

**ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF MEDICINE**



**DEPARTMENT OF EMERGENCY MEDICINE AND CRITICAL CARE
NURSING**

**KNOWLEDGE, PRACTICE AND ASSOCIATED FACTORS OF NURSES
WORKING IN INTENSIVE CARE UNIT TOWARDS OPEN ENDO-
TRACHEAL SUCTIONING FOR MECHANICALLY VENTILATED
PATIENTS IN PUBLIC HOSPITALS OF ADDIS ABABA, ETHIOPIA,
2023.**

BY: ABEBE MERCHAW FARIS (BSC)

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**JUNE, 2023
ADDIS ABABA, ETHIOPIA**

APPROVAL BY THE BOARD OF EXAMINATION

This thesis by Abebe Merchaw is accepted in its present form by the board of examiners as satisfying thesis requirement for the partial fulfilment of the requirements for the master of science emergency medicine and critical care nursing.

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DECLARATION

Letter of declaration

By my signature below, I declare and affirm that this is entirely that this thesis is my original work. I have followed all ethical principles in the preparation, data collection, data analysis, and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation. I affirm that I have cited and referenced all sources used in this document. Every effort has been made to avoid plagiarism in the preparation of this thesis. This thesis submitted to Addis Ababa university college of health sciences department of emergency medicine and critical care, for partial fulfillment of the requirements for the master of science emergency medicine and critical care nursing.

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ABBREVIATIONS AND ACRONYMS

AARC	American Association of Respiratory Care
AOR	Adjusted Odds Ratio
BP	Blood Pressure
COR	Crowds Odds Ratio
ETB	Ethiopian Birr
ETS	Endotracheal Suctioning
ETT	Endotracheal Tube
HR	Heart Rate
ICP	Intra Cranial Pressure
ICU	Intensive Care Unit
NS	Normal Saline
PIP	Peak Inspiratory Pressure
RR	Respiration Rate
SPSS	Statistical Product and Social Service
SRS	Simple Random Sampling
UK	United Kingdom
VAP	Ventilator Associated Pneumonia

ABSTRACT

Introduction: Endotracheal suctioning is one of the commonly performed invasive procedures in intensive care unit so as to keep airway patent in intubated patients. Knowledge and practice of nurses working in intensive care unit towards endotracheal suctioning is directly related to minimize complications, to improve standard of care, to promote effective/safe suctioning and to reduce length of stay in intensive care unit.

Objective: To assess knowledge, practice and associated factors of nurses working in intensive care unit towards open endotracheal suctioning for mechanically ventilated patient in public hospitals of Addis Ababa, Ethiopia, 2023.

Methods: Institutional based cross-sectional study was conducted on nurses working in six public hospitals. Simple random sampling method was used and data were collected using structured self-administered questionnaire and observational checklist. Data were entered into epi data version 4.6 and analysis was done using SPSS version 27. Frequency and percentage were done for categorical data. In addition, mean and standard deviation were done for continuous data. Besides, binary logistic regression was used to determine association between dependent and independent variables.

Result: A total of 136 were included with response rate of 97% (132). From this, 78 (59.1%) with 95% CI (50.67, 67.53) and 51 (38.6% with 95% CI (30.30, 46.91) of nurses had good knowledge and practice respectively. Qualification [AOR = 6.01; CI: 1.24–29.05] and training [AOR= 3.69; CI: 1.40-9.67] were significantly associated with knowledge with P-value <0.05. Moreover, professional qualification of masters and above [AOR = 7.5; CI: 1.76–31.78], training [AOR= 9.4; CI: 2.86-30.59], adequate equipment supplies [AOR= 5.0; CI: 1.71-14.38], and experience => 6years [AOR= 6.8; CI: 2.21-20.86] were associated of practice.

Conclusion: In this study, more than half of the nurses who were working in intensive care units had good knowledge, but majority had poor practice on endotracheal suctioning. Training, qualification, experience and availability of adequate equipment were major factors associated with knowledge and practice.

Keywords: endotracheal suctioning, knowledge, practice, Intensive care unit

1. INTRODUCTION

1.1. Background

Patent airway is crucial for successful gas exchange. Patency of airway is naturally protected by action of the muco-ciliary system when mucus is produced by the local immune system and the cough reflex (1). In patients who are ill critically, function is impaired, resulting in excessive pulmonary secretions (1). When involuntary physiological mechanisms fail to clear the airway, collaborative nursing intervention i.e. endotracheal suctioning is required to maintain a patent airway (2).

Suctioning is an essential technique for patients in the ICU (1,3). Because of the disruption of cough reflex and ciliary movement, secretions accumulate in airway increases airway resistance and respiratory strain. As a result, atelectasis, hypoxemia, hypercapnia and infection occur. So, accumulated mucus must be routinely suctioned (4).

When patients are mechanically ventilated, endotracheal suctioning ETS is used to mechanically aspirate the patient's pulmonary secretions through an artificial airway (5). ETT suctioning can be done with closed and open methods. In contrast to closed suction system, which may be used multiple times without disconnecting the ventilator and allows suction without disconnecting the ventilator, the open suction method used by disconnecting the mechanical ventilator (6–8).

Open ETS is the process of inserting single-use tube into the artificial airway after removing the ventilator or swivel connector (9). It is one of the techniques that involves aspirating secretions mechanically (10). It minimizes the accumulation of pulmonary secretions, maintains airway patent, ensures adequate oxygenation and ventilation, as well as saves life (11).

For patients who are mechanically ventilated, ETS is regarded as one of the crucial activities(11). Besides, ETS is frequently performed procedures in the ICU (12). Oxygen desaturation, secretions in the ETT, coughing frequently, change in vital signs, dyspnea, restlessness, increased PIP and high-pressure alarms are some of the indications for suctioning patients with endotracheal tube (13).

1.2. Statement of the Problem

Endotracheal Suctioning is life saving activity which is mostly done in ICU and patients who are with ETT may require ETS 3 to 24 times every day (14). If it is not done appropriately, endotracheal suctioning has several complications and side effects such as bleeding, endothelial injury, respiratory arrest, hypoxia, cardiac dysrhythmias, elevated intracranial pressure, cardiac arrest, and death (15,16). For the vast majority of patients having an artificial airway, suctioning is necessary to keep the airway patent. In addition, ETT is a foreign body, increasing secretion production in patients whose normal muco-ciliary reflex is disturbed (17).

Mechanically ventilated patients must get well-structured and technically advanced level of care (18). Endotracheal suctioning is a daily activity; however, it is done differently between nurses to nurses (19) . Some suctioning practices continue to be practiced despite the fact they are out of use (20).

In addition, it is invasive procedure, if not performed correctly, it might have a number of negative outcomes. Some of these are: tracheobronchial edema, ulceration, and denudation of the epithelium (21,22). Furthermore, suctioning is seen as a highly unpleasant and traumatic experience for ICU patients (23). Study findings revealed that ETS conducted by trained and educated nurses reduce effects (24,25). As a result, it is crucial for health care practitioners to have evidence-based up-to-date knowledge of ETS with evidence-based practices in order to perform the care scientifically and thereby limit patient difficulties and potential dangers (26).

Nurses working in ICU must have the knowledge and practice based on proven, evidence-based practice to prevent harm to the patients (27). The appropriate ETS has a direct impact on the patients' prognosis such as decreased morbidity like, ventilator associated pneumonia, mortality, length of hospitalization and costs. However, poor adherence to best practice is typical problem among nurses performing ETS (28). If suctioning is not performed appropriately, it has potentially fatal side effects some of these are: hypoxia, VAP, elevated ICP, tracheal destruction, atelectasis, arrhythmias and death. Therefore, it is important for all nurses working in intensive care units to understand any potential risks that patients may encounter when receiving ETS (29).

Risky endotracheal suctioning practices continue to be a major issue in the world today. Though there are guidelines for ETS, most of them have not been implemented by nurses possibly because they are not aware of the established, evidence-based guidelines for ETS (30). For instance, study conducted in Canada showed that despite evidence-based practice guidelines showing that this therapy may be harmful to patients, registered nurses and respiratory therapists use normal saline instillation while performing ETS (31).

