ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

DEPARTMENT OF NURSING

ASSESSMENT OF KNOWLEDGE, PRACTICE, AND ASSOCIATED FACTORS TOWARDS CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) THERAPY AMONG NURSES WORKING AT NICU IN PUBLIC HOSPITAL, ADDIS ABABA, ETHIOPIA, 2021.

BY: KASSAYE AHMED (BSC)

A THESIS SUBMITTED TO POST GRADUATES STUDIES OF ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES, SCHOOL OF NURSING AND MIDWIFERY, FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS IN NEONATAL NURSING.

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APPROVAL BY THE BOARD OF EXAMINATION

This thesis by Kassaye Ahmed (Bsc) is accepted in its present form by the board of examiners as satisfying thesis requirement for degree of Masters of Science in Neonatal Nursing.

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STATEMENT OF DECLARATION

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical principles of scholarship 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 is submitted in partial fulfillment of the requirement for a graduate degree from the Addis Ababa University at College of Health Sciences, School of Allied Health Sciences department of Nursing and Midwifery. The thesis is deposited in the Addis Ababa University Digital Library and is made available to local, national and international scientific community. I solemnly declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

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BIOGRAPHICAL SKETCH

My name is Kassaye Ahmed. I was born in 1981 E.C at Lasta woreda, Noth wollo, Northern Ethiopia. I had completed my elementary education at Debire Tsihay elementary school from1990-1997 E.C and I had learned High school education from 1998-1999 E.c at Kulmesk Genaral and preparatory school. Then, I had advanced diploma certificate in clinical nursing at Debre Debirhan Health Science College in 2000 E. C. After four years of experience in nursing I had joined to Debre Tabor University for Bachelor of Science in neonatal nursing and I graduated in 2009 E.C. Then I worked as a neonatal nurse in Woldia General Hospital for nearly 2 years and Joined to University of Gondar (UOG), College of Medicine and health science at department of pediatrics as a Graduate Assistant II (GA II) in 2010 E.C. After one year of work experience at UOG, I had joined to Addis Ababa University, college of health science, school of nursing and midwifery department of nursing for Master of Science in neonatal nursing and currently I am candidate graduation.

ABBREVIATIONS AND ACRONYMS

AAU	Addis Ababa University
ALS	Advanced life supporter
CPAP	Continuous Positive Airway Pressure
GMH	Gandhi Memorial Hospital
HMD	Hyaline Membrane Disease
LMIC	Low- And Middle-Income Countries
MAS	Meconium Aspiration Syndrome
N CPAP	Nasal Continuous Positive Airway Pressure
NICU	Neonatal Intensive Care Unit
PAS	Proportional Allocation Size
RD	Respiratory Distress
RDS	Respiratory Distress Syndrome
SPHMMC	St. Paul's Hospital Millennium Medical College
TASH	Tikur Anbessa Specialized Hospital
TTN	Transient Tachypnea of the Newborn
VON	Vermont Oxford Network
Y12H	Yekatit 12 Hospital

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ABSTRACT

Back ground: Continuous positive airway pressure (CPAP), a noninvasive respiratory support method used to manage neonates with respiratory distress, provides continuous pressure that helps prevent the collapse of alveoli, increasing the lungs' functional residual capacity, and thus minimizing the work of breathing. Good nurses' skills and knowledge are needed to prevent and overcome complications such as nasal trauma, pneumothorax, and gastric distension due to the use of CPAP.

Objective: This study aim was to assess knowledge, practice, and associated factors towards Continuous positive airway pressure therapy among nurses working in NICU in public Hospitals of Addis Ababa, Ethiopia, 2021.

Methods and Materials: A facility-based cross-sectional study design was conducted during the period of March, 2021 to May, 2021. Simple random sampling was used to obtain the study participants. A self-administered questionnaire and observational checklist technique were unitized to gather the data from 120 nurses working in four public Hospitals Addis Ababa, Ethiopia. The collected data was entered by using Epi-data version 4.6 and exported to SPSS version 26 for analysis. Logistic regression model was used to identify the association between the dependent variable and independent variable. In bivariate model, Variables that had p-value ≤ 0.25 were further analyzed into the multivariable model and confidence level at 95%, the p-value of <0.05 was a statistically significant association.

Results: One hundred twenty nurses were participated in the study with a response rate of 96.8%. Among the participant nurses 60% had inadequate knowledge regarding CPAP therapy**.** Nurse with experience ≥11 years at NICU (AOR=13.74, 95% CI: 2.27-83.24), nurses had formal training on CPAP (AOR=0.16, 95% CI: 0.05-0.46), available of protocol for CPAP therapy (AOR=11.95, 95% CI: 2.27-62.89) and 1:1 nurse-to-patient ratio (AOR=15.38, 95% CI: 2.46-96.23) were associated to knowledge on CPAP therapy. The findings of this study also revealed that 55.8% of nurses had good practice about CPAP therapy. Nurses working at NICU ≥11 years' experience were (AOR=0.06, 95% CI: 0.01-0.04) and nurse-to-patient ratio 1:2 was (AOR=0.23, 95% CI: 0.05-0.96) were associated to practice on CPAP therapy.

Conclusion and Recommendations: In conclusion, three-fifth and almost half of the studied nurses had inadequate and good practice levels towards CPAP therapy in NICU respectively. Continuous and regular training regarding about CPAP should be given to the NICU nurses.

Keywords: Nurses, knowledge, practice, CPAP therapy, NICU, Addis Ababa

1. INTRODUCTION

1.1. Background

Worldwide, 2.4 million neonates died in the first 28 days of life in 2019. The highest mortality rate was registered in Sub-Saharan Africa being 27 deaths per 1,000 live births. A child born in sub-Saharan Africa is ten times more likely to die in the neonatal period than a child born in a high-income country (1). A systemic review showed that nine of the eleven countries worldwide with estimated preterm birth rates of more than 15% were in sub-Saharan Africa (2). According to Ethiopian demographic health survey of 2019, the neonatal mortality of the country was 30 per 1000 live births (3). A study done in Ethiopia at black lion hospital findings showed that 42.9% of the admitted neonates were developed respiratory distress (4).

In pretrms,50% of infants born before 31 weeks gestation can develop respiratory distress syndrome (RDS) (5). Respiratory distress is a major contributor to neonatal death admitted to neonatal intensive care units (NICU) caused by respiratory distress syndrome (RDS), transient tachypnea of the newborn (TTN), and meconium aspiration syndrome (MAS) (6,7).

Thus, Continuous positive airway pressure machine emerged to manage various respiratory conditions in the newborn, including respiratory distress syndrome (RDS), transient tachypnea of the newborn (TTN), meconium aspiration, congenital pneumonia, pulmonary edema, and apnea (8) . CPAP was first Introduced in 1971 in the treatment of acute respiratory distress (9). CPAP has different component equipment. Binasal Hudson prongs are among the type of prongs used, with size 0 fitting infants weighing < 700 g, 1 for 700 to 1250 g, 2 for 1250 to 2000 g, 3 for 2000 to 3000 g, 4 for 3000 to 3500 g and size 5 fitting infants weighing > 3500 g (10). In resource scarce areas for the sustainability of CPAP therapy, commercial available special model devices are designed such as Pumani and Diamedica bubble CPAP and also an economically effective and locally assembled CPAP delivery system decrease neonatal mortality related to respiratory distress (11,12).

CPAP is a noninvasive, inexpensive and easy technique being mainstay management of respiratory distress accomplished using nasal a CPAP with minimal risks, as an alternative to mechanical ventilation. In bubble CPAP, a flow is continuous provided via an oxygen

blender connected to a flow meter, a warmed humidifier, a respiratory circuit, and a chamber containing sterile distilled water that is attached to a threshold resistor. The level of pressure is changed by submerging the expiratory limb of the tubing into the chamber at the depth of the desired CPAP. CPAP works by increasing of functional residual capacity, tidal volume; lung compliance and decreases perfusion ventilation mismatch, and work of breathing as well as by conserving surfactant and splints upper airway. This results keep airway splinted and open to improve the functional residual capacity of the lung (6,7,13–15).

During CPAP therapy, the nurse records neonates' respiratory rate, oxygen saturation, respiratory severity score, CPAP pressure, gas flow, CPAP complications, and nasal irritation every 2 to 4 hour starting commencement of the therapy. Neonates steady on a CPAP of less than 5 cm H_2O with an RSS of less than 5 is encouraged to Wean to nasal cannula or room air (16). CPAP pressure gauge is usually fixed between 5 and 8 cm H_2O and is constantly flow in a spontaneously breath baby (10). In the nonexistence sophisticated equipment world, Downe score and Silverman Anderson score used for initiation and monitoring response for CPAP therapy (17,18).

Weaning is determined by the resolution of the respiratory distress signs and when FIO_2 reaches 21%–30%. Newborns are usually weaned off at a pressure of 6 cm H_2O. Vital signs and respiratory distress signs were assessed and documented hourly (19). Effectiveness of CPAP is revealed by studies. As studies has been shown that CPAP come to be standard management in a spontaneously breathing neonate with respiratory distress by decreasing 50 % of surfactant and mechanical ventilation need and 48% of the possibility of mortality (20). Another study also revealed that CPAP is effective for the survival of 54.5% for all neonates and 48.3% of neonates having RDS treated with CPAP (21).

The most frequently encountered CPAP complication is nasal septum injury, nasal bridge injury, abdominal distention, Pneumothorax, Eye puffiness, and hyperemia being the most common. None of these complications have happened if a skillful and knowledgeable nurse performs CPAP therapy (19). CPAP is contraindicated in Congenital malformations (choanal atresia, cleft lip and palate, Pierre Robin sequence, congenital diaphragmatic hernia, and tracheoesophageal fistula (22).

Factors that influenced the implementation of CPAP include inadequate knowledge concerning CPAP therapy and inadequate equipment and set-up practice (23).

1.2. Statement of the problem

Nurses in the neonatal intensive care units are the pillars of all neonatal ICUs by encouraging excellence and improvement of provision care in the NICU in the world. Nurses are key personnel in a NICU who establishing strong communication between neonatal staff. For sustainable change, leadership from within the nursing profession for policies on educational opportunities, and competency-based training programs are needed. Experienced nurses can coach young nurses to improve quality care in the NICU (24).

Nurses in NICU perform actions surpassing their competencies. This is due to either worsening of the neonate condition initiate the nurses themselves or when doctors offer their functions to nurses (25). Nurses caring for infants on CPAP must be knowledgeable of adverse effects of CPAP, such as pneumothoraces, abdominal distention, and nasal septum erosion, and be capable to assess and notice the problems immediately to seek earlier appropriate interventions. Thus bedside nurses are the first alarm in the success or failure of the infant on CPAP which is interconnected to nurses' knowledge and skills in assessing and understanding the infant's status (10).Nurses are twenty-four-seven in the front line in the management of neonates requiring CPAP therapy whereas the doctors may be present only during ward rounds (26).As the researcher knowledge there is no research done similar to the this title and no evidenced is found in Ethiopia.

Hence, knowledge regarding CPAP has utmost significance to nurses. Because knowledge aids nurses to generate proper decisions during management of neonates treated with CPAP and advances comfort (27).

Caring for neonates with respiratory failure treated in NICU requires extensive knowledge of nursing theory and practical skills. Proper nursing allows one to identify problems quickly and take appropriate measures to eliminate the offending aspects (28).

Different nursing practice between individual to individual and NICU to NICU due to the absence of common written nursing protocol for CPAP therapy delay management of respiratory distress. Written nursing protocol for CPAP therapy minimizes complications and avoids undesirable variation in the clinical area in turn enhance neonatal comfort during CPAP therapy which improves the nursing quality of respiratory therapy in NICU (29).

Prevention of CPAP failure would likely to decrease exposure to mechanical ventilation. This is possible by increasing the protective effects of CPAP complications (30–32).

Nurses with highly experienced have a key role in the success of CPAP (32). A quasi-experimental study done upon nurses' knowledge toward the CPAP machine in Iraq showed that all the 24 participants in the pretest scored was low (33).

Similarly, a descriptive-analytic study in Indonesia among 30 nurses assessed knowledge of CPAP usage on neonates in the NICU room at Bekasi Hospital and Depok Hospital revealed that there was no significant relationship between age, education, years of experience, training, knowledge with CPAP usage behavior on neonates (34).

In Ethiopia, a quality improvement report in 2013 on improving neonatal mortality in an Ethiopian referral hospital showed that the foremost problem with the neonatal unit is poor neonatal knowledge held by the nursing and medical staff. Thus, to decrease the knowledge and practice gap training was given to everyone on the use of CPAP in Felege Hiwot referral hospital. Even local homemade, evidence-based, continuous positive airway pressure (CPAP) circuit was made from accessible materials to manage respiratory distress syndrome in preterm newborns. An effective result was obtained (35).

As to increase nurses' skill to provide proper care, nurses need to update their knowledge and practice (36). Thus, to set theoretical and practical intervention programs in the identified gap, this study aimed to determine level of knowledge and practice as well as associated factors to identify the gap. Hence, this study aims to assess nurses' knowledge, practice, and associated factors towards CPAP therapy among nurses working in NICUs in public Hospitals of Addis Ababa, Ethiopia, 2021.

1.3. Significance of the study

CPAP therapy is more efficient to reduce the risk of death in newborns with respiratory distress. Upright nursing knowledge and practice regarding CPAP therapy of respiratory distress neonates acts essential role in decreasing disease and death as well as advance their survival.

However, there is no any research done about nurses' knowledge and practice for the optimal implement of CPAP therapy studied in the setting area previously.

