed and approved your above research proposal. Your application approval number is **P325/03/2023**. The approval period is 5th August 2023 –4th August 2024.

This approval is subject to compliance with the following requirements;

- i. Only approved documents including (informed consents, study instruments, MTA) will be used.
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by KNH-UoN ERC.
- iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KNH-UoN ERC 72 hours of notification.
- iv. Any changes, anticipated or otherwise that may increase the risks or affected 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.
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. 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.
- vii. Submission of an executive summary report within 90 days upon completion of the study to KNH-UoN ERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://research-portal.nacosti.go.ke> and also obtain other clearances needed.

Yours sincerely,




PROF. BEATRICE K.M. AMUGUNE
SECRETARY, KNH- UoN ERC

- c.c. The Dean, Faculty of Health Sciences, UoN
 The Senior Director, CS, KNH
 The Chairperson, KNH- UoN ERC
 The Assistant Director, Health Information Dept., KNH
 The Chair, Dept. of Nursing Sciences, UoN.
Supervisors: Dr. Samuel Kimani, Dept. of Nursing Sciences, UoN
 Dr. Lilian Omondi, Dept. of Nursing Sciences, UoN

Appendix 7: Approval Letter from Kenyatta National Hospital

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

Study Registration Certificate

1. Name of the Principal Investigator/Researcher
S. HALLI NAFULA AMUTALLA
2. Email address: amutalla@haloetel@gmail.com Tel No. 0725 555 962
3. Contact person (if different from PI) MIA
4. Email address: MIA Tel No. _____
5. Study Title
Nurses' Practices on Caring Endotracheal Tube Circuitry
(Specimens among Adult Patients in ICU Critical Care Unit)
6. Department where the study will be conducted Intensive Nursing Unit
(Please attach copy of Abstract)
7. Endorsed by Research Coordinator of Department where study will be conducted.

Name: _____ Signature _____ Date _____
8. Endorsed by KNH Head of Department where study will be conducted.

Name: Dr Kennedy Mwangi Signature _____ Date 14/08/2023
9. KNH UoN Ethics Research Committee approved study number _____
(Please attach copy of ERC approval)
10. I S. HALLI NAFULA AMUTALLA commit to submit a report of my study findings to the Department where the study will be conducted and to the Department of Medical Research.

Signature _____ Date 14-8-2023
11. Study Registration number (Dept/Number/Year) Anaesthesia 1184/12
(To be completed by Medical Research Department)
12. Research and Program Stamp _____
14 AUG 2023

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

Appendix 8: Work Plan

Activity	2023								
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Development of the concept									
Proposal writing and presentation									
Submitting the proposal to ERC									
Pretesting the study tool									
Collecting the study data									
Data analysis, report writing and corrections									
Defense of the project									

Appendix 9: Study Budget

Component	Description	Item	Quantity	Unit Cost (Ksh)	Total (Ksh)
Literature Review	Literature search	Airtime	6 Months	1,000/Month	6,000
		Internet	6 Months	3,000/Month	18,000
	Stationery	Laptop	1	50,000	50,000
		External Hard Disc	1	7,000	7,000
		Pens, Pencils, Eraser, Folders	10	@ 100	1,000
Proposal	Related costs	Plain paper	2 reams	@650	1,300
		Printing	1 Draft	@750	750
		Photocopying	2 Drafts	@250	500
		Binding	3 Drafts	@100	300
Approval	KNH Data ERC		1	@500	500
			1	@ 2,000	2,000
	Consent Form and study tool	Printing, photocopy	97	@60	5,820
	Data collection	Research Assistants	2	@ 10,000	20,000
	Data Processing and analysis	Statistician	1	@ 40,000	40,000
Report Phase	Final Report	Printing	1 copy	@ 500	500
		Photocopying	4 copies	@ 500	2,000
		Binding	5 copies	@ 100	500
Publishing					30,000
Sub Total					186,170
Contingencies	10% of sub-total				18,617
Grand Total					204,787

Source of funding: Self

Appendix 10: plagiarism report

Nurses Practices On Closed Endotracheal Tube Airway Suctioning At Kenyatta National Hospital Adult Critical Care Unit

ORIGINALITY REPORT

13 %	9 %	7 %	3 %
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

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5	www.sciencedirect.com Internet Source	<1 %
6	Submitted to Kenyatta University Student Paper	<1 %
7	www.lhp.leedsth.nhs.uk Internet Source	<1 %
8	Halita J Pinto, Fatima D'silva, Thankappan S Sanil. "Knowledge and Practices of Endotracheal Suctioning amongst Nursing	<1 %

PROF. SAMUEL KIMANI

[Signature]

09/11/2023



Professionals: A Systematic Review", Indian
Journal of Critical Care Medicine, 2020
Publication

9	Submitted to Far Eastern University Student Paper	<1 %
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13	Hanaa Mohamed Elshahat, Rehab Kafli. "Impact of evidence based recommendations about open endotracheal suctioning on nurses' performance in neonatal intensive care units", Assiut Scientific Nursing Journal, 2022 Publication	<1 %
14	eclass.upatras.gr Internet Source	<1 %
15	Sarmila Koirala, Raj Kumar Mehta, Santosh Acharya, Pooja Gauro. "Critical Care Nurses' Views on Handover in Chitwan, Nepal", Connect: The World of Critical Care Nursing, 2019 Publication	<1 %