Moreover, study done in France showed only 50% of the of nurse followed the recommendation of suctioning only when secretions are evident (32). Study conducted in Iran indicated that nurses' ETS knowledge and performance were good and average, respectively (33). Besides, study done in China, showed that there were discrepancies between Chinese ICU nurses' practice and the suggestions made by the guidelines and that they were unaware of certain critical evidence-based ETS practice (34).

Study done in Johannesburg South Africa revealed that nurses lack the necessary up-to-date knowledge of the most recent, scientifically supported recommendations for ETS (35). Another study done in Rwanda found around 86% of nurses did not do proficient suctioning. Furthermore, nurse knowledge, work experience, degree of certification and ongoing education were influencing suctioning practice among nurses (36).

Despite the fact that ETS is commonly performed for patients with ETT, a few studies have been done in the world-wide context, with very little research being conducted in Ethiopia regarding knowledge and practice of nurses. As a result, further information about critical care nurses' understanding and practice of ETS in Ethiopia particularly in Addis Ababa is required. Therefore, assessing ETS knowledge and practices is important for the overall improvement of patients care in the intensive care units.

1.3. Significance of the Study

This study may help those clinicians to have updated knowledge and skills about endotracheal suctioning. In addition, it serves as baseline to develop protocols for prevention of complications while performing endotracheal suctioning. Moreover, the findings of this study will be used by hospital administrators, health institutions and policymakers to focus on areas of improvement to provide supportive educational and training support for professionals. In addition, it will serve as baseline data for future enhancements of ETS knowledge and practice for patients' well-being in the intensive care units.

2. LITERATURE REVIEW

2.1. Overview of Endo-tracheal Suctioning

For critical patients in ICU, ETS is a vital procedure which involves the evacuation of accumulated secretions via an ETT (30). It is common care of patients and includes patient preparation, the suctioning process, and post-suction activities. The major goals of ETS are: to enable gaseous exchange, airway permeability as well as decrease VAP (37). It is critical that this process be done with competence based on current recommendations that ensure efficiency and patient safety. Professional nurses who are responsible for patient care must conduct ETS correctly and successfully keeping sterility (30).

2.2. Knowledge about Endo-tracheal Suctioning

A cross-sectional study conducted at Kaski District, Nepal, revealed that almost 50% nurses working ICU had poor knowledge (30). Another cross-sectional study done in Tanzania, revealed 77% of nurses knew action taken if there is change in ECG monitor. Nevertheless; 80.6% nurses had poor knowledge of ETS (38).

In addition, study in the study done in Brazil showed knowledge of nurses was good in 73.2% of professionals (39). In another study conducted in Nigeria, 44.8% Practitioners were aware that wearing gloves, an apron, and a face mask while suctioning, hand cleaning prior to suctioning, and correct disposal of used catheters and gloves are infection control practices during the suctioning procedure (33). A study conducted in Bharatpur, Nepal, critical care units revealed good knowledge of 55.8% (28).

Besides, study conducted in western Turkey showed good knowledge of nurses towards duration of suctioning was 97.2%. and 93.1% of the nurses answered that 100% oxygen should be given to the patient again after suctioning and overall good knowledge of the nurses was 34.7%(41). Cross-sectional study conducted among intensive care unit nurses in Peshawar, Northern Pakistan showed that the mean knowledge of nurses on ETT suctioning was 50.04%±18.96 (42).

Moreover, study conducted in Baghdad teaching hospitals, Iraq, showed that 72.0% of nurses had good knowledge regarding ETS frequency, 26% of nurses have poor knowledge about ETS catheter changed, 46% of nurses have fair knowledge about Prevention of nosocomial infections, 42.9% stated tachycardia, dyspnea and VAP are result of saline instillation, 26% of nurses had knowledge of suction pressure 80-120 mmHg pressure and 64% of nurses knew catheter size should be less than internal diameter (43).

Most importantly, study conducted in Mato Grosso do Sul, Brazil, showed that 92.6% of nurses knew that ETS done when needed. Regarding hand hygiene, all (100%) participants answered the question correctly, 44.5% correctly stated that instillation of normal saline 0.9% before the ETS is not recommended (44) Descriptive cross-sectional study conducted in Karachi, Pakistan revealed knowledge score were (10.4 ± 1.8 SD) (45).

Study conducted in Lahore, institute of child health showed 85.6% knew that hyperventilation before suctioning is mandatory, 8.5% stated that ETS should not done by saline administration and overall knowledge score was 24 ± 3.0 (46).

By and large, a survey carried out in Changsha, China revealed that 68% of nurses has awareness of Suctioning should only be done when necessary, 44.5% of nurses are aware of that Suction catheters should be less than internal diameter 31.3% of nurses are not aware that suctioning procedure should last no longer than 15 seconds (47). Another study done in Narayana, India, showed that knowledge of ET suctioning among staff nurses showed that 20% of nurses had good knowledge (48). Similarly, study done in Saudi Arabia, 57.9% of nurse had adequate knowledge (49) Study done in Sudan showed 14.3% of nurses had good knowledge (50).

A research done in ICUs of Amhara region revealed that 57.6% of nurses had good knowledge of ETS. 60% of the participant did not knew rotation of catheter 360-degree, 62.2% were not aware semi fowler position is best position for suctioning. However, 57.8% aware of the maximum time limit for ETS (51).

2.3. Practice on Endo-tracheal Suctioning

An observational study done in Finland revealed that 5.3% of nurses done Patient assessment: Patient' chest auscultation before ETS, 61.5% done Patient preparation, 57.5% done Pre-suctioning hyperoxygenation, 25.0% checked Cuff pressure before suctioning, 72.2% of nurses done hand disinfection prior to suctioning, 72.5% of nurses suction in (< 15 seconds), 15.0% of nurses used negative pressure of 80-120 mmHg, 62.5% of nurses done Post-suctioning hyper oxygenation and 52.5% of nurses done Hand disinfection post suctioning (52).

A prospective observational study conducted in Iran, Isfahan University of Medical Sciences showed that 72.5% of nurses did not done Patient preparation whereas 67.5% of nurses put the patient Semi-fowler position. Regarding pre hyperoxygenation 28% of nurses done it (53). Study conducted in western Turkey showed that poor knowledge of 79.2% (41). Another study done in Peshawar, practice score of ICU nurses was $80.37\% \pm 8.37$ (46). Moreover, study done in Dares Salaam, Tanzania, showed that all nurses observed did not auscultate chest and 85.7% did not check cuff pressure. Likewise, at post suctioning 74.3% did not auscultate chest, 77.1% did not hyper-oxygenate the patient and 94.3% did not check cuff pressure (38).

A study conducted in Baghdad, Iraq, showed 66% of nurses collect equipment for suctioning, 74% over half of nurses check function of device, 80% of all nurses check vital signs and 82% of nurses did not indications for suctioning to patient. 88% perform hand washing, 88% of nurses wear sterile gloves, majority wear face mask, 82% return patient to oxygen, 70% stop suctioning if the heart rate is abnormal and 64% done hyper oxygenation directly after suctioning(19).

A study conducted in Changsha, China, revealed that 50% of nurses did not follow the evidence-based recommendations for suctioning(47). Moreover, study conducted in Chitwan, Nepal, in critical care units revealed 55.8% participants had poor level of practice whereas 44.2% had good level of practice (28).

Study employed in Karachi, Pakistan, showed that the mean score of practice was $(11.2 \pm 1.2$ SD) (45). In addition, study done in Sri Lanka, showed that mean score of practices of nurses was $63.7\% \pm 11.8$ SD and reported correct practices were performed by 57.8% of nurses reported practices (54). The study done in Hodeida city, Yemen, showed that 55% of nurses had poor practice of endotracheal suctioning (55).

A study conducted in ICU of Amhara region public hospitals 91.1% of the participants monitor vital signs, 86.7% identify indication and 64.4% preoxygenate the patient. Besides this, 53.3% of nurses put the patient in semi fowlers position, 53.3% rotate the catheter 360 degrees while withdrawing and 136 (75.6%) suction within 10 to15 seconds. Moreover, 168 (93.3%) reassess patient's vital signs, and 71.1% perform documentation (51).

2.4. Factors Associated with Knowledge and Practice of Endotracheal Suctioning

Study done in Baghdad teaching hospitals, Iraq showed that training, work experience and age with P value < 0.005 were associated with knowledge and practice (19). In the mixed method study (descriptive survey and observation) done in Calabar Teaching Hospital, Calabar, age and working experience ($p = .001$) were associated significantly with high knowledge (40).