Therefore, this study aimed to assess nurses' knowledge and practice and associated factors regarding CPAP therapy at NICU in in public hospitals, Addis Ababa-Ethiopia.

Finally, this research believed to identifies the gap of nurses' knowledge and practice related to CPAP therapy and it advances the neonates' survival and quality of life in the study area.

This research finding use for health care settings to aid guidelines and protocols, nurses to identify knowledge and skill gaps, nurse educator to reference point, health care policymakers to develop new policy, ministry of health to plan strategic interventions and researchers uses it as a baseline source of data for future study regarding CPAP therapy in the study area.

2. LITERATURE REVIEW

This literature review explains about knowledge, and practice nurses towards Continuous Positive Airway Pressure (CPAP) therapy and Factors affecting Nurse's knowledge and practice regarding CPAP Therapy such as Socio- demographic Characteristics of Nurses, Organizational related factors and neonatal basic characteristics affecting nurse's knowledge and practice regarding CPAP therapy

2.1. Knowledge of Nurses Towards Continuous Positive Airway Pressure Therapy

A quantitative descriptive study done in Indonesia at Bekasi and Depok Hospital NICU among 30 nurse about Continuous Positive Airway Pressure (CPAP) usage knowledge in Neonates showed that 21(70%) had good knowledge and 73.3% of the participants had taken CPAP therapy training (34).

A study done in Tanzania concerning CPAP among 149 nurses showed that only 6.7% of nurses had good knowledge about the use of CPAP device but 8.7% of them had poor knowledge regarding CPAP therapy contraindications. On the other hand, 38.9% of the nurses had good level of knowledge about general information of CPAP. The study also described that 11 % of the nurses over all knowledge was high about CPAP usage in the study (27).

A descriptive study performed among 24 nurses on the assessment of nurses' knowledge towards Continuous Positive Airway Pressure (CPAP) Machine at Al-Diwanyia City Hospitals NICU showed that all (100%) of the participants had poor knowledge. The study also states that nurses' skills and knowledge are desired to avert and overcome problems owing to the use of CPAP (37).

A study done on the care of preterm infants among 72 nurses in Khartoum and Omdurman showed about 86.1% of the nurses considered respiratory distress syndrome as a common complication of prematurity, that about one-fifth (20.8%) stated that they needed training courses on CPAP (38).

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2.2. Practice of Nurses Towards Continuous Positive Airway Pressure Therapy

A descriptive study done in Baghdad-Iraq to assess nurses' knowledge toward the Continuous Positive Airway Pressure (CPAP) Machine in NICU among 24 nurses in 2016 showed that Nurses must have advanced skills and establishment of Policy should be needed to provide a special educational course about Neonates with CPAP therapy (37).

A cross-sectional study done in 2014 in Belgium on Nurses' practice concerning weaning from mechanical ventilators with CPAP mode in the intensive care unit among 423 participants showed that 77% of nurses involved in decision making on weaning of CPAP.44% of nurses use weaning protocols and 20% of them never used the protocol and 20% of the nurses had training about the use of their protocol (39).

A study was done in Egypt NICU among 50 nurses who were providing direct CPAP therapy to neonates with RDS using quasi-experimental design through an observational checklist tool to assess nurse's practice showed that 10.0% of the nurses had good practice score before the implementation of educational module and 84.0% of them had good practice post-implementation of educational module follow up in eight meetings about the care of the infant on CPAP. The study found that there was a statistically significant relation before the implementation of the educational module between nurses' practice score and their educational level and their years of experience but no statistically significant relationship between nurses' practice score and their age. The study also showed that 15.4% of the studied nurses had good total practice scores before the implementation of the program but 88.5% after implementation of the program follow up. It also revealed that 98.0% of the participant nurses never had any former training program (40).

Selecting suitable CPAP masks and prongs is a significant portion for applying CPAP therapy in newborns with respiratory distress. Therefore, good practice in the use of CPAP therapy should be followed to avert discomfort and leaks (40–42).

An observational study done about nursing care provided for preterm neonates undergoing CPAP ventilation at NICU in Egypt among 55 nurses revealed that 36.4% and 73.6% of the participated nurses had Competent level and incompetent level respectively in preprogram

implementation. While 81.8% and 18.2% of them had competent and incompetent level of performance in that order post program implementation (43).

A descriptive quantitative study performed in Baghdad NICU among 100 nurses caring for neonate with respiratory distress syndrome revealed that below the relative sufficiency value (75%) which showed poor performance. In addition, 81% of nurses did not check the water level in heat chamber of CPAP, and 88% of the nurses did not observe and monitor tube of CPAP from the puncture or warp but 99% of the nurses recorded all procedures in child chart (44).

2.3. Factors affecting Nurse's knowledge and practice regarding CPAP Therapy

2.3.1. Socio- demographic Characteristics of Nurses

A descriptive study done at Neonatal Intensive Care Unit at in Iraq among 24 nurses revealed that there is statistical significant association between nurses' years of services in NICU and nurses' level of education and their knowledge concerning CPAP device at post-2 of educational program (p value < 0.05) (33).

A descriptive study carried out at the Neonatal Intensive Care Unit at Baghdad revealed that there is no statistical significant association between nurses' age, nurses' gender, nurses' level of education, years of service in the nursing field, nurses' years of services in NICU, nurses' training course and their knowledge toward the Continuous Positive Airway Pressure (CPAP) Machine follow up (p-value > 0.05) (37).

A study done in Nepal showed that the level of knowledge among nurses was associated with their age ($p \leq 0.005$), professional experience ($p \leq 0.001$), clinical area ($p=0.002$), and professional experience in a critical area ($p \leq 0.001$) (45).

A study done in Germany revealed that 57% of institutions approved having either CPAP guidelines or a designated CPAP protocol for the use of CPAP in neonates of which 16% were prepared by Nurses (46).

A study in Indonesia at NICU explained that 12 (40%) of the nurses had 1-5 year work experience (34) and another study was done at in Al-Diwanyia city, Iraq at Teaching Hospital

NICU showed that 16 (66.7%) of the nurses had (1-5) years of services (37). Although there is no statistically significant association between nurses' years of services and their knowledge about CPAP therapy (p-value > 0.05) (34,37).

A descriptive quantitative study carried out in Egypt on nursing care provided to preterm neonates undergoing CPAP ventilation among 55 nurses showed that there were highly statistical significant association between the studied nurses' total practice score and their age, academic qualifications, and years of experience and also showed there was a highly statistical significant association between the studied nurses' total knowledge score and their years of experience (43).

A study conducted in Egypt revealed there was a statistically significant correlation between total knowledge and total practice with nurses' age, education, and years of experience (47).

2.3.2. Organizational related factors affecting Nurse's knowledge and practice regarding CPAP Therapy

A study in Indian government hospitals with neonatal units showed that staff trained in the use of CPAP were present in 56.0% (45.8% to 65.8%) of hospitals and Clinical guidelines were available in 31.0% of hospitals (22.2% to 41.4%) (48).

A cross sectional study in India revealed that nurse to patient ratio was high (7.3%) in tertiary hospitals. The study also concluded that training, guidelines implementation and staffing were needed to improve the use of CPAP at NICU (49).

A study in India showed that pulse oximetry monitors oxygen saturation of hemoglobin and heart rate continuously for treating respiratory distress in newborns placed around the foot that completed CPAP therapy (50).

Studies showed that Downe score is a tool used to assess the course of RDS. RDS classifies as mild, moderate and severe based on Downe score tool. CPAP is active in mild and moderate managing of RDS (17,18).

A pre- post quasi-experimental study conducted in Turkey showed that among 36 participated nurses 36.1% (13/36) of them had a graduate degree, 50 % (18/36) had been working at the NICU for 1-5 years and all were female. The study showed that the knowledge level of

nurses concerning CPAP was found to be a statistically significant association with training (6).

A quasi experimental study done at Taiwan among 59 medical staff on Quality Improvement of Continuous Positive Airway Pressure Therapy in Neonatal Intensive Care Unit revealed that the use of the nursing protocol significantly associated to basic knowledge of CPAP (51).

A quasi experimental study done among 70 nurses in Egypt revealed that there were statistically significant association between the studied nurses' total knowledge and protocol implementation ($P<0.05$ and it also showed that there were highly statistically significant association between total practice level and nursing protocol implementation regarding CPAP ($P<0.001$) (52).

2.3.3. Factors related to Baseline characteristics of neonates undergoing CPAP ventilation

A study conducted at Benha city revealed that 22(40%) of the studied neonates undergoing CPAP ventilation them had respiratory distress syndrome. In addition to more than three quarters of them 43 (78.3%) were male, and 45(81.8%) of them their gestational age was between 28≤ 36 weeks (43).

A study was conducted in the NICU) at Benha Specialized Pediatric Hospital Which Affiliated to the Ministry of Health, Benha, showed that nearly two-third (75.0%) of studied infants gestational age was between 33-< 36 weeks and mean of gestational age. More than half of the infant (62%) was male and 68.8% of the infants were birth weight <2500gm. more than half (62.5) of the studied infant had respiratory distress syndromes (47).

Another study carried out at NICU at Benha city study in 2018 showed that 34(68%) of neonates were male, 31(62%) of the studied neonates were born between gestational age of 32-36 weeks. Regard to admission weight 19(38%) of the neonates were at 2000-2500 gm. More than half of the infants were less than 10 days of age since birth (53).

2.4. Conceptual framework of the study

The conceptual framework of this study was developed after different literature review and adapted with modified accordingly the setting area situation. Nurses' change in knowledge and practice regarding CPAP determine effectiveness of the CPAP therapy. The conceptual framework shows the relation between various factors of independent variables and nurses' knowledge, and practice towards CPAP therapy (6,24, ,25,30,36,37,42,50,51,52,54–58). Therefore, the investigator tries to review works of literature about CPAP therapy administration to respiratory distressed neonates in NICU and write up the following as a framework for the study.

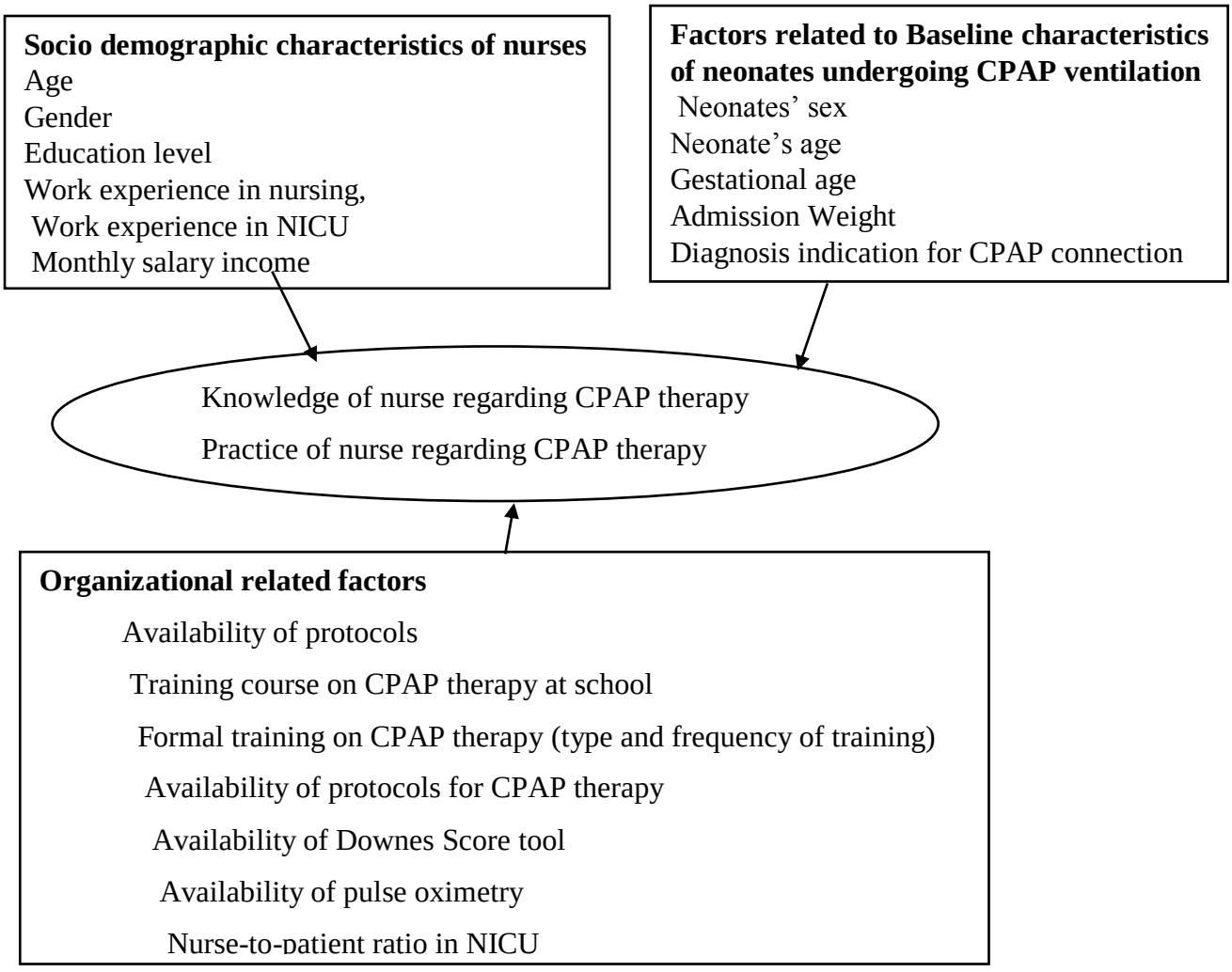

Figure 1: A conceptual framework on the assessment of knowledge, practice, and associated factors towards CPAP therapy among nurses working in NICU in Public hospitals, Addis Ababa, Ethiopia, 2021.