Moreover, survey done in Changsha, China showed that training and experience associated with knowledge of ETS) (47) In the study conducted in Bharatpur, Chitwan ICU revealed that training and income were associated with practice (56) In another study conducted in Najran Hospitals, Saudi Arabia showed significant association between knowledge of nurses and their training(49)

In descriptive study done in Kaski District, sex and qualification were associated with knowledge of endotracheal suctioning (30). In study conducted in Dar es Salaam city revealed that nurses who took ICU training was associated with knowledge of ETS (38). In study conducted in Yemen, education level, experience in the ICUs and training significantly associated with practice(55)

In the descriptive study done in Karachi, Pakistan education, work experience and nurse patient ratio were associated with knowledge and practice (45). In another study done in Peshawar, gender was significantly associate with knowledge and practice (46). Study done in Sri Lanka showed unmarried nurses had better knowledge compared to those who were married ($p < 0.05$) (28)

2.5. Conceptual Framework

This framework is developed by reviewing related literatures on knowledge and practice of nurses on ETS (19,28,30,38,40,45,47,49,50,55).

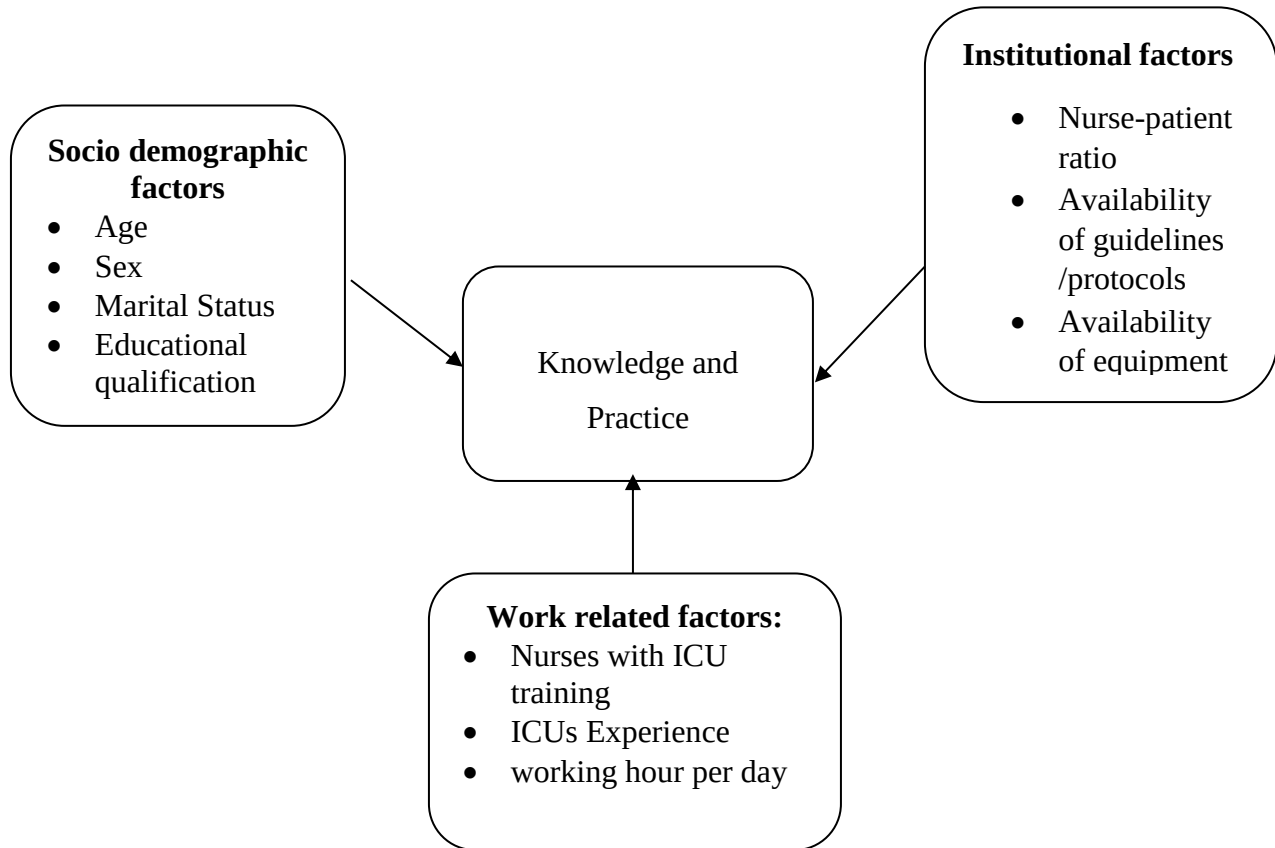


Figure 1: Conceptual Framework Adopted from different studies on Knowledge and Practice of Nurses Working in ICU towards ETS for Mechanically Ventilated patients.

3. OBJECTIVES

3.1. General Objective

To assess the knowledge, practice and associated factors of nurses working in ICU about open ETS for mechanically ventilated patients in public hospital of Addis Ababa, Ethiopia, 2023.

3.2. Specific Objectives

- To assess knowledge of nurses working in intensive care units about endotracheal suctioning for mechanical ventilated patients in selected public hospital of Addis Ababa, from 15 March ,2023 to 15 April ,2023.
- To determine practice of nurses working in intensive care units on endotracheal suctioning for mechanically ventilated patients in selected public hospital of Addis Ababa from 15 March.2023 to 15 April, 2023.
- To identify factors associated with knowledge and practice of nurses working in intensive care units towards open endotracheal suctioning for mechanically ventilated patient in selected public hospital of Addis Ababa from 15 March ,2023 to 15 April, 2023.

4. METHODS AND MATERIALS

4.1. Study Area and Period

The study was carried out in Addis Ababa, the capital and largest city of Ethiopia, with population of 5,005,524. Addis Ababa has 13 hospitals and 98 health centers, according to the Ministry of Health's 2012 (EFY) Health and Health Related Indicators report (57). The study was carried out in six selected public hospitals in Addis Ababa which were selected by simple random sampling. These were Tikur Anbessa Specialized Hospital, largest teaching hospital with multi-specialty service and teaching programs with 12 beds in adult ICU, eight mechanical ventilators, the nurse patient ratio is one to one, one pulmonologist, two neurosurgeons, seven anesthesiologists, seven internal medicine specialists, 36 nurses and average monthly admission of 75 patients, St. Paulos Hospital Millennium Medical College ICU with well-organized unit, one to one nurse to patient ratio, 13 beds in the ICU, 13 functional mechanical ventilators, two dialysis machines, two defibrillators and 10 functional monitors, 40 nurses, six anesthologists, four internal medicine specialists and average monthly admission of 60 patients, Zewditu Memorial Hospital with ICU, a total number of 10 beds, six functional mechanical ventilators, one to one nurse patient ratio, 30 nurses, three anesthologists, two internal medicine specialists and average admission of 40 patients per month, Minilik Referral Hospital with ICU of eight beds, five functional mechanical ventilators, one to one nurse patient ratio, 20 nurses, 3 anesthologists, three internal medicine specialists and with average admission of 35 patients per month, St. Peter Referral Hospital with ICU of 10 beds, 10 functional mechanical ventilators, one to one nurse to patient ratio, 30 nurses, three anesthologists, three internal medicine specialists and average monthly admission of 55 patients and Alert Specialized Hospital ICU with eight beds, eight mechanical ventilators, 30 nurses, five anesthologists, four internal medicine specialists, one to one nurse to patient ratio and average monthly admission of 50 patients. Data was collected from 15 March to 15 April, 2023.

4.2. Study Design.

Institutional based cross-sectional study was conducted.

4.3. Population

4.3.1. Source Population

All nurses working in adult ICU of public hospitals in Addis Ababa.

4.3.2. Study Population

Nurses who were working in adult ICU of selected public hospitals.

4.4. Eligibility Criteria

4.4.1. Inclusion Criteria

Nurses who were working in ICU for 6 months and greater were included.

4.4.2. Exclusion Criteria

During the study period, nurses who were unavailable because of maternity leave, annual leave, or sick leave were excluded.

4.5. Sample Size Determination and Sampling Procedure

4.5.1. Sample Size Determination

The study sample size was calculated by single population proportion formula and p value taken as 0.578 from a study conducted in Amhara region hospitals (51).

$$n = \frac{(z_{\alpha/2})^2 P(1-P)}{d^2} = \frac{(1.96)^2 0.578(1-0.578)}{(0.05)^2} = 375$$

n= sample size

$Z_{\alpha/2}$ =standard normal deviation of 1.96 corresponding to 95% confidence interval.

P= Proportion = 0.578.

d= Margin of error =0.05

Then, sample size was n=375

The total population was below 10,000, then, sample size was corrected.

$$n_f = \frac{n}{1+\frac{n}{N}} = \frac{375}{1+\frac{375}{186}} = 124$$

Adding 10% of non-response rate, final sample size was 136.

4.5.2. Sampling Procedure

For this study, six public hospitals from a total of 12 hospitals with ICU set-up in Addis Ababa were selected in order to address within the given resource and time. The final sample was allocated proportionally. from the data given from hospitals, 36, 40, 30, 20, 30 and 30 nurses were found in Tikur Anbesa, St. Paulos, Zewditu, Minilik, St. Peter, and Alert hospitals respectively. Nurses working at ICU in selected public hospitals was 186. Simple random sampling was used to select final sampled nurses.

sample size allocation was done by using proportional allocation.

$$n_i = \frac{N_i \times n}{N}$$

N

n_i = Total sample size in each hospital

N_i = Total Number of nurses working at ICU of each selected hospital

n = Total sample size determined (136)

N = Total nurses working at ICU of the specified hospitals (186)

For Tikur Anbesa specialized hospital $(36 \div 186 \times 136) = 26$

For St. Paulos hospital is $(40 \div 186 \times 136) = 29$

For Minilik referral hospital is $(20 \div 186 \times 136) = 14.6=15$

For Alert specialized hospital is $(30 \div 186 \times 136) = 21.9=22$

For Zewditu memorial hospital is $(30 \div 186 \times 136) = 21.9=22$

For St. Peter Referral Hospital is $(30 \div 186 \times 136) = 21.9=22$

Finally, simple random sampling was used in each hospital till the desired sample size fulfilled.

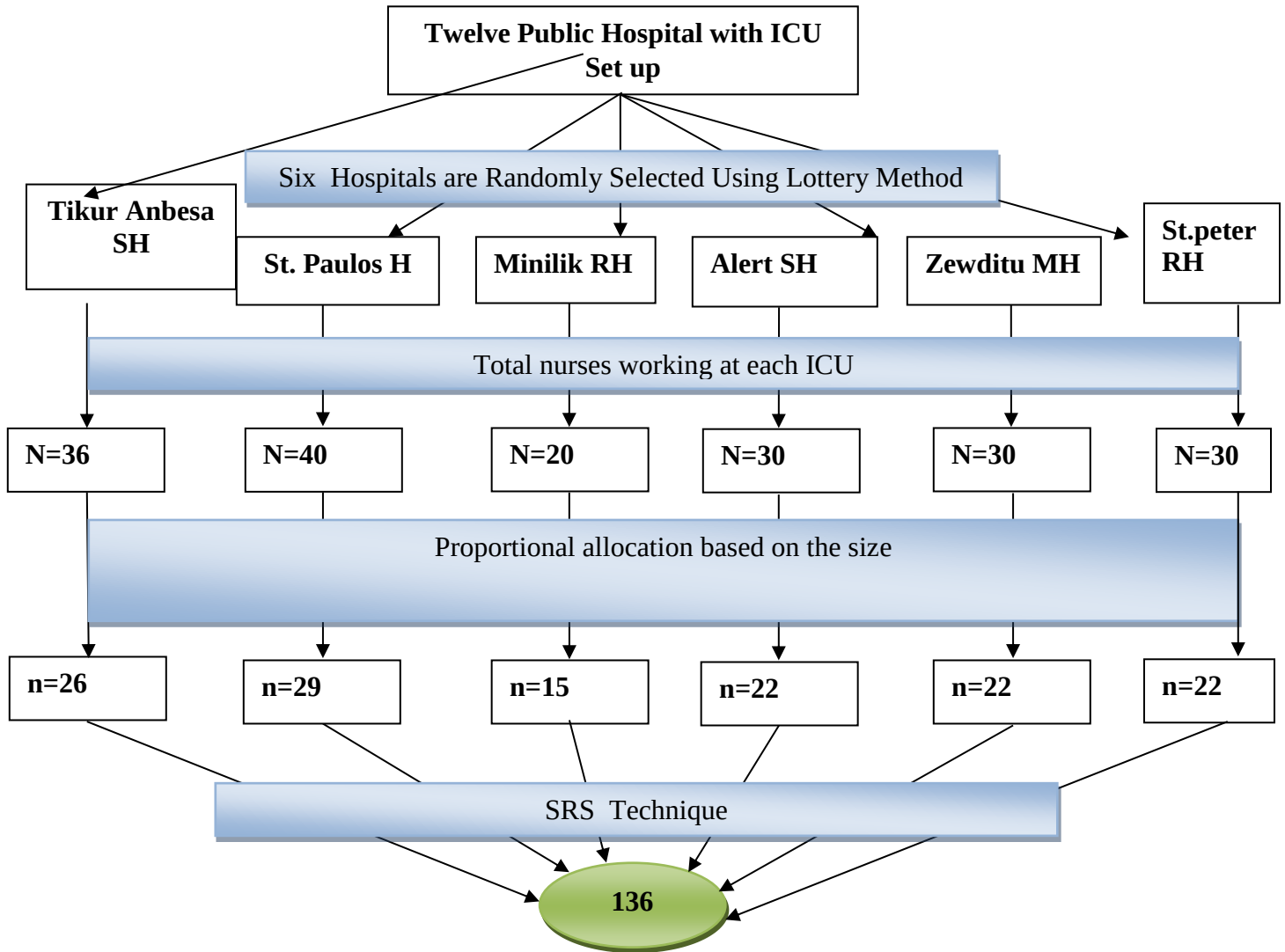


Figure 2: Diagrammatic Presentation of Sampling Procedure of Study on the Knowledge and Practice of Nurses towards Endo-tracheal suctioning in Public Hospital of Addis Ababa, Ethiopia ,2023.

4.6. Data Collection Tools and Techniques

To assess knowledge and practice, English version structured self-administered questionnaire and an observational checklist were used respectively. Questioners and observational checklist were adapted and modified according to the setup (28,41,50,51,55). The questionnaire was divided into two sections as follows: section one contained 10 items of socio-demographic characteristics of study participants, while Section two contained 16 questions about the participants' endotracheal suctioning knowledge. In addition, the observational checklist included 26 questions and was divided into three sections. Section one contained 12 questions that elicited information about the pre-suctioning procedure, section two contained 8 questions that elicited information about the intra-suctioning procedure, and section three contained 6 questions that elicited information about the post-suctioning procedure. Four bachelor degree nurses who had received the proper training and two master's degree nurses were involved as data collectors and supervisors respectively.

4.7. Study Variables

4.7.1. Dependent Variables

Knowledge of nurses working in the intensive care unit

Practice of nurses working in the intensive care unit

4.7.2. Independent Variables

Socio-Demographic Variables: Sex, age marital status, educational qualification

Institutional Factors

Nurse-patient ratio

Availability of equipment

Availability of guidelines protocol

Work Related Factors

Training on ETS

Working hour per day

ICU work experience

4.8. Operational Definitions

Knowledge: the ability of nurses in to answer questions regarding endo-tracheal suctioning which is measured as two scores (51).

- **Good knowledge:** nurses who scored higher than or equal to the mean of knowledge assessing items.
- **Poor knowledge:** nurses who scored lower than the mean of knowledge assessing items

Practice: it is about activity of nurses in performing endotracheal suctioning and was observed by using observational check list and leveled in two (51).

- **Good practice:** practice level of nurses greater than or equal to 75% of practice assessing checklist.
- **Poor practice:** practice level of nurses less than 75% of practice assessing checklist.

Endo-tracheal Suctioning: a part of bronchial hygiene therapy that entails mechanically aspirating a patient's pulmonary secretions (1).