Source: different pieces of literature review (6,24, ,25,30,36,37,42,50,51,52,54–58).

3. OBJECTIVES OF THE STUDY

3.1. General objective of the study

To assess nurses' knowledge, practice, and associated factors towards CPAP therapy among nurses working at NICU in public Hospitals of Addis Ababa, Ethiopia, 2021.

3.2. Specific objectives of the study

To assess the level of nurses 'knowledge toward CPAP therapy among nurses working at NICU in public hospitals of Addis Ababa, Ethiopia, 2021.

To assess nurses 'practice level toward CPAP therapy among nurses working at NICU in public hospitals of Addis Ababa, Ethiopia, 2021.

To determine factors associated with the level of nurses' knowledge among nurses working at NICU in public hospitals of Addis Ababa, Ethiopia, 2021.

To determine associated factors with practice level toward CPAP therapy among nurses working at NICU in public hospitals of Addis Ababa, Ethiopia, 2021.

4. METHODS AND MATERIALS

4.1. Study area and period

4.1.1 Study area

The study was carried out in Addis Ababa the Capital City of Ethiopia, and the Seat of the African Union and the United Nations World Economic Commission for Africa. It is composed of 11 sub-cities with a total area of 527km^2 (54). In Addis Ababa city, there are 12 public hospitals. Among the 12, one hospital has no NICU (55). Then four of the eleven hospitals with NICU were randomly selected by lottery method. These were Gandhi Memorial Hospital, St. Pauls' Hospital Millennium Medical College, Tikur Anbessa Specialized Hospital, and Yekatit 12 Hospital. Currently, there are a total of 158 nurse employees working in the randomly selected hospitals of NICU.

Gandhi Memorial Hospital (GMH): The average annual admission of 2500 neonates and in GMH had four CPAP machine in NICU. 27 nurses were working in NICU (56).

St. Paul's Hospital Millennium Medical College (**SPHMMC):** The average neonatal annual admission was 3000 neonates and 60 nurses were working in the NICU. There was four CPAP machine in the NICU (57).

Tikur Anbessa Specialized Hospital (TASH): The NICU had four CPAP machine and average annual admission rate of 2850 neonates. There were 33 nurse working in the NICU of TASH (58).

In Yekatit 12 Hospital Medical College (Y12HMC): The hospital NICU had four CPAP machine and average annual admission of 2500 neonates. In the hospital 38 nurses were working in the NICU (59).

4.1.2. Study period: The study was conducted from March, 2021 to May, 2021.

4.2. Study Design

A facility-based cross-sectional study design was employed

4.3. Source Population

The source population was all nurses working in public hospital NICUs at Addis Ababa.

4.4. Study Population

The study subjects were all nurses working in NICU in selected hospitals and those fulfilling inclusion criteria.

4.5. Eligibility Criteria

4.5.1. Inclusion Criteria

All nurses working in the selected public hospital at NICU in Addis Ababa who had more than six months of service and who were willing to participate, not seriously ill and available during the data collection period was included in the study.

4.5.2. Exclusion Criteria

Nurses who give free service and Nurse students working for their apparent ship or internship in the NICU. Nurses who are in nursing managerial position not involved in the direct bedside management of neonates such as head nurse, coordinator and matron at NICU was excluded from the study.

4.6. Sample Size Determination

The sample size was determined by using a single population proportion formula and bearing in mind the following assumptions: Z = standard normal distribution Value at 95% confidence level of $Z\alpha/2$ = 1.96, and margin of error (d) = 5%: which is degree of accuracy set at 0.05 is the standard allowed deviation from the true proportion.

The proportion of nurses' knowledge and practices towards CPAP therapy is not known in Ethiopia. Due to lack of a baseline studies in the study area. Thus, p=proportion of 0.5 (50%) was used for the calculation of sample size determination.

$$\text{Formula}=no = \boxed{\frac{Z_{\frac{\alpha}{2}}^{2} p(1-p)}{d^2}} \quad \text{..... step (1)}$$

$$no = \boxed{\frac{1.96^2 0.5(1-0.5)}{0.05^2}}$$

no=384

Thus, the total numbers of nurses working at the NICUs of the chosen public Hospitals are 158 nurses. Since the study population is less than 10,000, a correction formula was used.

The final sample size was determined as follows by using the correction formula

$$nf = \frac{\text{no}}{1+\text{no}\div\text{N}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{step (2)}$$

$$nf = \frac{384}{1+384\div158} = 111.94$$

Where n_f is the final sample size, n_o is the initial sample size, and N is the number of staff nurses working in the NICUs of the selected public hospitals of Addis Ababa.

Considering a 10% non-response rate, the total sample size was calculated as:

$$\text{non} - \text{response rate} = \frac{10}{100}(nf) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{step (3)}$$

$$\text{non} - \text{response rate} = \frac{10}{100}(111.94) = 11.194$$

111.94+11.194=123.134……step (4)

Finally, the total estimated sample size was124 nurses.

4.7. Sampling Procedure

A simple random sampling (SRS) technique was used to select hospitals from eleven public hospitals with NICU in Addis Ababa. After allocating nurses from the selected public hospitals by proportional allocation to size, the participant nurses were selected by using simple random Sampling from each hospital.

Each nurse in the sample population who was present during data collection was symbolized by a piece of paper and put in a box and mix up. This was performed after sorting the lists of nurses' which was given by the matron or coordinator of nurses' by arranging their identification card with alphabetical order. Then the lottery method was continued till the final sample size was full filled by picking up from the box.

The proportional sample size for each hospital NICU was calculated by the final sample size of 124 determined for this study multiply by the current number of nurses working at each selected hospital NICU and divided by the total number of nurses in the study population which was 158.

Number of nurses in the proportional allocation size (n) =

$$\frac{\text{total sample size} \times \text{number of nurses in a specific NICU}}{\text{total number of nurses in the study population NICU}}$$

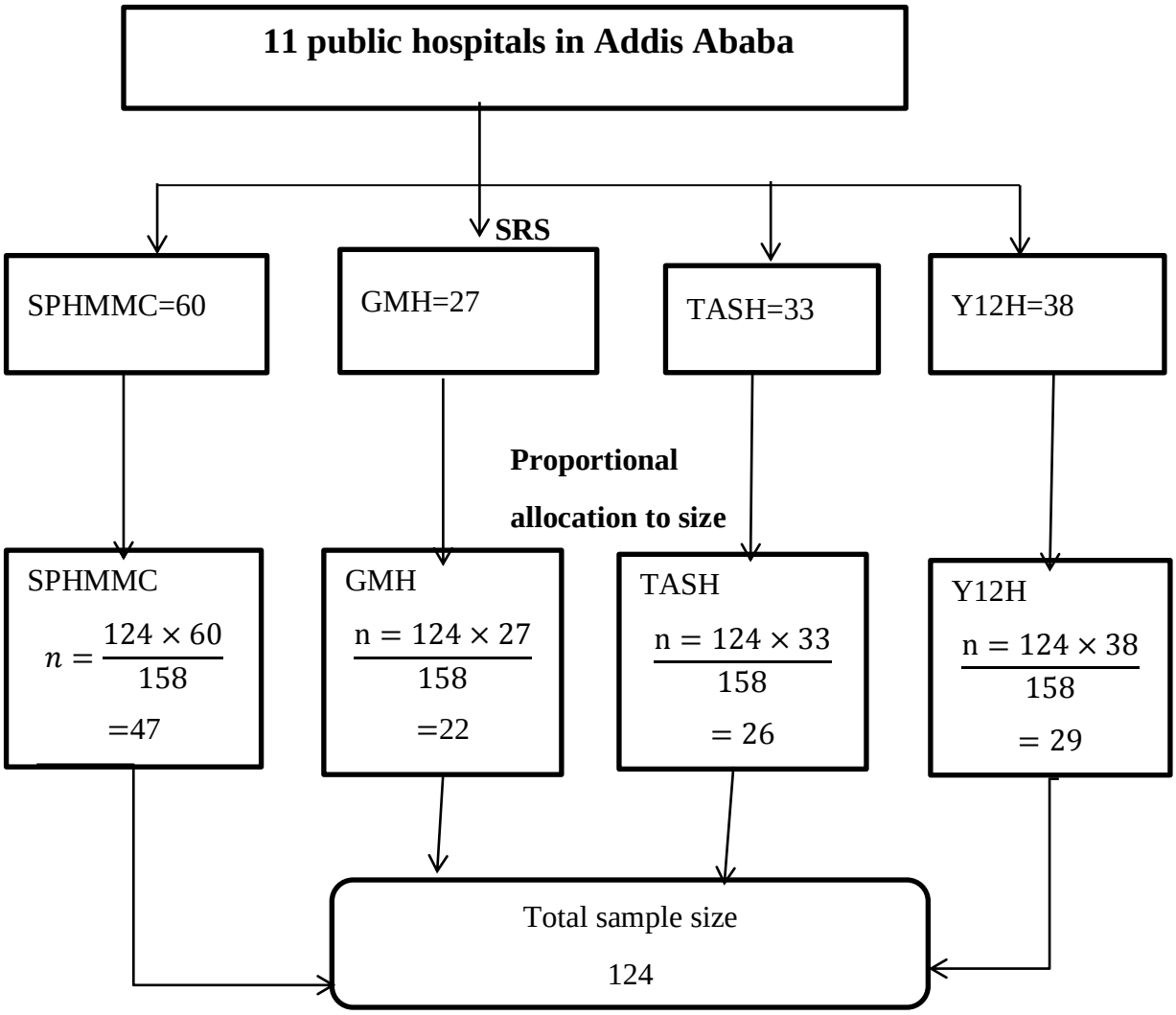

Figure 2: schematic presentation of the sampling procedure for the assessment of knowledge, practice, and associated factors regarding CPAP therapy among nurses working in NICU in public hospitals, Addis Ababa, Ethiopia, 2021.

4.8. Variables of the Study

4.8.1. Dependent Variables

Nurses' knowledge level regarding CPAP therapy in NICU

Nurses practice level regarding CPAP therapy in NICU

4.8.2. Independent Variables

Socio demographic characteristics of nurses

Age, Gender, Education level, Work experience in nursing, Work experience in NICU and Monthly salary income

Organizational related factors

Training course on CPAP therapy at school**,** Formal training on CPAP therapy (type and frequency of training)**,** Availability of protocols for CPAP therapy**,** Availability of Downes Score tool**,** Availability of pulse oximetry**,** and Nurse-to-patient ratio in NICU

Factors related to Baseline characteristics of neonates undergoing CPAP ventilation

Sex of neonate, Neonates Age, Gestational age, Admission Weight, and Diagnosis indication for CPAP connection

4.9. Data Collection Methods

4.9.1. Data Collection Tool

The data collection tool study was adapted from different literature. The tool was papered in English version having that composed of 5 main parts: part I. socio demographic characteristics of nurses (6 questions), part II. Knowledge item questions (28 questions), part III. Organizational related factor item questions (9 questions), part IV. Checklist for practical item questions (8 procedures with 57 steps) and part V. Factors related to Baseline characteristics of neonates undergoing CPAP ventilation (5 questions).

The knowledge assessing question item was adapted from different literatures The knowledge item question was true or false questions and each question take value of 1 point for each correct response (27,33,34,37,60). Scoring system for knowledge: Nurses' knowledge assessed upon completion of the self-administered questionnaire as the studied nurses'

knowledge checked with a model key answer. Accordingly, correct answer scored (1) score, the incorrect answer was given (0) score in the total score ranged from 0-28. Then, the subtotal score for each knowledge part and total knowledge categorized as a score of 70%, and more considered adequate and a score below 70% was considered inadequate.

The questionnaire for the practice item questions was check list which was adapted by reviewing the works of literature of different studies and guidelines prepared for CPAP therapy. The questionnaire also harmonizes to fit the latest situation of the therapy (47,51,52,61–65). Scoring system for the checklist: A score of (2) gave for correctly done, a score of (1) for incorrectly done, and a score of (0) for not done. The total score ranged from 0-114 (57questions x 2). Total scores converted into percent. Then, the subtotal score for each practice part and total practice categorized as a score of ≥ 80% considered good practice and a score < 80% considered poor practice.

The environmental factor related an item question also has yes or no questions. This study data was collected through the utilization of the structured self-administrative questionnaire and observational checklist for nurses knowledge and practice at the NICU regarding CPAP therapy (17,47,51–53,62,65).

The other tool was used to collect data for baseline characteristics of neonates undergoing CPAP ventilation. The tool was prepared for recording of basic characteristics of neonates on admission such as neonates' sex, gestational age in weeks, admission weight in grams, age in hour at admission, and diagnosis of indication for CPAP connection (33,43,47,52,53).

4.9.2. Data Collection Procedure

The data was collected by 4 trained Bsc neonatal nurses and were supervised by 2 BSc neonatal nurses having previous experience in data collection. The data collector was visited the study hospital NICU five days per week from Monday to Friday during morning and afternoon shifts. COVID-19 prevention was component of data collector training. During data collection all possible ways of COVID-19 prevention methods was practiced strictly. The data collector gave greeting at least 1 meter away from the participant and no hand shaking was allowed. Before and after material exchange, during consent taking, questioner exchange and observation hand rub with sanitizer was performed by the data collectors. In case Nurses who were not wearing mask was obtained at the time of data collection, the data

collector would have given mask to the nurse to wear and the data collectors must be always wore mask and used sanitizers hand rub during data collection. Sanitizer and mask were buying by the principal investigator for that purpose and includes in the budget expenses of the study. After taking consent and explaining the aim of the study to obtain their permission and cooperation, the data collector would have given the studied nurses the questionnaire to fill and assess their knowledge for neonates who went to on CPAP therapy. Every single nurse was observed separately for 3 to 4 hours to assess performance by using observational checklists during their actual performance of CPAP therapy while nurses apply CPAP on neonates in NICU. On daily base completeness of collected data and immediate incidents happen during data collection process was checked and solved by the supervisors and the total quality of data collection was monitored by the principal investigator throughout the data collection period.