4.9. Data quality control and Management

Supervisors and data collectors were given orientation on how to use a checklist and training was given for two days. on the fundamental techniques in order to assure quality data. Investigator verified that the data was comprehensive and that no information was missing. Pretest was done on seven ICU nurses in Yekatit 12 hospital to check variables are relevant and to prevent any misinterpretation. Internal consistency was detected by calculating Cronbach alpha and its value was 0.85. On-site supervision was provided to resolve any uncertainty with data collecting instruments and methods. Moreover, the filled checklists were revised to ensure that they were completed well.

4.10. Data Processing and Statistical Analysis

After data was checked, it was loaded in Epi data version 4.6.0.6 for editing and coding then exported to SPSS version 27. Statistical analysis like frequency percentage and proportion was done. Binary logistic regression was done and variables having P-value less than 0.25 were candidate to multivariable model. In multivariable analysis, those variables having P-value less than 0.05 were decided statistically significant and reported using Adjusted odds ratio with 95% confidence interval. Multicollinearity was checked by using variance inflation factor. Goodness

of fit model was checked by using Hosmer-Lemeshow test showed the model was fit with p value greater than 0.05. Tables, texts and figures were used to report the findings.

4.11. Ethical Consideration

Before data collection, an ethical approval letter from the Departmental Review Committee of the Emergency Medicine and Critical Care and the Addis Ababa Health Bureau was received. Before the actual data collection phase, consent was received from each hospital and Each ICU head nurse received a letter of authorization. Participants in the study received comprehensive information regarding the study. The consent form was then signed by each participant before data collection started. They were informed during the consent process, both verbally and in written about privacy for their information and their right to withdraw from the study whenever they want without repercussions of rights.

4.12. Dissemination of Result

Result of the study will be submitted and presented to Addis Ababa University, College of Health Science Department of Emergency Medicine, and Critical Care. A copy of the paper will be given to the studied respective hospital and Addis Ababa Health bureau. In addition, publication will be attempted.

5. RESULT

5.1 Socio-demographic Characteristics of the Study Participants

In this study, 136 nurses were involved. Of these, 132 nurses were agreed to participate in the study and this resulted in a response rate of 97%. From 132 respondents, 68 (51.5%) of nurses were female and majority (60.6%) of nurses age were 20–29 years. Regarding their marital status, 61 (46.2%) of nurses were single, 49 (37.1%) of nurses were married, 12 (9.1%) of nurses were separated and 8 (6.1%) of nurses were widowed. By educational qualification, majority (87.9%) of nurses were BSC degree holders. More than two third (72%) of nurses had no training about endotracheal suctioning. About half (51.5%) of the participants had reported adequate supply of equipment for suctioning. All of the nurses reported that the nurse patient ratio is one to one (table 1).

Table 1: Socio Demographic Characteristics of Participant Nurses Working in the Intensive Units of Selected Public Hospitals of Addis Ababa, Ethiopia 2023.

Variable	Frequency	Percent
Sex		
Male	64	48.5%
Female	68	51.5%
Age		
20-29 years	80	60.6%
30-39 years	48	36.4%
≥ 40 years	4	3%
Marital status		
Married	49	37.1%
Single	61	46.1%
Widowed	2	1.5%
Divorced	12	9.1%
Separated	8	6.1%
Work experience in ICU		
6 months-1-year	28	18.9%
2 - 6 years	72	54.5%
7-11 years	22	18.93%
12-16 years	9	6.8%
>16 year	1	0.75%
Professional qualification		
BSC Nurse	116	87.9%
MSC and above	16	12.1%
Training on endotracheal suctioning		
Yes	37	78.0%
No	95	72.0%
Working hours per day		

<8 hours	5	3.8%
8 hours	48	36.4%
12 hours	19	14.4%
>12 hours	60	45.5%
Presence of guidelines in your ICU		
Yes	64	48.5%
No	68	51.5%
Availability of adequate equipment for suctioning		
Yes	68	51.5%
No	64	48.5%

5.2 Knowledge of Nurses Towards Endotracheal Suctioning

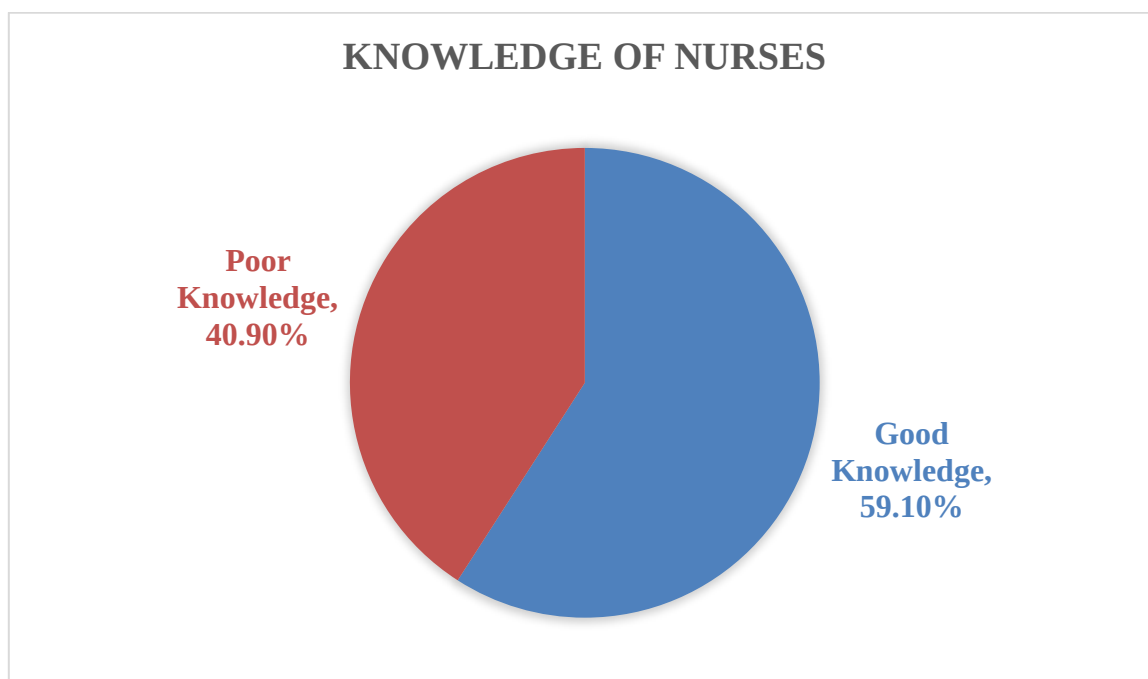


Figure 3: Knowledge Level of Nurses Working in Intensive Care Unit of Public Hospitals of Addis Ababa Ethiopia, 2023.

From this study, majority 78 (59.1%) with 95% CI (50.67, 67.53) nurses had good knowledge of suctioning, however 54 (40.9%) with 95% CI (32.51, 49.23) of nurses had poor knowledge about endotracheal suctioning.

Majority (60.6%) of the participants were aware of when to suction, but 109 (82.6%) participants were not aware rotation of 360-degree. In addition, (56.1%) of nurses were not aware of patient positioning in semi fowler's position whereas more than half 84 (63.6%) of nurses knew that it should be done when required.

majority 69 (52.3%) of nurses knew time limit of suctioning. More than three fourth aware the effect of pre-oxygenation. In addition, about (54.5%) of nurses were aware of the confirmation of successful suctioning and 83 (62.9%) of nurses were understood recommended suction pressure for endotracheal suctioning in adults. Around three fourth (70.5%) of nurses knew the correct size of endotracheal suctioning. Besides, 61 (46.2%) of participants did not knew the effect of increased endotracheal suctioning frequency. And also, 61 (46.2%), 68 (51.5%) and 81 (61.4%) of respondents did not realize about the reason behind discontinuation of endotracheal suctioning, adverse effect of endotracheal suctioning and normal saline instillation during endotracheal suctioning respectively (**table 2**).

Table 2: Knowledge Distribution of Participant Nurses about Endotracheal Suctioning in Public Hospitals of Addis Ababa,2023.