4.9.3. Data Quality Assurance

To preserve the quality of the data, data collectors and supervisors was trained in data collection procedures by the principal investigator. The questionnaire had been designed in English language for this study data collection. Before actual data collection time, the questionnaire (tool) was checked for clarity, comprehensiveness, and content validity by an expert and pretested for reliability on 5% of the total sample at Zewditu Memorial Hospital. Then, based on the finding of the pretest, the questions were modified for wording, completeness, clarity, length, skip patterns and correctness. Expert opinion was asked from VON groups who worked on CPAP therapy and their professional opinion was incorporated in the tool. The collected data was then reviewed and checked for completeness and consistency by the principal investigator daily.

4.10. Data Processing and Analysis

The data was entered into EPI-data version 4.6, and then the data was cleaned and analyzed by using Statistical Package for Social Science (SPSS) version 26 statistical software. Descriptive statistics such as proportion, frequencies, percentage, and cross tabulation was calculated. Then data presented using tables, pie chart, bar graphs, and texts. Bivariate and multivariate logistic regression was computed to assess the statistical association between the outcome variable and independent variables using Odds Ratio; the significance of statistical association was assured or tested using 95% confidence interval (CI) and p value (<0.05).

4.11. Operational Definitions

CPAP is defined as a noninvasive method for applying a continuous distending pressure level during expiration and inspiration to support spontaneously breathing neonates with respiratory distress administering to nostrils via bi-nasal prongs with devices of CPAP at the NICU for the purpose of this study (66).

Knowledge: medical staff including nurses having basic knowledge about indications, mechanism, application, settings, contraindications, and complications of CPAP (51). In this study knowledge was defined and category as the following:

Adequate knowledge: Nurses who answered greater than or equal to 70 % of the knowledge questions correctly (53).

Inadequate knowledge: Nurses who answered less than 70 % of the knowledge questions correctly (53).

Practice is a measure of competency to perform activities following standard guidelines or certain protocols by nurses in NICU for neonates undergoing CPAP therapy (43,52).For the purpose of this study practice was explained and classified as the following:

Good practice: Nurses who scored equal or greater than 80% of practice related item questions correctly in this study (47,52)

Poor Practice: Nurses who scored below 80% for practice-related item questions correctly in this study (47,52).

4.12. Ethical Consideration

Ethical clearance was obtained from Department of Nursing and Midwifery, Institutional Review Board (IRB) research committee, College of Health Sciences, Addis Ababa University. Then the department was written cooperation letter to Addis Ababa Health Bureau to participant Hospitals of St. Pauls' Hospital Millennium Medical College and Tikur Anbessa Specialized Hospital. Then after getting permission from Addis Ababa public health research and emergency management core process directorate institution review board cooperation letter had been written to Yekatit 12 Hospital medical college and Gandhi Memorial Hospital.

Then after getting permission from each participant institution review board and head of each NICU, the study participants were informed about the objective, purpose and procedures of the study and written and verbal consent was obtained for guaranteeing their choice of participation or refusal. Even they would have the right to withdraw at any time or skip any question that they do not want to respond. No name or other identifying information was included in the questionnaire of this study. The principal investigator was kept questionnaires locked with a key drawer and the computer folder also would lock with strong passwords. All information was recorded anonymously and confidentiality was assured during data collection procedure and after data collection through coding of all data in this study.

4.13. Dissemination of the Result

The final report of the study was presented and submitted in the form of soft and hard copy to Addis Ababa University, College of Health Sciences, School of Nursing and Midwifery and Department of Nursing as partial fulfillment of master's degree in neonatal nursing. The result of the study will also be disseminated to Addis Ababa public health research and emergency management core process and the study participant hospitals.

In addition, efforts will be to present the findings on scientific conferences like professional associations such as Ethiopian pediatrics associations and peer reviewed international journal publications were considered.

5. RESULTS

5.1. Socio- demographic Characteristics of Nurses

Of the 124 nurses study participants 120 (96.8%) were response with non-response rate of 3.2%. From the total participant nurses 106 (88.3%) were female. The predominant age group was 25-29 years which accounted for 56 (46.7%) followed by age group of 30-34 that accounted 44 (36.7%). Regard to level of education 93 (77.5%) of nurses were Bsc nursing holders. In this study 75 (62.5%) of nurses had work experience of less or equal to five years in nursing profession. Majority of the participant nurses 78 (65%) had experience of less or equal to five years in NICU. Regarding monthly salary income, 74 (61.7%) of nurses in this study had monthly earned between 5251-7800 Ethiopian birr monthly (**Table 1**).

Table 1: Distribution of Scio-demographic characteristics of nurses towards nurse's knowledge and practicing regarding CPAP therapy among nurses working in NICU at public hospitals of Addis Ababa ,2021(n=120)

Variables	Frequency	Percent (%)
Gender		
Male	14	11.7
Female	106	88.3
Age groups	7	5.8
≤24	56	46.7
25-29	44	36.7
30-34	13	10.8
≥35		
Educational level group		
Bsc nurse	93	77.5
Bsc Neonatal nurse	19	15.8
MSc neonatal nurse	8	6.7
Experience in nursing group	75	62.5
≤5 years	33	27.5
6-10 years	12	10.0
≥11 years		
Experience in NICU group		
≤5 years	78	65.0
6-10 years	32	26.7
≥11 years	10	8.3
Monthly salary (Ethiopian birr)		
<5250	19	15.8
5251-7800	74	61.7
≥7801	27	22.5

5.2 Knowledge level of nurses towards Continuous Positive Airway Pressure (CPAP) therapy

Nurses' knowledge was assessed through 28 self-administered questionnaires. In this study a nurse who score ≥70% of subtotal score for each knowledge part and total knowledge categorized as had adequate knowledge on CPAP therapy.

In this study, out of the total of 120 nurse participants 72 (60%) had inadequate knowledge towards CPAP therapy whereas 48(40%) of the nurses score less than 70 % by answering incorrectly the knowledge item questions in NICU at the selected public hospitals Addis Ababa.

Table 2: Classification of Nurse's knowledge Level towards on the assessment of knowledge, practice and associated factors regarding CPAP therapy among nurses working in NICU at public Hospitals at public hospitals of Addis Ababa, Ethiopia,2021, (n=120)

Variables of knowledge	Frequency	Percent (%)
Fundamentals about of CPAP device		
In adequate knowledge	18	15.0
Adequate knowledge	102	85.0
Aim of CPAP device		
In adequate knowledge	46	38.3
Adequate knowledge	74	61.7
Indications to use the device (CPAP) for newborn and premature babies	72	60.0
In adequate knowledge	48	40.0
Adequate knowledge		
Contraindications to use the device (CPAP) for newborn and premature babies	58	48.3
In adequate knowledge	62	51.7
Adequate knowledge		
Complications of CPAP related to infant		
In adequate knowledge	59	49.2
Adequate knowledge	61	50.8
Complications of CPAP related to Device		
In adequate knowledge	41	34.2
Adequate knowledge	79	65.8
Over all knowledge level		
In adequate knowledge	72	60.0
Adequate knowledge	48	40.0

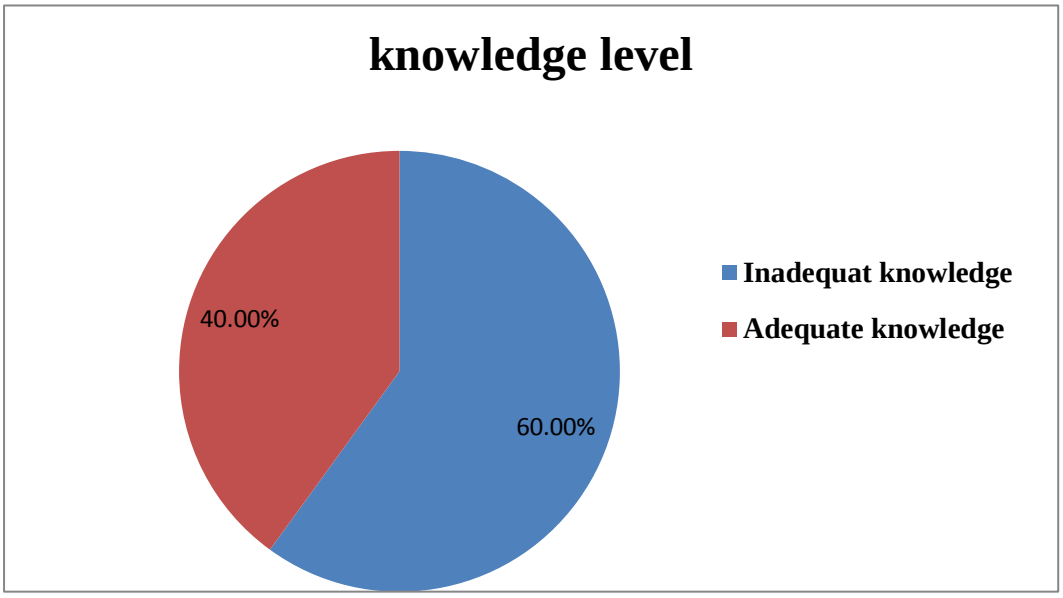

Figure 3: Distribution of nurses' knowledge level regarding CPAP therapy among nurses working in NICU at public hospital of Addis Ababa, Ethioipia,2021, (n=120)

5.3. Practice level of nurses towards Continuous Positive Airway Pressure CPAP therapy

Out of 120 NICU nurses, bout 67 (55.8%) achieved ≥80% of the practiced item questions had good practice towards CPAP therapy whereas 53 (44.2%) were scores less than 80% of the practice item questions had poor practice towards CPAP therapy in the studied NICU.

The study practice level of the nurses was determined based on 57 questions that had total score range from 0 to 114. Nurses considered had good practice while they scored ≥ 80% and when they scored < 80% of the checklist tool questions prepared in this study, they said to be poor practice regard to CPAP.

Table 3: Nurses' practice level towards on assessment of knowledge, practice and associated factors regarding CPAP therapy among nurses working in NICU at public hospitals of Addis Ababa, Ethiopia, 2021, (n=120)

Practice variables	Frequency	Percent (%)
Initial nursing Care of CPAP		
Poor	77	64.2
Good	43	35.8
Setting up of CPAP		
Poor	15	12.5
Good	105	87.5
Preparing the Baby for CPAP		
Poor	46	38.3
Good	74	61.7
Connect the nasal prong system to the neonate		
Poor	44	36.7
Good	76	63.3
Bonnet with Ties		
Poor	28	23.3
Good	92	76.7
Methods of Securing CPAP device		
Poor	80	66.6
Good	40	33.4
Performing safety check for Troubleshooting in CPAP		
Poor	47	39.2
Good	73	60.8
Monitor of CPAP/ Ongoing assessments		
Poor	113	94.2
Good	7	5.8
Total practice		
Poor	53	44.2
Good	67	55.8

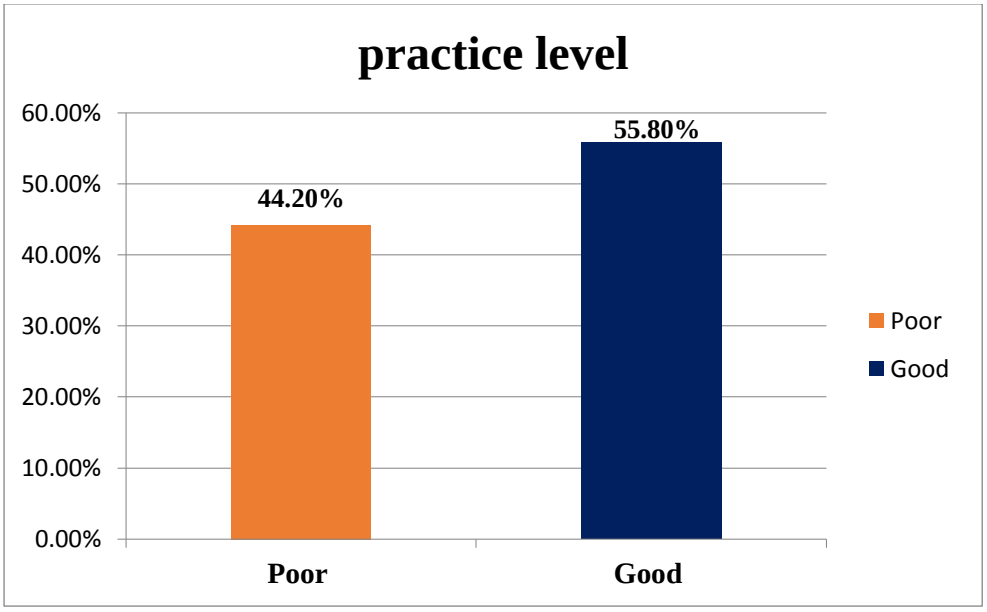

Figure 4: Distribution of nurses' Practice level regarding CPAP therapy among nurses working in NICU at public hospital of Addis Ababa, Ethioipia,2021, (n=120)

5.4. Environmental factors affecting nurse's knowledge and practice regarding CPAP Therapy

Majority of the participant nurses 106 (88.3%) report that did not receive any courses regarding CPAP therapy. Among the respondents 84(70%) of them also did not receive formal training regard to CPAP therapy. Among the 120 participant nurses, 97(80.8%) responded that there was no protocol available for CPAP therapy in NICU. Out of the total participant nurses 77(64.2%) reported that at the time of data collection nurse to neonate ratio was 1:2 in their NICU.

Table 4: Environment related factors participate response on the assessment of knowledge, practice and associated factors regarding CPAP therapy among nurses working at NICU in public hospitals of Addis Ababa, Ethiopia,2021, (n=120)

Variables	Frequency	Percent (%)
Did you receive any course on CPAP therapy during your Study?		
Yes	14	11.7
No	106	88.3
Have you received any formal training on CPAP therapy?		
Yes	36	30.0
No	84	70.0
Is Protocols for CPAP therapy available in the room?		
Yes	23	19.2
No	97	80.8
Is Down's Score (DS) RDS assess't tool available		
Yes	49	40.8
No	71	59.2
Is there pulse oximetry available for each neonate on CPAP ventilation continuously?		
Yes	21	17.5
No	99	82.5
What is the Nurse-to-patient ratio in your NICU (at the time of data collection)?		
1:1	28	23.3
1:2	77	64.2
>1:2	15	12.5

5.5. Baseline characteristics of neonates undergoing CPAP ventilation

This study finding showed that 64 (53.3%) of studied infants were males and born after 34 weeks of gestation accounted 76 (63.3%). Majority of the infants (90.8%) admission weight was more than 2500 gram and 103 (85.8%) of the studied infant had respiratory distress syndrome as cause for CPAP ventilation.

Table 5: Distribution of baseline characteristics of neonates undergoing CPAP on the assessment of knowledge, practice and associated factors regarding CPAP therapy among nurses working at NICU in public hospitals of Addis Ababa, Ehiopia,2021, (n=120).

Neonatal Variable	Frequency	Percent (%)
Sex		
Male	64	53.3
Female	56	46.7
Gestational age in weeks		
<34	44	36.7
≥34	76	63.3
Admission weigh in grams		
<2500	109	90.8
≥2500	11	9.2
Age in hour		
<1 hour	68	56.7
≥1 hour	52	43.3
Diagnosis of indication for CPAP connection		
RDS	103	85.8
AOP	17	14.2

5.6. Factors associated with the level of knowledge regarding CPAP Therapy among nurses working at NICU

Regarding to knowledge of CPAP therapy among nurses working at NICU, the association of the independent and dependent variable were first tested by using bi-variable analysis

variable which were associated (P≤0.25) were tested in the final multivariable analysis to see their significant association with CPAP therapy. Accordingly, as shown in Table 6 below in the bivariate analysis, nurses' educational level, work experience in NICU, received formal training regard to CPAP, available of protocols for CPAP, available to downes score tool and nurse to patient ratio were significantly associated with knowledge regard to CPAP therapy.

However, work experience in NICU, received formal training regard to CPAP, available of protocols for CPAP, and nurse to patient ratio were found to be significant associated in the multivariate analysis (p≤ 0.05).

The odds of work experience among nurses working at NICU ≥11 years were 14 (AOR=13.74, 95% CI: 2.27-83.24) times more likely had adequate knowledge on CPAP therapy compared with nurses who had those working experience ≤5 years.

In this study, the odds of nurse who did not receive formal training were 0.16 (AOR=0.16, 95% CI: 0.05-0.46) times less likely had adequate knowledge compared those who received the formal training.

Regarding protocols, the odds of nurses who worked with protocols were 12 (AOR=11.95, 95% CI:2.27-62.89) times more likely had adequate knowledge regard to CPAP therapy compared to those nurses who did not obtain protocols for CPAP in their NICU.

In Nurse-to-patient ratio, the odds of nurses who worked in 1:1 nurse to patient were 15 (AOR=15.38, 95% CI: 2.46-96.23) times more likely adequate knowledge than compared nurses who worked in NICU with nurse to neonate ratio>1:2 (Table 6).

Table 6: Bi-variable and multivariable logistic regression knowledge on CPAP Therapy among nurses working at NICU in public hospitals of Addis Ababa, Ethiopia, 2021, (n=120)

Variable	Knowledge		COR (95% OF CI)	AOR (95% OF CI)
	Inadequate	Adequate		
Educational level				
BSC	62(66.7%)	31(33.3%)	1	1
BSC NN	8(42.4%)	11(57.9%)	2.76(1.01-7.53) *	2.51(0.65-9.63)
MSC	2(25.0%)	6(75.0%)	6.00(1.44-31.47) *	8.18(0.99-67.15)
Nurses work experience in NICU				
<5	53(67.9%)	25(32.1%)	1	1
5-10	17(53.1%)	15(46.9%)	1.87(0.81-4.34) *	2.68(0.91-7.88)
≥11	2(20.0%)	8(80.0%)	8.48(1.68-42.89)	13.74(2.27-83.24) **
Received any formal training on CPAP therapy				
Yes	15(41.7%)	21(58.3%)	1	1
No	57(67.9%)	27(32.1%)	0.34(0.15-0.76) *	0.16(0.05-0.46) **
Protocols for CPAP therapy available				
Yes	27(84.4%)	5(15.6%)	1	1
No	45(51.1%)	43(48.9%)	2.87(0.99-8.35)	11.95(2.27-62.89) **
Is Down's Score (DS) RDS assess't tool available				
Yes	26(53.1%)	23(46.9%)	1	1
No	46(64.8%)	25(35.2%)	0.60(0.29-1.29)	0.47(0.14-1.54)
Nurse-to-patient ratio				
1:1	18(64.3%)	10(35.7%)	1	1
1:2	50(64.9%)	27(35.1%)	0.97(0.39-2.40) *	1.72(0.41-7.13)
>1:2	4(26.7%)	11(73.3%)	4.95(1.24-19.69) *	15.38(2.46-96.23) **

Key 1= Reference

* Statistically significant by COR at p-value ≤0.25

**Statistically significant by AOR at p-value <0.05

5.7. Factors associated with practice of CPAP therapy among nurses working at NICU

Regarding to CPAP therapy among nurses working at NICU, the association of the independent and dependent variable were first tested by using bi-variable analysis variable which were associated (P≤0.25) were tested in the final multivariable analysis to see their significant association with practice of CPAP therapy. In the bivariate analysis, nurses' educational level, work experience in NICU, received formal training regard to CPAP, available of protocols for CPAP, nurse to patient ratio, age in hour at initiation of CPAP therapy, and gestational age were significantly associated with practice regard to CPAP therapy. However, work experience in NICU, and nurse to patient ratio were found to be significant associated in the multivariate analysis (p≤ 0.05).

Those nurses who had served for ≥11 years in NICU were 0.06 (AOR=0.06, 95% CI, 0.01-0.04) times less likely to be poor practice regard to CPAP therapy than those whose service years were ≤5 years. In addition, nurses who had work experience for 6-10 years in NICU were 0.15 (AOR=0.15, CI: 95%, 0.05-0.44) times less likely to be poor practice regard to CPAP therapy than those whose service years ≤5 years.

Regarding patient to nurse ratio, nurses who worked in 1:2 nurse to patient ratio had 0.23 (AOR=0.23, 95% CI: 0.05-0.96) times less likely had poor practice compared than those nurses who worked in NICU with 1:1 nurse to patient ratio (Table 7).

Table 7: Bi-Variable and multivariable logistic regression practice of CPAP therapy among nurse working at NICU in public Hospitals of Addis Ababa, Ethiopia, 2021, (n=120)

	Practice		COR (95% OF CI)	AOR (95% OF CI)
Variable	Poor	good		
Educational level				
BSC	45(48.4%)	48(51.6%)	1	1
BSC NN	6(31.6%)	13(68.4%)	2.03(0.71-5.80) *	0.21(0.02-2.63)
MSC	2(25.0%)	6(75.0%)	2.81(0.54-14.66) *	0.42(0.03-7.03)
Experience in NICU				
≤5 years	24(30.8%)	54(69.2%)	1	1
6-10 years	21(65.6%)	11(34.4%)	0.23(0.09-0.56) *	**0.15(0.05-0.44) ****
≥11 years	8(80.0%)	2(20.0%)	0.11(0.02-0.56) *	**0.06(0.01-0.44) ****

Received any formal training on CPAP therapy				
Yes	11(30.6%)	25(69.4%)	1	1
No	42(50.0%)	42(50.0%)	0.44(0.19-1.01) *	0.49 (0.17-1.15)
Is Protocols for CPAP therapy available				
Yes	4(17.4%)	19(82.6%)	1	1
No	49(50.5%)	48(49.5%)	0.21(0.07-0.65)	0.34 (0.08-1.39)
Age in hour at initiation of CPAP therapy				
< 1hour	23(33.8%)	45(66.2%)	1	1
>1 hour	30(57.7%)	22(42.3%)	0.38(0.18-0.79)	0.52(0.20-1.33)
Nurse-to-patient ratio				
1:1	5(17.9%)	23(82.1%)	1	1
1:2	41(53.2%)	36(46.8) %	0.91(0.07-0.55) *	**0.23(0.05-0.96) ****
>1:2	7(46.7%)	8(53.3%)	0.25(0.06-1.01) *	0.23(0.04-1.48)
Gestational age				
<34 weeks	15(34.1%)	29(65.9%)	1	1
>34 weeks	38(50.0%)	38(50.0%)	1.93(0.89-4.17)	0.73(0.28-1.85)

Key 1= Reference

* Statistically significant by COR at p-value ≤0.25

**Statistically significant by AOR at p-value <0.05

6. DISCUSSION

The aim of this study was to assess nurses' knowledge, practice, and associated factors towards CPAP therapy among nurses working at NICU in public Hospitals of Addis Ababa town.

In this study 60% of the participants with 95% CI (50.8.7-69.2) had inadequate knowledge towards Continuous Positive Airway Pressure (CPAP) therapy. The study was low when compared to a study from Iraq that revealed all (100%) participant nurses had poor knowledge concerning CPAP (42). This difference may due to educational level, study design, and sample size variation between the studies. The study finding was higher than a study from Tanzania a poor knowledge level was found in 7 (4.7%) of nurses (30). The finding difference may be due to variation educational level and received previous training on CPAP.

On the other hand, the study was contrary to study at Indonesia showed that 21(70%) of the participant nurses scored above 75% and level as had good knowledge on CPAP. This was may be due to 22 (73.3%) of Indonesian nurses were given training as regular training improve nurses 'knowledge (37).

The odds of work experience among nurses working at NICU ≥11 years were 14 times more likely had adequate knowledge on CPAP therapy compared with nurses who had those working ≤ 5 years' experience in NICU. Similarly, a study revealed that significant advances in the field of neonatal CPAP was beyond the use of CPAP reflect on the personal experience and preferences of the individual rather than sound data (46). This finding may be due to increasing years of experience leads to an increase in their needs for improvement in their level of knowledge.

In this study, the odds of nurse who did not receive formal training were 84% times less likely had adequate knowledge compared those who did receive the formal training. Similarly, a retrospective cohort study in Rwanda, in sub-Saharan Africa revealed that training with ongoing clinical mentorship and intermittent refresher trainings led to improved nurses knowledge on the use of CPAP in NICU (67).Besides a study conducted at Taiwan on Quality Improvement of Continuous Positive Airway Pressure Therapy in NICU revealed that training was improved knowledge and increase communication among the medical staff

about indications, mechanism, application, settings, contraindications, and complications and basic knowledge of CPAP among medical staff was associated with the successful application of early CPAP therapy (29). On the other hand, the finding of this study was disagreed with a study conducted at Iraq that revealed no statistically significant association between nurses' training course and their knowledge concerning CPAP device (p value > 0.05). The difference may be due to effectiveness of training program (33).

Regarding protocols, the odds of nurses who worked with protocols were 12 times more likely had adequate knowledge regard to CPAP therapy compared to those nurses who did not obtain protocols for CPAP in their NICU. This finding of the present study showed that there was a statistically significant association between the available of protocol in the NICU for neonates undergoing CPAP and the studied nurse's level of knowledge. This finding also agreed with a study conducted at NICUs of Benha Specialized Pediatric Hospital at Benha city in Egypt that finding demonstrated that there was an improvement in the studied nurses′ level of knowledge after the implementation of the nursing protocol (52). The result of the current study was also supported by other studies showed that significant improvement in the studied nurses' knowledge about CPAP post-program implementation of regarding CPAP therapy (33,47,68).This finding may be due to that as no standard protocol for CPAP therapy were available till date in the ward, nurses did not have very sound base to analyze interventions regarding to CPAP therapy.

In nurse-to-patient ratio, the odds of nurses who worked in 1:1 nurse to patient were 15 times more likely adequate knowledge than compared nurses who worked in NICU with nurse to neonate ratio>1:2. The British Association of Perinatal Medicine (BAPM) recommended a 1:1 nurse-to-patient ratio for all infants in NICU. When neonate: nurse ratios fell short of BAPM recommendations in NICU, there was statistically significantly less time spent on tasks such as ventilator paying attention to alarms and nursing activities such as cleansing, drug administration and record keeping were not affected by the caseload. Where there was adequate staffing, more time was spent teaching other staff in the NICU (69).This finding is in line with the study findings. This may enhance to obtain time in busy NICU nurses to read and communicate with other staffs that increase the knowledge level of the nurse regarding CPAP therapy.