Knowledge assessing items	Category	Frequency	Percent
decision to suction ET tube	correct	80	60.6%
	Incorrect	52	39.4%
suction catheter should be rotated	correct	23	17.4%
	incorrect	109	82.9
Patient positioned for giving ETS	correct	74	56.1%
	In correct	58	43.9%
ETS should be done	Correct	84	63.6%
	Incorrect	48	36.4%
Time limit for ETS	Correct	69	52.3%
	Incorrect	63	47.7%
Effects of pre-oxygenation	Correct	99	75.0%
	Incorrect	33	25%
Contraindication for ETS	Correct	91	68.9%
	Incorrect	41	31.1
Confirmation of successful suctioning	Correct	72	54.5%
	Incorrect	60	45.5%
Recommended suction pressure for ETS	Correct	83	62.9%
	Incorrect	49	37.1%
When suction catheter should be changed	Correct	63	47.7%
	Incorrect	69	52.3%
Effect of normal saline installation	Correct	88	66.7%
	Incorrect	44	33.3%
Size of ETS catheter	Correct	93	70.5%
	Incorrect	39	29.5
Effect of increased ETS	Correct	71	53.8%
	Incorrect	61	46.2%

The reason behind discontinuation of ETS	Correct	71	53.8%
	Incorrect	61	46.2%
Effect of ETS	Correct	64	48.5%
	Incorrect	68	51.5%
Recommendation of normal saline instillation	Correct	51	38.6%
	Incorrect	81	61.4%

5.3 Factors Associated with Knowledge of Nurses

In this study, sex, professional qualification, guideline, training, equipment and experience were candidate for multivariable regression of suctioning knowledge of nurses. In the final adjusted model, nurses who had professional qualification of master's degree and above had six times of better knowledge than those bachelor degree nurses [AOR = 6.0; CI: 1.24–29.05] and those nurses who had training on endotracheal suctioning had four times of good knowledge [AOR= 3.69; CI: 1.41-9.67] (Table 3).

Table 3: Factors Associated with knowledge of Nurses Working in Intensive Care Units of Public Hospitals of Addis Ababa Ethiopia ,2023.

Factors		Overall knowledge					
		Poor	Good	COR (95%CI)	p-value	AOR (95%CI)	P-value
Sex of respondents	Male	24	40	1		1	
	Female	30	38	0.76(0.38,1.53)	0.044*	0.64(0.29,1.38)	0.255
Professional qualification	BSC	52	64	1		1	
	MSC and above	2	14	5.69(1.24,26.16)	0.026*	6.01(1.24,29.05)	0.026**
Training	No	46	49	1		1	
	Yes	8	29	3.40(1.41,8.21)	0.006*	3.69(1.41,9.67)	0.008**
Equipment availability	No	32	32	1		1	
	Yes	22	46	2.09(1.03,4.23)	0.041*	1.71(0.74,3.93)	0.207
Experience	≤6years	47	50	1		1	
	>6 years	7	28	3.76(1.50,9.43)	0.005*	2.30(0.81,6.59)	0.120
Guideline	Yes	40	24	1		1	0.985
	No	38	30	1.32(0.56,2.64)	0.214*	0.99(0.45,2.18)	

Note: * = significant at $p < 0.25$, **= at $p < 0.05$

5.4 Nurses Practice of Endo-tracheal Suctioning

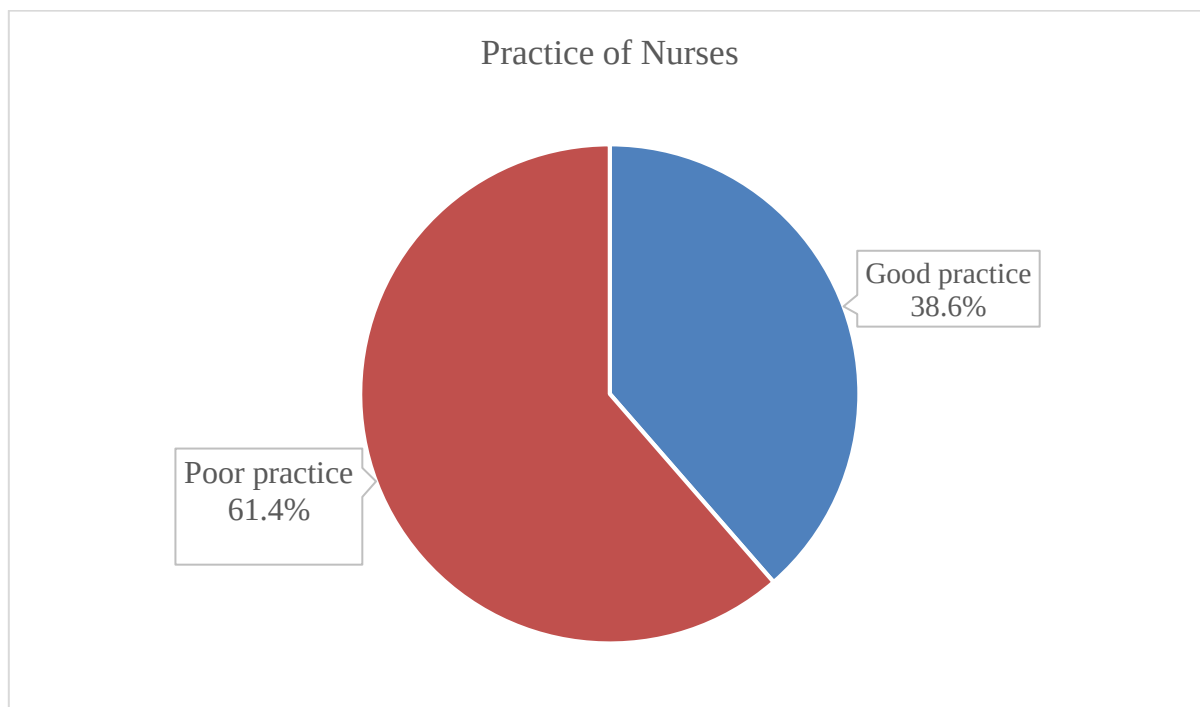


Figure 4: Nurses Practice towards Endotracheal Suctioning in Public Hospitals of Addis Ababa, Ethiopia ,2023.

In this study, 51 (38.6%) with 95% CI (30.3, 46.91) of nurses had good practice of endotracheal suctioning, but majority 81 (61.4%) 95% CI (53.1, 69.71) of nurses had poor practice of endotracheal suctioning.

From this, 50 (37.9%) of the participants monitored blood pressure, 68 (51.5 %) of participant nurses monitored heart rate. However, 90 (75.8%) of participants monitored oxygen saturation and 89 (67.4%) of nurses identified the indication of suctioning, but 48 (36.4%) auscultate breath sound. Besides, 97 (73.5%), 92 (69.7%), 106 (80.3%) and 72 (54.5%) of participant nurses position the patient in semi-fowlers position, hyper oxygenate the patient, wear face mask prior to suctioning and use sterile gloves respectively. 85 (64.4%) of participated nurses did not suction with 10 to 15 seconds.

Regarding post suctioning practice of nurses, around two third of participant nurses 76 (57.6%) of hyper oxygenate with (100% O₂), 87 (65.9%) turn of suction device and 68 (51.5%) reassess patient's vital signs, but 74 (56.1%) of nurses did not wash their hands and 75 (56.8%) did not do documentation (**table 4**).

Table 4: Endotracheal Suctioning Practice in public hospitals of Addis Ababa Ethiopia, 2023.