Regarding practice, good practice of CPAP therapy among nurses working at NICU was 55.8% with 95% CI (46.7-64.2). These findings was lower than by a study conducted in the

NICU at Benha Specialized Pediatric Hospital with 80 nurses in Egypt that revealed that most (87.5%) of the nurses had incompetent practice, while post guideline most (82.5%) of them had competent practice CPAP therapy (p=<0.001) (47). This difference may be due to study design in which the study was quasi-experimental with pre-post intervention.

Those nurses who had served for ≥11 years in NICU were 94% times less likely to be poor practice regard to CPAP therapy than those whose service years were ≤5 years. In addition, nurses who had work experience for 6-10 years in NICU were 85% times less likely to be poor practice regard to CPAP therapy than those whose service years ≤5 years. This finding was disagree with a study in Egypt demonstrated that there was a statistically significant correlation between total practice pre & post guideline with years of experience increase and practice increases (P= <0.001) (47).This could be due to the differences in health facility, study design, and sample size variation across studies. Another explanation may be due to the young age of the studied nurses working in NICU.

Regarding patient to nurse ratio, nurses who worked in 1:2 nurse to patient ratio had 77% times less likely had poor practice compared than those nurses who worked in NICU with 1:1 nurse to patient ratio. As number of neonates on CPAP increases without proportional addition of the nurses, the work load increase in the NICU nurses. This may lead to an exhaustion among the nurse and become a cause for inappropriate knowledge and practice apply to wards CPAP therapy and sometimes it may also lead human errors. In addition, it may lead avoidable delays and consume a lot of time to read to improve the knowledge and practice towards CPAP therapy.

7. STRENGTH AND LIMITATION OF THE STUDY

7.1. STRENGTH OF THE STUDY

This study is the first in its kind conducted at NICU in Addis Ababa even in the Ethiopia.

The assessment of practice uses observational checklist for CPAP therapy

Withstand challenges faced by observational study design problems of data collection such as requiring high cost, plenty of time and hard effort and travelling and staying at NICU daily

The study uses more than 30% of the public hospitals with NICU found in Addis Ababa which maximizes the representativeness of the sample for the source population

7.2. Limitation of the study

Hawthorne effect is the effect of the observer ‘on the observed. and is an important threat to the validity of observational research, whereas participants ‘may aware of being in a study or Observation; it causes the participants to change their practice or behavior temporary.

Another bottleneck of the study was limited previous studies found for the discussion and comparison of this study.

8. CONCLUSION AND RECOMMENDATION

8.1. Conclusion

In conclusion, 72(60%) and 48(40%) of nurses in NICU had inadequate and adequate knowledge respectively towards Continuous Positive Airway Pressure (CPAP) therapy. Regard to practice 67 (55.8%) had good practice whereas 53 (44.2%) had poor practice regard to CPAP therapy. Work experience in NICU and nurse to patient ratio were independent variables significantly associated for both knowledge and practice level of the nurses regarding CPAP therapy among nurses working at NICU in public hospitals of Addis Ababa.

8.2. Recommendation

Based on the findings of the study, the following recommendations could be suggested:

Addis Ababa Health Bureau: Addis Ababa health bureau might collaborate with Ministry of health, Ministry of education, universities and nurse educator to incorporate CPAP therapy as a course while formulating curriculum for nurses working in NICU. AAHB should develop protocols for CPAP therapy and should emphasize the importance of applying adequate knowledge and good practice of nurses during CPAP therapy at all NICUs as a standard.

Hospitals: Hospitals should conduct periodical orientation programs and in-service training for nurses to update the knowledge and practice regarding CPAP therapy. Hospitals should make NICU environment enable nurses to increase knowledge into practice by ensuring availability evidence based practical protocol in NICU.

Nurse practitioners: Nurses in NICU should update themselves for the new technology of CPAP therapy. Nurses should practice and know about CPAP therapy before they provide to neonates who need CPAP ventilation through in-service training.

Researchers: Finally, researchers should do further study to identify the knowledge and practices of nurses towards CPAP therapy to a wide area with different qualitative and quantitative study.

9. REFERENCE

1. World Health Organization. Newborns: improving survival and well-being. World Health Organisation. 2019.

2. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: A systematic analysis and implications. Lancet. 2012;379(9832):2162–72.

3. Ethiopian Public Health Institute (EPHI) [Ethiopia] I. Ethiopia Mini Demographic and Health Survey 2019: Key Indicators. Rockville, Maryland, USA; 2019.

4. Aynalem YA, Yirga T, Habtewold TD, Shiferaw WS. Incidence of Respiratory distress and its predictors among neonates admitted at neonatal intensive care unit , Black Lion Specialized Hospital , Addis Ababa ,. 2020;(October 2019).

5. Kawaza K, Machen HE, Brown J, Mwanza Z, Iniguez S, Gest A, et al. Efficacy of a low-cost bubble CPAP system in treatment of respiratory distress in a neonatal ward in Malawi. Malawi Med J. 2016;28(3):131–8.

6. Tiryaki Ö, Cinar N. Management of Continuous Positive Airway Pressure in the Newborn: Impact of Lecture-based Interactive Workshops on Training for Neonatal Intensive Care Nurses. Aquichan. 2016;16(2):159–68.

7. Yagui ACZ, Vale LAPA, Haddad LB, Prado C, Rossi FDS, Deutsch ADA, et al. Bubble CPAP versus CPAP with variable flow in newborns with respiratory distress: A randomized controlled trial. J Pediatr (Rio J). 2011;87(6):499–504.

8. Abdulkadir I, Hassan L, Abdullahi F, Purdue S, Ogala WN. Nasal Bubble CPAP: One Year Experience in a Neonatal Unit of a Tertiary Health Facility in Northwestern Nigeria. Niger Postgrad Med J. 2015;22(1):21–4.

9. Sekar K. The Role of Continuous Positive Airway Pressure Therapy in the Management of Respiratory Distress in Extremely Premature Infants. J Pediatr Pharmacol Ther. 2006;11(3):145–52.

10. Bonner KM, Mainous RO. The nursing care of the infant receiving bubble CPAP therapy. Adv Neonatal Care. 2008;8(2):78–95.

11. Switchenko N, Kibaru E, Tsimbiri P, Grubb P, Berry AA, Fassl B, et al. Implementation of a Bubble CPAP Treatment Program for Sick Newborns in Nakuru , Kenya : A Quality Improvement Initiative. Glob Pediatr Heal. 2020;7:1–10.

12. Daga S, Mhatre S, Borhade A, Khan D. Home-made continuous positive airways pressure device may reduce mortality in neonates with respiratory distress in low-resource setting. J Trop Pediatr. 2014;60(5):343–7.

13. De Paoli AG, Morley C, Davis PG. Nasal CPAP for neonates: What do we know in 2003? Arch Dis Child Fetal Neonatal Ed. 2003;88(3):168–72.

14. Pillow JJ, Hillman N, Moss TJM, Polglase G, Bold G, Beaumont C, et al. Bubble continuous positive airway pressure enhances lung volume and gas exchange in preterm lambs. Am J Respir Crit Care Med. 2007;176(1):63–9.

15. Petty J. Fact sheet: Understanding neonatal non invasive ventilation. J Neonatal Nurs. 2013;19(1):10–4.

16. McAdams RM, Hedstrom AB, Diblasi RM, Mant JE, Nyonyintono J, Otai CD, et al. Implementation of bubble CPAP in a rural Ugandan neonatal ICU. Respir Care. 2015;60(3):437–45.

17. Pankaj M Buch, Aarti M Makwana RKC, Brown TAM, Fowler L, Campbell R, Shennan DB. Usefulness of Downe Score as Clinical Assessment Tool and Bubble CPAP as Primary Respiratory Support in Neonatal Respiratory Distress Syndrome. J Pediatr Sci. 2013;5(1):e176.

18. Shashidhar A, Pn SR, Jose J. Downes score VS. siverman Anderson score for assement of respiratory distress in preterm newborns. Pediatr Oncall J. 2016;13(3):65–8.

19. Al-lawama M, Alkhatib H, Wakileh Z, Elqaisi R, Almassad G, Badran E, et al. Bubble CPAP therapy for neonatal respiratory distress in level III neonatal unit in Amman , Jordan : a prospective observational study. Int J Gen Med. 2019;12:25–30.

20. Thukral A, Sankar MJ, Chandrasekaran A, Agarwal R, Paul VK. Efficacy and safety of CPAP in low- and middle-income countries. J Perinatol. 2016;36(S1):S21–8.

21. Carns J, Kawaza K, Liaghati-Mobarhan S, Asibon A, Quinn MK, Chalira A, et al. Neonatal CPAP for respiratory distress across Malawi and mortality. Pediatrics. 2019;144(4):e20190668.

22. Egesa WI, Waibi WM. Bubble Nasal Continuous Positive Airway Pressure (bNCPAP): An Effective Low-Cost Intervention for Resource- Constrained Settings. Int J Pediatr. 2020;2020:1–10.

23. Nyondo-Mipando AL, Kinshella MLW, Bohne C, Suwedi-Kapesa LC, Salimu S, Banda M, et al. Barriers and enablers of implementing bubble Continuous Positive Airway Pressure (CPAP): Perspectives of health professionals in Malawi. PLoS One. 2020;15(2):1–16.

24. Murki S. Role of neonatal team including nurses in prevention of ROP. S11 COMMUNITY EYE Heal J. 2018;31(11):1–5.

25. Skorobogatova N, Žemaitiene N, Šmigelskas K, Tameliene R, Markuniene E, Stoniene D. Limits of professional competency in nurses working in Nicu. Open Med. 2018;13(1):410–24.

26. Paterson D, Shivananda S, Helou S El, Fusch C, Mukerji A. Impact of interprofessional education on noninvasive ventilation in a tertiary neonatal intensive care unit. Can J Respir Ther. 2016;52(3):81–4.

27. Lomnyack WP. Knowledge about continuous positive airway pressure machine usage among nurses at a tertiary hospital in Tanzania. South Sudan Med Journa. 2020;13(4):131–5.

28. Lewicka M, Sulima M, Taras E, Stawarz B. Non-invasive respiratory support in newborn - nursing care. J PUBLIC Heal Nurs Med RESCUE. 2013;2:7–13.

29. Chen CY, Chou AK, Chen YL, Chou HC, Tsao PN, Hsieh WS. Quality Improvement of Nasal Continuous Positive Airway Pressure Therapy in Neonatal Intensive Care Unit. Pediatr Neonatol. 2017;58(3):229–35.

30. Ammari A, Suri M, Milisavljevic V, Sahni R, Bateman D, Sanocka U, et al. Variables associated with the early failure of nasal CPAP. J Pediatr. 2005;147:341–7.

31. Dargaville PA, Aiyappan A, De Paoli AG, Dalton RGB, Kuschel CA, Kamlin CO, et al. Continuous positive airway pressure failure in preterm infants: Incidence, predictors and consequences. Neonatology. 2013;104(1):8–14.

32. Aly H, Milner JD, Patel K, El-Mohandes AAE. Does the experience with the use of nasal continuous positive airway pressure improve over time in extremely low birth weight infants? Pediatrics. 2004;114(3):697–702.

33. Aziz AR, Abdul-hamza MA. Effectiveness of an Educational Program upon Nurses ' Knowledge toward the Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit at AL-Hussein and the Pediatric Teaching Hospital. Int J Sci Res. 2017;7(8):469–76.

34. Cristianti Dwi Irtanti TAU. Knowledge The Use of Continous Positive Airway Pressure (Cpap) In Neonatus. Indones J Nurs Sci. 2019;1(2):95–102.

35. Fulton C. Improving neonatal mortality in an Ethiopian referral hospital. BMJ open Quality. 2013.

36. Price S, Reichert C. The Importance of Continuing Professional Development to Career Satisfaction and Patient Care: Meeting the Needs of Novice to Mid- to Late-Career Nurses throughout Their Career Span. Adm Sci. 2017;7(2):17.

37. Aziz AR, Abdul-hamza MA. (Assessment of nurses ' knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals). Int J Sci Res Publ. 2017;7(8):460–8.

38. Fadlalmola H, Mohammed A. Nurse's Knowledge and Practice on the Care of Preterm Infants at Khartoum State Hospitals. Sudan J Med Sci. 2020;15(2):184–94.

39. Borkowska M, Labeau S, Blot S. Nurses' practice concerning weaning from mechanical ventilation in the intensive care unit. Intensive Care Med Exp. 2015;3(1):561.

40. El-samad FAA, Dakhakhny AME-, El- KZ. Effectiveness of Applying an Educational

Module about Neonatal Respiratory Distress Syndrome on Nurse ’ s Practice. Zagazig Nurs J. 2018;14(1):62–73.

41. Wright CJ, Sherlock L, Sahni R, Polin RA, Clyde J. Wright, Laurie Sherlock, Rakesh Sahni and RAP. Preventing CPAP Failure: Evidence-Based and Physiologically Sound Practices From Delivery Room to the NICU. Clin Perinatol. 2018;45(2):257–71.

42. Vries MAG De, Zimmermann LJI. Clinical practice Noninvasive respiratory support in newborns. Eur J Pediatr. 2010;169:777–82.

43. G.Mohammed, Sabah S. Al Sharkawi , Basma R. Abd_Elsadek , Khadega M. Said E. Intervention Program for Nurses about Care of Preterm Neonates Undergoing Continuous Positive Airway Pressure. Semant Sch. 2019;1–18.

44. H.Mansi Q, Aziz AR. Assessment Nursing Care in Neonatal Respiratory Distress. Int J Sci Res. 2017;6(5):550–3.

45. Pradhan C, Shrestha R. Nurses’ Knowledge Regarding Weaning Criteria of the Patients with Mechanical Ventilation in a Teaching Hospital, Chitwan. Anesth Med Pract J. 2017;2(2):1–4.

46. Roehr CC, Schmalisch G, Khakban A, Proquitté H, Wauer RR. Use of continuous positive airway pressure (CPAP) in neonatal units - A survey of current preferences and practice in Germany. Eur J Med Res. 2007;12(4):139–44.

47. Elsobkey FA, Abdalha S, Amer M. Effect of Educational Guidelines Program about Nursing Care of Neonates Receiving Continues Positive Airway Pressure. J Nurs Heal Sci. 2018;7(3):16–26.

48. Dewez JE, Nangia S, Chellani H, White S. Availability and use of continuous positive airway pressure (CPAP) for neonatal care in public health facilities sectional cluster survey in India : a cross- -. BMJ Open. 2020;10:1–9.

49. Dewez JE, Nangia S, Chellani H, White S, Mathai M, Van Den Broek N. Availability and use of continuous positive airway pressure (CPAP) for neonatal care in public health facilities in India: A cross-sectional cluster survey. BMJ Open. 2020;10(2):1–9.

50. Col L, Malik RK, Gen M, Gupta RK. A Two Year Experience in Continuous Positive Airway Pressure Ventilation Using Nasal Prongs and Pulse Oximetry. Med J Armed Forces India. 2003;59(1):36–9.

51. Chen CY, Chou AK, Chen YL, Chou HC, Tsao PN, Hsieh WS. Quality Improvement of Nasal Continuous Positive Airway Pressure Therapy in Neonatal Intensive Care Unit. Pediatr Neonatol. 2017;58(3):229–35.

52. Said KM, Mohamed RA, Draz SF. Effect of Nursing Protocol Regarding Nasal Skin Breakdown for Preterm Infants Receiving Continuous Positive Airway Pressure. Evidence-Based Nurs Res. 2019;1(3):189–204.

53. Khalaf SM, Abd-elaziz SM, El HN. Effect of Training Clinical Positioning Guidelines on Physiological Parameters of Premature Infants undergoing Nasal Continuous Positive Airway Pressure. 2019;6(2):580–92.

54. World Population Projections.Ethiopia Demographics Profile. CIE world. Addis Ababa; 2019.

55. Addis Ababa Health service information general hospital. Addis Ababa; 2019.

56. Neonatal intensive care unit Team GMH. Addis Ababa; 2020.

57. Neonatal intensive care unit case team.SPMMCH. Addis Ababa; 2020.

58. Neonatal intensive care unit case team.THASH. Addis Ababa; 2020.

59. Neonatal intensive care unit team .Y12HMC. Addis Ababa; 2020.

60. Abdallah AR. Assessment of Nurses Knowledge Regarding Care of Preterm Babies. proposal. 2019;1(1):1–70.

61. Sankar MJ, Deorari A. Learner's Guide Protocol for Administering CPAP. AIIMS Protoc. 1971;1(1):1–89.

62. Ababa A. Neonatal Intensive Care Unit (NICU) Training Participants ' Manual. Train Man. 2021;194.

63. Wilson PT, Benckert MM, Moresky RT, Morris MC. Development and

implementation of a training-of-trainers program for continuous positive airway pressure in neonatal and pediatric patients in five low- and middle-income countries. J Trop Pediatr. 2017;63(5):358–64.

64. Egesa WI, Waibi WM. Bubble Nasal Continuous Positive Airway Pressure (bNCPAP): An Effective Low-Cost Intervention for Resource-Constrained Settings. Int J Pediatr. 2020;2020:1–10.

65. Jeeva Sankar M, Sankar J, Agarwal R, Paul VK, Deorari AK. Protocol for administering continuous positive airway pressure in neonates. Indian J Pediatr. 2008;75(5):471–8.

66. DiBlasi RM. Nasal continuous positive airway pressure (CPAP) for the respiratory care of the newborn infant. Respir Care. 2009;54(9):1209–35.

67. Nahimana E, Ngendahayo M, Magge H, Odhiambo J, Amoroso CL, Muhirwa E, et al. Bubble CPAP to support preterm infants in rural Rwanda: A retrospective cohort study. BMC Pediatr. 2015;15(1):1–7.

68. Hammod HJ, Mohammed SJ. Effectiveness of an Educational Program on Nurses Knowledge Concerning Complications Prevention of Mechanical Ventilation at Intensive Care Unit in Al- Hussain Teaching Hospital at Nassiryah City. Kufa J Nurs Sci. 2016;6(2):1–11.

69. Pillay T, Nightingale P, Owen S, Kirby D, Spencer A. Neonatal nurse staffing and delivery of clinical care in the SSBC Newborn Network. Arch Dis Child Fetal Neonatal Ed. 2012;97(3).

10. ANNEXES

ANNEX I. INFORMATION SHEET FOR PARTICIPATION IN THE RESEARCH STUDY

Good morning/ afternoon! My name is----------. I am working as data collector on behalf of the principal investigator who is a candidate for Master of Science in Neonatal Nursing graduate at AAU, College of Health Science, Department of Nursing, and Midwifery.

You are kindly requested and included in the study as part of the sample study to complete the questionnaire designed by the researcher on the assessment of knowledge, practice, and associated factors towards CPAP therapy among nurses working at NICU in public Hospitals of Addis Ababa, Ethiopia, 2021. You were participating if you give me consent after you have under stood the following information.

Objective of the study: to assess knowledge, practice, and associated factors towards CPAP therapy among nurses working at NICU in public Hospitals.

What I was ask you: if you agree to participate in this study, I was conducted a self-administered question about your socio demographic characteristics and your knowledge and practice question using checklist regarding CPAP therapy.

Participants: Nurses who are working at Neonatal Intensive Care Unit in randomly selected public hospitals of Addis Ababa who full fill the inclusion criteria.

Potential Risks: There is no predicted risk due to participating in this study. The result of the study helps programmers or policy makers to design intervention related to nurse's knowledge and practice of CPAP therapy.

Benefits: No financial benefit was related to this study. There is no payment and risk or discomfort because of participating in this study except that you lost your time.

Confidentiality is guaranteed absolutely for your voluntary participation in this study and the information you provide were kept unidentified. Your participation in this study is extremely appreciated and is an irreplaceable input in the improvement of the quality CPAP Therapy. These questionnaires were used only for the intended above-titled study only and no any

connections made between your response and you. You can also choose not to participate in this study or if you become uncomfortable during this study, you will be allowed to leave the study at any time of the study. But your truthful response will pay a lot to generate information to arise with significant findings. If you have any questions related to this study you can communicate principal investigator through the following address:

Name of the investigator: Kassaye Ahmed

Mobile: +251920633460 or e-mail Kassahmed2013@gmail.com

Will you willing to participate in the study? Yes/ No (Circle the response).

Yes = continue and thank you very much for taking part in this study.

If no, stop and say thank you.

ANNEX II. CONSENT FORM

In signing this document, I was giving my consent to participate in the study entitled assessment of knowledge, practice, and associated factors towards CPAP therapy among nurses working at NICU in public Hospitals of Addis Ababa, Ethiopia,2021.

I had been informed that the purpose of this research project and I understand to participate in this study. I had been informed that my participation in this study is willing to full and voluntary even I have the right to refuse or interrupt the filling of the questionnaire and my name would not be mentioned on the questionnaire. I, undersigned, have understood the purpose of the study & fully agree to participate in the study.

Signature of the participant---------- Date ----------

Name of investigator- Kassaye Ahmed

Address: phone no- +251920633460

Email: Kassahmed2013@gmail.com

Thank you for your help!

ANNEX III. የተሳታፊዎች መረጃ መስጫ ቅጽ በአማርኛ

እንድምን አደሩ/ዋሉ። ስሜ.....ይባላል። የመጣሁት በአዲስ አበባ ይኒቨርሲትይ፣ በጤና ሳይንስ ኮሌጅ ት/ቤት፣በንርሲንግ እና በሚድዋይፈሪ ት/ርት ክፍል በጨቅላ ህጥጻናት ንርሲንግ የሁለተኛ ዲግሪ እጩ ተመራቂ ለሆኑትለ.....በዋናው ተመራማሪ በኩል የጥናት መረጃ ሰብሳቢ በመሆን ነው።የነርስ ሙያተኞችችን የሲፓፕ ህክምና እውቀት እና አተገባብር እንዲሁም ተዛማጅ ችግሮችን አዲስ አበባ ኢትዮጵያ ውስጥ ባሉ የህዝብ ሆስፒታሎች የጨቅላ ህጻናት ጽኑ ህሙማን ተኝቶ መታከሚያ ክፍል ውስጥ የሚሰሩ ነርሶችን በ 2021 ዓም በሚጠናው ጥናት እርሰዎ በተመራማሪው ሲመረጡ በትህትና ነው። እርሰዎ በዚህ ጥናት ተሳታፊ እንዲሆኑ ተመርጠዋል።ጥናቱ ውስጥ የሚሳተፉት የሚከተውን መረጃ አንብበው እና ተረድተው ከተስማሙ ብቻ ነው።

የጥናቱ አላማ፡-የዚህ ጥናት ዋና አላማ በጨቅላ ህጻናት ጽኑ ህሙማን ተኝቶ መታከሚያ ክፍል ውስጥ የሚሰሩ ነርሶች የሲፓፕ ህክምና እውቀት እና አተገባበር እንዲሁም ተዛማጅነት ያላቸውን ነገሮች መዳሰስ ነው።

ጥናቱ ውስጥ ለመሳተፍ ከተስማሙ፤ መጠይቁን አንብበው ሰለ እርሰዎ የማህበራዊ ና የስ|ነ ህዝብ ሁኔታ ፤የእርሰዎን የሲፓፕ ህክምና እውቅወት እና አተገባበር የሚመለከቱ መጠይቆችን እንዲሞሉልኝ ነው።

ተሳታፊዎች፡ በተበረጡት የአዲስ አበባ ሆስፒታሎች ውስጥ በጨቅላ ህጻናት የጽኑ ህሙማን ተኝቶ መታከሚያ ክፍል ውስጥ በመስራት ላ ያሉ ነርሶች

የጥናቱ ጥቅም፡ የዚህ ጥናት ውጤት መንግስት እና የመንግስት አካላት የነርሶችን የሲፓፕ እውቀት እና አተገባበር እንዲሁም ተዛማጅ ነገሮች በተመለከተ ፖሊሴንዲቀርጹ ይረዳል።በመሆኑም እርሰዎ ከሚቀረጸው ፖሊሲ ሊጠቀሙ ይችላሉ።

የጥናቱ ጉዳት፡ ጥናቱ ውስጥ በመሳተፈዎ የሚከፈለዎት ክፍያ የለም። መጠይቁን ለመሙላት ከሚጠፋው ጊዜ በስተቀር የሚፈራ አደጋ ወይም ሲጋት አይኖርም።

ሚስጥራዊነት፡ በዚህ ጥናት በራሰዎ ፍቃድ መሳተፈዎ ሚስጥር ፍጹም የተጠበቀ ሲሆን የሚሰጡት ሃሳብ ለማንም አይገለጽም።በዚህ ጥናት መሳተፈዎ እጅግ የሚበረታታ ሲሆን ለሲፓፕ ህክምና ጥራት መሻሻል የማይተካ ሚና አለው። ይህ መጥይቅ የሚያገለግልው ከላይ በእርስ ለተገለጸው ጥናት ብቻ ይሆናል። እንዲሁም እርስዎ በሚሰጡት ምላሽ እና በእርሰዎ መካከል ምንም አይነት ማመሳሰል አይደረግም።

በዚህ ጥናት ያለመሳተፍ ምርጫ አለዎት፤ በሌላ አነጋገር በዚህ ጥናት ካልተመቸዎት ከጥናቱ በማንኛውም ጊዜ አቋርጦ መውጣት ይችላሉ። ነገር ግን እርሰዎ የሚሰጡት እውነተኛ ምላሽ ለሚጠናው ጥናት ግኝት እጅግ በጣም አስፈላጊና ብዙ አስተዋጽው አለው።

ይህን ጥናት በተመለከት ጥያቄ ካለዎት በሚከተለው አድራሻ አጥኝውን ማግኘት ይችላሉ።

ስም ፡ ካሳዬ አህመድ

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በዚህ ጥናት ለመሳተፍ ፍቃደኛ ነዎት? አዎ አይደለሁም (መልስዎን ያክብቡ)

መልሰዎ አዎ ከሆነ መጠይቁን ይቀጥሉ። የጥናቱ ተሳታፊ ሰለሆኑ በጣም አመስግናለሁ።

መልሰዎ አይደለሁም ከሆነ ጨርሰዋል። አመስግናለሁ።

ANNEX IV. የስምምነት ቅጽ በአማርኛ

እኔ ከዚህ በታች የፍረምኩ በጭቅላ ህጻናት ጽኑ ህሙማን ክፍል ውስጥ የሚሰሩ ነርሶች የሲፓፕ ህክምና እውቀት እና አተገባበር እንዲሁም ተዛማጅ ችግሮችን በአዲስ አበባ ኢትዮጵያ ባሉ የህዝብ ሆስፒታሎች 2021 በሚል ርዕስ በሚጠናው ጥናት ለመሳተፍ በፊርማዬ ፍቃደኝነቴን እገልጻለሁ።

የዚህ ጥናት አላማ የተነገረኝ ሲሆን በሚጠናው ጥናት ለመሳተፍ ተርድቻለሁ።በዚህ ጥናት የመሳተፍ በኔ ሙሉ ፍቃደኝነት ላይ የተመሰርተ እንደሆነና ከዛም በላይ እንቢ የማለት መብት እንዳለኝ እንዲሁም መጠይቁን መሙላት ማቋረጥ እንደምችል እና ስሜ በመጠይቁ ውስጥ እንደማይጠቀስ ተነግሮኛል።የዚህን ጥናት አላማ የተረዳሁ እና ለመሳተፍ ሙሉ በሙሉ የተስማማሁ መሆኔን በፊርማዬ አረጋግጣለሁ።

የተሳታፊ ፊርማ..... ቀን.....