Prior Suctioning	Yes frequency (%)	No frequency (%)
Monitor blood pressure	50(37.9)	82(62.1%)
Monitor heart rate	68(51.5%)	64(48.5%)
Monitor oxygen saturation	100(75.8%)	32(24.2%)
Identify indication for suctioning	89(67.4%)	43(32.6%)
Check function of suction apparatus	100(75.8%)	32(24.4%)
Auscultate breath sound	48(36.4%)	84(63.6%)
Check function of suction machine	86(65.2%)	46(34.8%)
Check suction machine with connecting tube	78(59.1%)	54(40.9%)
Prepare ambu bag with O2 supplies	60(45.2%)	72(54.5%)
Adjust suction pressure at 80-120 mmHg	41(31.1%)	91(68.9%)
Wear face mask	106(80.3%)	26(19.7.0%)
Hyper oxygenate the patient before suctioning.	92(69.7%)	40(30.3%)
During Suctioning		
Put patient semi-fowlers	97(73.5%)	35(26.5%)
Put sterile towel on the patient's chest	35(26.5%)	97(73.5%)
Open and use sterile gloves	72(54.5%)	60(45.5%)
Disconnect circuit and keep sterility	42(31.8%)	90(68.2%)
360-degree rotation of catheter	50(37.9%)	82(62.1%)
Suction time 10-15 second	47(35.6%)	85(64.4%)
Assess patient's cardiopulmonary status during suctioning	64(48.5%)	68(51.5%)
Apply suction when inserting the ETT tube	88(66.7%)	44(33.3%)
Post Suctioning		
Hyper oxygenate after suctioning (100%)	76(57.6%)	56(42.4%)
Turn of suction device	87(65.9%)	45(34.1%)
Reassess patient vital signs	68(51.5%)	64(48.5%)
Discarded used supplies	69(52.3%)	63(47.7%)

Wash hands	58(43.9%)	74(56.1%)
Documentation of the overall procedure	57(43.2%)	75(56.8)

5.5 Factors Associated with Practice of Nurses

In bivariable logistic regression, factors such as professional qualification of nurses, training about endotracheal suctioning, equipment for suctioning, experience, sex and availability of guideline were candidate for multivariable analysis.

From multivariable regression, qualification, training, equipment's and experience were associated with practice. Those nurses who had professional qualification of masters had eight times more good practice of endotracheal suctioning than degree nurses [AOR = 7.5; CI: 1.76–31.78] and nurses who took training about endotracheal suctioning had nine times more likelihood of having good suctioning practice [AOR= 9.4; CI: 2.86-30.59]. Similarly, nurses who had adequate equipment supply had five times higher likelihood of good suctioning practice than those nurses who had not adequate equipment supply [AOR= 4.9; CI: 1.71-14.38] and nurses whose experience was greater than six years had seven times more likely of good suctioning practice [AOR= 6.8; CI: 2.21-20.86] Table 5).

Table 5: Factors Associated with practice of Nurses Working in ICU of Some Public Hospitals in Addis Ababa Ethiopia ,2023.

Factors					Overall practice		
		Poor practice	Good practice	COR (95%CI)	P-value	AOR (95%CI)	P-value
Professional qualification	BSC	76	40	1		1	
	MSC and above	5	11	4.18 (1.36, 12.87)	0.013*	7.48(1.76, 31.78)	0.006**
Training	No	68	27	1	1	1	
	Yes	13	24	4.65 (2.07, 10.44)	0.001*	9.35 (2.86, 30.59)	<0.001**
Sex	Male	39	25	1		1	
	Female	42	26	0.97 (0.48, 1.95)	0.066*	2.52 (0.97, 6.57)	0.059
Equipment availability	No	52	12	1		1	
	Yes	29	39	5.83 (2.64, 12.85)	0.001*	4.96 (1.71, 14.38)	0.003**
Availability of guideline	No	39	25	1		1	
	Yes	42	26	0.97 (0.48, 1.95)	0.099*	0.61 (0.23, 1.64)	0.326
Experience	<=6 years	74	23	1		1	
	>6 years	7	28	12.87(4.97,33.32)	0.001*	6.79 (2.21, 20.86)	<0.001**

Note: * = at $p < 0.25$, ** = sig at $p < 0.05$

6. DISCUSSION

The aim of this study was to assess knowledge, practice and associated factors of nurses working in the ICU towards ETS for mechanically ventilated patients in public hospitals of Addis Ababa Ethiopia. It was found that (59.1%) had good knowledge and 38.6% had good practice of endotracheal suctioning.

The total proportion of good knowledge was 59.1%, with 95% CI (50.67, 67.53). Similar with study conducted in western Turkey (41) where 59.7% of nurses had good knowledge of endotracheal suctioning. This could be the tool used for the study and the cut point to categorize knowledge. It is lower than the study done in Midwestern state of Brazil (44) in which (73.2%), of professionals had good knowledge of endotracheal suctioning. This difference could be in difference of nurses in accessing information between countries, education, the difference in technological advancement and quality of Inservice training for nurses.

Is greater than Najran Hospitals, Saudi Arabia(49) where 57.9% of nurses had adequate knowledge, Nepal (30) in which 55.8% had good knowledge, Peshawar, Pakistan (43) where 50.04% nurses had good knowledge on endotracheal suctioning and it was much higher than the study done in Narayana, India(48) where 20% of staff nurses had good knowledge of suctioning, Sudan, Khartoum(50) in which 14.5% of nurses had good knowledge of endotracheal suctioning this could be due to discrepancy in the setup, sample size used, year of study conducted, difference in personal understanding, cut point for classification of knowledge, continuing educational program, access to knowledge related information, difference in curriculum and other factors among countries.

In this study, nurse's professional qualification and training were statistically associated with the knowledge. The result is supported by the study conducted in Baghdad, Iraq(19) where nurses who had training on endotracheal knowledge has more knowledge than those who did not had and Bhtrapur, Chitwan (28) where nurses who had professional qualification of master's degree and above had better knowledge than those who were lower than them. Those findings indicate that training and professional education may be important factors for improving the knowledge and skills of nurses in this area.

The above result is in line with the study done in Dare Salam, Tanzania (38) where training was significantly associated with knowledge on endotracheal suctioning. In addition, it is similar

with study done in Pakistan (45) where nurses having professional qualification of master's degree had better knowledge than their counter parts. Professional qualification ($p=0.028$) was significantly associated with knowledge of endotracheal suctioning. The possible reason for this might be due to nurses might have updated their knowledge through trainings and while upgrading their qualification level from bachelor degree to master's degree.

Nurses good practice in this study was 38.6% with 95% CI (30.295, 46.905). it was greater than study done in western Turkey(41) which showed the level of good practice was 18.1% and Amhara region(51) where 28.9% had good practice of suctioning. This might due to sample size used, difference in study characteristics, criteria to classify practice and the tool used to assess practice.

The result is lower than that of Sri Lanka(54) in which 57.8% performed good practice of endotracheal suctioning, Changsha, China(47) where 50 % practiced endotracheal suctioning, Nepal (30) in critical care units showed that 44.2% had Yemen(55) where 45% of nurses had good level of practice regarding endotracheal suctioning and it is much lower than Peshawar, Pakistan (43) in which 80.37% had good practice of suctioning. This difference in practice among nurses might be because of difference in the setup, cut point to classify practice of nurses, training of nurses, presence or absence of skill-based simulation, implementation of continuous professional development among countries and other factors.

Nurses training about endotracheal suctioning, professional qualification, equipment and their experience were associated with their practice. Similar study done in Baghdad teaching hospitals, Iraq(19) showed that there were significant association nurses' practices with training and work experience with P value < 0.005 , Chitwan (28) showed that nurses practice was associated with training ($p = 0.04$), Tanzania, Dare salaam(38) city revealed training was associated with practice, Pakistan (45) revealed qualification and experience had significant association with practice and Yemen (55) showed education, experience and training were associated with practice. This could suggest that better-educated and trained nurses with more experience and adequate equipment supply are more capable of performing endotracheal suctioning in ICU settings. This result may have implications to invest in the education, training,

and supply of equipment for ICU nurses, which has been shown to affect their practice positively.

7. STRENGTH AND LIMITATION OF THE STUDY

7.1. Strength of the Study

It was multi-centered and addressed its objectives. Moreover, it used pretested assessment tools. In addition, primary data was collected from nurses.

7.2. Limitation of the Study

The study only included adult intensive care unit nurses of government hospitals. It did not include private hospital nurses. Moreover, it was cross-sectional study, it could not establish causal relationship between knowledge and practice with predictors.

8. CONCLUSION AND RECOMMENDATION

8.1. Conclusion

The finding of this study revealed that although significant proportion nurses in intensive care unit of Addis Ababa had good knowledge on endotracheal suctioning, only a relatively smaller proportion of those nurses had good practice. Major factors associated with good knowledge of nurses were training and professional qualification. In addition, major factors associated with good practice of nurses were experience, training, availability of adequate equipment and professional qualification. Hence, ETS is the commonest activity performed in the ICU for critical patients, it is important to make nurses be knowledgeable and skillful through training, education and experience sharing programs.

8.2. Recommendations

The following recommendations were forwarded.

Addis Ababa Health Bureau

Should train nurses regarding basic intensive care unit patient care i.e. endotracheal suctioning to make them have updated knowledge. In addition to this, educational programs have to be arranged so that nurses may get the chance of upgrading their educational qualification. Besides, the health bureau should work jointly with non-governmental organizations so as to involve them in the provision of training and supply of materials that are needed for intensive care units.

Hospitals

Should fulfil necessary equipments that are used for endotracheal suctioning. Most importantly, hospitals should facilitate peer learning programs to have experience sharing among nurses as well as conduct simulation programs which enables to improve the skill of nurses. In addition, they should encourage nurses to prepare seminars and discuss regarding patients care in the intensive care units. Moreover, hospitals should ensure that nurses who perform the procedure are adequately trained and competent enough. In addition, hospitals must assure that quality assurance programs are in place to monitor and assure the quality of care provided to patients

requiring endotracheal suctioning. Finally, hospitals should give regular feedback on the suctioning practices of nurses in order to help them improve their knowledge and skills.

Ministry of Health

Should arrange educational programs, training and experience sharing abroad that enable them to have better knowledge. In addition, ministry of health should accomplish regular supervision of hospitals at least every six months. Moreover, ministry should check for possible shortage of supplies and facilities within the hospitals. Besides, ministry of health should prepare workshops that involve nurses working in intensive care units thereby they can update their knowledge and skill.

Future Researcher

Had better study attitude of nurses towards endotracheal suctioning and assess outcome of patients who undergone suctioning prospectively.

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10.APPENDIX

Annex I: English Version Participant Information Sheet and Informed Voluntary Consent

Information Sheet

Greeting: Good morning/afternoon!

My name is----- . I am working as a data collector for the study being conducted on the assessment knowledge and practice of nurses working in Intensive care unit towards open Endo-tracheal suctioning for mechanically ventilated patient in selected public hospital in Addis Ababa, Ethiopia 2023.

The Aim of this Study is; to the assess knowledge and practice of nurses working in the intensive care unit towards open Endo-tracheal suctioning for mechanically ventilated patient in some selected public hospital in Addis Ababa, Ethiopia 2023.

Risk/Discomfort: There is no risk in participating in this research project.

Benefits: If you participate in this research project, there may not be direct benefit to you and you will not be provided any incentives to take part in this project, but your participation is likely to help us in assessing knowledge and practice of Intensive care unit nurses towards open Endo-tracheal suctioning for mechanically ventilated patient and this will help the concerned bodies for developing appropriate interventions.

Confidentiality: The information collected from this research project will be kept confidential and information about you that will be collected by this study will be stored in a file, without your name, but a code number assigned to it and it will not be revealed to anyone except the principal investigator.

Right to Refuse or Withdraw: You have full right to refuse from participating in this research. You can choose not to respond to some or all questions if you do not want to give your response. You have also the full right to withdraw from this study at any time you wish.

Procedure and Duration: Totally the questionnaire contain 26 questions. And some of the questions may have more than one answer as alternatives.

Do you agree to participate?

Yes ☐ continue to the next page No ☐ Thank the participant

Individual Consent Form

First, I would like to thank you for taking your time and participating in our study.

I the undersigned participated in the study on “assessment knowledge and practice of nurses working in the intensive care unit towards open Endo-tracheal suctioning for mechanically ventilated patient in some selected public hospital in Addis Ababa, Ethiopia 2023.” on my free will and interest after being oriented about the purpose of the study.

Can you sign for your voluntariness?

Yes ----- NO-----

Interviewer name: ----- Signature -----

Date -----

Person to Contact: If you want more information and check about this project you can contact the following people.

Principal Investigator Name and Address:

Name: Abebe Merchaw Faris Phone number: +251922314225 Email: abemerchye2021@gmail.com

Do you have any question that you want to ask me about the study?

Annex II: English version Questionnaires

S/N	Questions	Responses
1.	Sex	1. Male 2. Female
2.	Age	-----year
3.	Marital status	A) Married B) Single C) Widow D) Divorced E) Separated
4	Work experience in ICU	A) 6 months-1-year B) 2- 6 years C) 7- 11 years. D) 12-16 years E) >16years
5	Professional qualification	A) Diploma. B) BSC. C) MSC and above
6	Do you have any training regarding Endotracheal suctioning?	A) Yes B) No
7	How many hours you work per day	A) <8 hours B) 8 hours C) 12 hours D) >12 hours
	What is the nurse to patient ratio	D.
	Do you have guidelines /protocols in your ICU	

	Is there availability of adequate equipment in your ICU	
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PART II: Knowledge Assessing Questions (modified from Suctioning an Adult ICU Patient with an Artificial Airway: A Clinical Practice Guide line) for some questions more than one answer is possible.

S/N	Questions	Responses	Remark
1	The decision to suction an endotracheal tube must be based on	A) Increased HR and BP. B) Visible, audible secretions. C) Increased RR and increased work of breathing D) All.	
2	During suctioning the suction catheter should be rotated?	A) 360 B) 180 C) 120 D) 90 E) I don't know	
3	Best position for giving endotracheal suctioning is?	A) Supine position. B) Semi fowler's position (semi sitting position). C) Right lateral position. D) Left lateral position	
4	Endotracheal suctioning should be done	A) Every 1 hour. B) Every 2 hours. C) When required. D) I don't know.	
5	Maximum time limit for an endotracheal suctioning is?	A) 20-30 second. B) 10-15 second C) 5-10 second D) I don't know	

6	Effects of pre-oxygenation in endotracheal suctioning are?	A) To prevent hypotension B) To minimize hypoxia. C) To minimize RR D) I don't know	
7	Contraindication for endotracheal suctioning is?	A) Patient with increased ICP B) Patient with sever HTN C) I don't know	
8	Successful suctioning is confirmed by	A) Improvement in SPO2 LEVEL B) No visible secretion in the ET tube C) Auscultation of the lung D) By looking the patient	
9	Recommendation of suction pressure for endotracheal suctioning in adult is?	A) -60 to -70. B) -80 to -120. C)-120 to -180 D) I don't know	
10	Suction catheter should be changed	A) After 6 hour B) After 12 hour C) After 24 hour D) After each suctioning	
11	Effect of normal saline instillation during endotracheal suctioning is?	A) Tachycardia B) Dyspnea C) Ventilator associated pneumonia. D) All	
12	Size of Endotracheal suctioning catheter should be	A) > half the internal diameter of the tracheal tube. B) < half the internal diameter of the tracheal tube. C) I don't know	
13	Effect of increased endotracheal suctioning frequency is?	A) Atelectasis B) Hypotension C) A and B.	

		D) I don't know	
14	The reason behind discontinuation of endotracheal suctioning is?	A) High HR. B) Low HR. C) Cough. D) A and B.	
15	An adverse effect of Endotracheal suctioning is?	A) Reduction in lung volume. B) Reduction in RR C) Increased in lung volume. D) I don't know	
16	Normal Saline instillation during endotracheal suctioning time	A) Is recommended. B) Is not recommended. C) I don't know.	

Part III: Practice Assessing checklist for ICU Nurse's towards ETS for Mechanically Ventilated Patients (modified from Suctioning an Adult ICU Patient with an Artificial Airway: A Clinical Practice Guide line)

Prior Suctioning	Yes	No
Monitor blood pressure		
Monitor heart rate		
Monitor oxygen saturation		
Identify indication for suctioning		
Check function of suction apparatus		
Auscultate breath sound		
Check function of suction machine		
Check suction machine with connecting tube		
Prepare ambu bag with O2 supplies		
Make sure that suction pressure at 80-120		
Wear face mask		
Hyper oxygenate the patient before suctioning.		
During Suctioning		
Position patient in semi-fowlers position		
Place the sterile towel on the patient's chest		
Open and use sterile gloves		
Detach circuit and maintain sterility		
360-degree rotation when withdrawing the catheter		
Suction time 10-15 second		
Assess patient's cardiopulmonary status during suctioning		
Apply suction when inserting the ETT tube		
Post Suctioning		
Hyper oxygenate after suctioning (100%)		
Turn of suction device		
Reassess patient vital signs		
Discarded used supplies		

Wash hands		
Documentation of the overall procedure		