ስለረዱኝ ከልብ አመሰግለሁ።

የዋና ተማራማሪው ስም፡ ካሳዬ አህመድ

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ANNEX V. ለጨቅላ ህጻናት ተሳታፊዎች ለእናቶች የመረጃ መስጫ ቅጽ በአማርኛ

እንደምን ኣድሩ/ዋሉ፤

ጤና ይስጥልኝ.....እባላለሁ፡፡አሁን ከእርሶ ጋር የተገናኘሁት በአዲስ አበባ ይኒቨርሲቲ፣ በጤና ሳይንስ ኮሌጅ ት/ቤት፣በነርሲንግ እና በሚድዋይፈሪ ት/ርት ቢት፣ በነርሲንግ ትምህርት ክፍል በጨቅላ ህጻናት ነርሲንግ የሁለተኛ ዲግሪ ተማሪ ለሆነው ለካሳዬ ኣህመድ የጥናት መረጃ ሰብሳቢ በመሆን ነው፤ጥናቱ የሚያተኩረው የሲፓፕ ህክምና እውቀት እና አተገባበር እንዲሁም ተዛማጅ ችግሮችን አዲስ አበባ ኢትዮጵያ ውስጥ ባሉ የህዝብ ሆስፒታሎች የጨቅላ ህጻናት ጽኑ ህሙማን ተኝቶ መታከሚያ ክፍል ውስጥ የሚሰሩ ነርሶችን በ 2021 ዓም የሚጠና ሲሆን፤ስለሆነም የእርስዎ ልጅ በጥናቱ የተካተተ ስለሆነ በጥናቱ ተሳታፊ ይሆን ዘንድ መረጃ እሰጠዎት ዘንድ ትኩረቶን ሰጥተው በጥሞና እንዲያዳምጡኝ በትህትና እጠይቀዎታለሁ፡፡

የጥናቱ አላማ፦-የዚህ ጥናት ዋና አላማ በጨቅላ ህጻናት ጽኑ ህሙማን ተኝቶ መታከሚያ ክፍል ውስጥ የሚሰሩ ነርሶች የሲፓፕ ህክምና እውቀት እና አተገባበር እንዲሁም ተዛማጅነት ያላቸውን ነገሮች መዳሰስ ነው።ጥናቱ ውስጥ ለመሳትፍ ከተስማሙ፤ መጠይቁን አንብበው ሰለ እርሰዎ የማህበራዊ ና የስነ ህዝብ ሁኔታ ፤የእርሰዎን የሲፓፕ ህክምና እውቀት እና አተገባበር የሚመለከቱ መጠይቆችን እንዲሞሉልኝ ነው። ተሳታፊዎች፡ በተበረጡት የአዲስ አበባ ሆስፒታሎች ውስጥ በጨቅላ ህጻናት የጽኑ ህሙማን ተኝቶ መታከሚያ ክፍል ውስጥ በመስራት ላዬ ያሉ ነርሶች እና የሲፓፕ ህክምና ላዬ በጨቅላ ህጻናት የጽኑ ህሙማን ተኝቶ መታከሚያ ክፍል ውስጥ ያሉ ህጻናት ናቸው፡፡

የመጠይቁ አካሄድ እና የሚወስደው ጊዜ፡ መረጃ የሚሰበሰበው የልጅን የህክምና ካርድ በማየት ሲሆን ይህም የሚደረገው በመጠይቅ ማገናዘቢያ /ቸክሊስት ሲሆን ይህ ደግሞ የጥናቱ ትክክለኛ መረጃ እንዲሆን ይጠቅማል፡፡ ይህ መጠይቅ 5 ጥያቄዎችን የያዘ ሲሆን ጥያቄዎች የሚመለሱት ከልጅዎ የህክምናማህደር/ካርድ ላይ በማየት ይሆናል፡፡ ለዚህም እናቶች ፍቃዳዎን ይሰጡኝ ዘንድ በትህትና እጠይቀዎታለሁ፡፡

የጥናቱ ጥቅም፡ የዚህ ጥናት ውጤት መንግስት እና የመንግስት አካላት የነርሶችን የሲፓፕ እውቀት እና አተገባበር እንዲሁም ተዛማጅ ነገሮች በተመለከተ ፖሊሴ እንዲቀርጹ ይረዳል።እርሰዎም ከሚቀረጸው ፖሊሲ ሊጠቀሙ ይችላሉ።

የጥናቱ ጉዳት፡ ጥናቱ ውስጥ ልጅዎ በመሳተፉ የሚከፈለዎት ክፍያ የለም። የሚፈራ አደጋ ወይም ሲጋት አይኖርም።

ሚስጥራዊነት፡ በዚህ ጥናት በራሰዎ ፍቃድ ልጅዎ ማሳተፍዎ ሚስጥር ፍጹም የተጠበቀ ሲሆን የሚሰጡት ሃሳብ ለማንም አይገለጽም።በዚህ ጥናት መሳተፈዎ እጅግ የሚበረታታ ሲሆን ለሲፓፕ ህክምና ጥራት መሻሻል የማይተካ ሚና አለው።ይህ መጥይቅ የሚያገለግልው ከላይ በእርስ ለተገለጸው ጥናት ብቻ ይሆናል። እንዲሁም እርስዎ በሚሰጡት ምላሽ እና በእርሰዎ መካከል ምንም አይነት ማመሳሰል አይደረግም።

በዚህ ጥናት ያለመሳተፍ መብት አለዎት፤ በሌላ አነጋገር በዚህ ጥናት ካልተመቾዎት ከጥናቱ በማንኛውም ጊዜ አቋርጦ መውጣት ይችላሉ። ይህን ጥናት በተመለከት ጥያቄ ካለዎት በሚከተለው አድራሻ አጥኝውን ማግኘት ይችላሉ።

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ከዚህ ጥናት ልጅዎን ለማሳተፍ ፈቃደኛ አዎ? አዎ አይደለሁም

መልሰዎ አዎ ከሆነ ልጅዎን በጥናቱ ተሳታፊ ሰማድርግ ስለፈቀዱ በጣም አመስግናለሁ።

መልሰዎ አይደለሁም ከሆነ ጨርሰዋል። አመሰግናሆሁ።

ANNEX VI፡ ለጨቅላ ህጻናት ተሳታፊዎች ለእናቶች የስምምነት ቅጽ በአማርኛ

ከሊይ በቀረበው የግንዛቤ ማስጨበጫ መሰረት ልጄን የጥናቱ ተሳታፊ ለማድረግ ፈቃደኛ ምሆኒን ኣረጋግጣልሁ፡፡ ለዚህም የጥናቱ የግንዛቤ ማስጨበጫ የመረጃ ተነቦልኛል (አንብቤዋሇሁ)፡፡ ስሇጥናቱ መሰረታዊ ዓላማ፣አካሄድ፣ ጥቅምና ጉዳት፣ ስሇመረጃው ዯህንነት፣ ስሇመብቴ የአጥኝው አድራሻ ተገልጾልኛል፡፡ በጥናቱ ጊዜ ስሇሚያጋጥሙኝ ግልጽ ያልሆኑ ጥያቄዎችን መጠየቅ እንዯምችልና በማንኛው ጊዜ ጥናቱን የማቋረጥ መብት እንዲለኝ ተረድቻሇው፡፡ ከዚህ መሰረት ልጄን በጥናቱ ለማሳተፍ ፈቃደኛ መሆኔን ከዚህ በታች በተቀመጠው ፊርማዬ አረጋግጣሇው፡፡

የጥናቱ ተሳታፊ ህጻን እናት ፊርማ ቀን

የመረጃ ሰብሳቢው ስምና ፊርማ ቀን

ሠለትብብርዎ በጣም አመሰግናሇሁ!!!

ANNEX VII. ENGLISH VERSION OF QUESTIONNAIRE

Title: Assessment of knowledge, practice, and associated factors towards continuous positive airway pressure (CPAP) therapy among nurses working at NICU in public hospitals, Addis Ababa, Ethiopia, 2021.

Questionnaire code……

Code	**Part I: socio demographic characteristics of nurses** Instruction: please fill the blank space with the correct response and for the questions with alternatives please encircle one response that is correct to you.	Response	
Code	Question	Response	
101	Gender	1.Male 2.Female	
102	Age	……. (in years)	
103	Education level	1.Diploma nurse 2.Bsc nurse 3.Bsc Neonatal nurse 4.Msc neonatal nurse 5.Other (specify)...	
104	Working experience in nursing	……(years)	
105	Working Experience NICU	……. (years)	
106	Monthly salary income	…… (in ETB)	
Part II: knowledge item questionnaires Instruction: For each of the following statements about nurse's knowledge regarding CPAP therapy, please encircle whether you think it is true or false.			
Code	Statement	Response	
		True	False
Fundamentals about CPAP device			
201	Continuous positive airways pressure (CPAP) is defined as a distending pressure applied with the nose for treatment of cessation of breathing in newborns.		

202	CPAP is an air pump to works by maintaining an open airway through the flow of pressurized air.		
203	CPAP starts at 4 cm H_2O level for treatment of respiratory distress syndrome (RDS) in newborns.		
204	Recurrent episode of apnea is not a sign for CPAP failure in the treatment of apnea of premature infants.		
Aim of CPAP device			
205	CPAP keep the airway open during the night.		
206	Does CPAP conserve surfactant.		
207	CPAP lowers upper airway resistance.		
208	CPAP maintains lung volume.		
Uses/indications of the device CPAP for premature babies and newborns			
209	CPAP uses for neonates with respiratory distress syndrome (RDS).		
210	CPAP uses to treat the Apnea of premature babies.		
211	CPAP is used for the neonate with Pneumothorax.		
212	CPAP is used to eliminate excessive respiratory secretions of Baby.		
213	CPAP works to increase intracranial pressure (ICP) for premature babies.		
214	The goal of (CPAP) is to reduce the need for respiratory tube in emergencies.		
Contraindications to use the device for newborn and premature babies			
215	CPAP is contraindicated in pneumothorax without chest drain.		
216	CPAP is contraindicated for nasal trauma.		
217	CPAP device cannot be used in case of Trachea-esophageal fistula.		
218	CPAP is not effective in the case of meconium aspiration.		
219	CPAP Machine prevents to use in the case of Post-extubation in preterm Very low birth weight infants.		
Complications of CPAP related to infant			
220	Obstruction of binasal prongs from secretions is complication of CPAP.		
221	Pneumothorax is complication of CPAP.		
222	CPAP increases work of breathing.		
223	Excessive CPAP level decreases cardiac output.		

224	Gastric distention is common complication of CPAP.		
Complications of CPAP related to devices			
225	Obstruction of prongs due to kinking of the prongs is device related complication.		
226	Skin irritation from securing tapes to the face is CPAP device related complication.		
227	Distortions of the nasal septum due to incorrect strapping and positioning is complication of binasal prongs.		
228	High air leak around the prongs due to mouth being open is CPAP device related complication.		

Part III. Organizational related factors

Instruction: please encircle for the alternatives questions and write you response on the blank space for open ended questions.

Code	question	Response	skip
301	Did you receive any course on CPAP therapy during your Study School? (University or college level)	1.Yes 2. No	
302	Have you received any formal training on CPAP therapy?	1.Yes 2.No	306
303	If your response is'yes'for question 302, what was the type of training?	1.Thory 2. Practical 3.Theory& practical	
304	If your response is 'yes' for question 302, what was the frequency of training per year about CPAP you receive at your working institution?	……..	
305	If your response is 'yes' for question 302, when was the last time you receive training?	……	
306	Is Protocols for CPAP therapy available in the room?	1. Yes 2. No	
307	Is Downes Score (DS) respiratory distress syndrome assessment tool available in the unit/room?	1.Yes 2.No	

308	Is there pulse oximetry available for each neonate on CPAP ventilation continuously in the room?	1.yes 2.No	
309	What is the Nurse-to-patient ratio in your NICU?	1.1:1 2.1:2 3.>1:2	

ANNEX VIII. CHECKLIST FOR THE ASSESSMENT LEVEL OF NURSES PRACTICE TOWARD CPAP THERAPY

Check list code……

Part IV: Checklist for the assessment level of practice toward CPAP therapy among Nurses working at NICU (filled by data collectors during observation)				
Code	Check points	Correctly done (2)	Incorrectly done (1)	Not done (0)
1	Initial nursing Care of CPAP			
1.1	Perform Hand washing or alcohol-based hand rub Hand washing/or sanitizer or Alcohol based hand rub before and after touching the neonate.			
1.2	Move the CPAP machine to bedside			
1.3	Provide family counseling about CPAP			
1.4	Record heart rate of the neonate			
1.5	Record respiratory rate of the neonate			
1.6	Record axillary body temperature of the neonate			
1.7	Right hand oxygen saturation is measured for the neonate			
1.8	Downes score is counted			
1.9	Downes score severity is classified			
1.10	Examination of the nasal cavity or nasal nares is performed			
2	**Setting up of CPAP**			
2.1	Position the CPAP machine 30 centimeters from the wall or curtains			
2.2	Plug the power cord into the main electric supply			

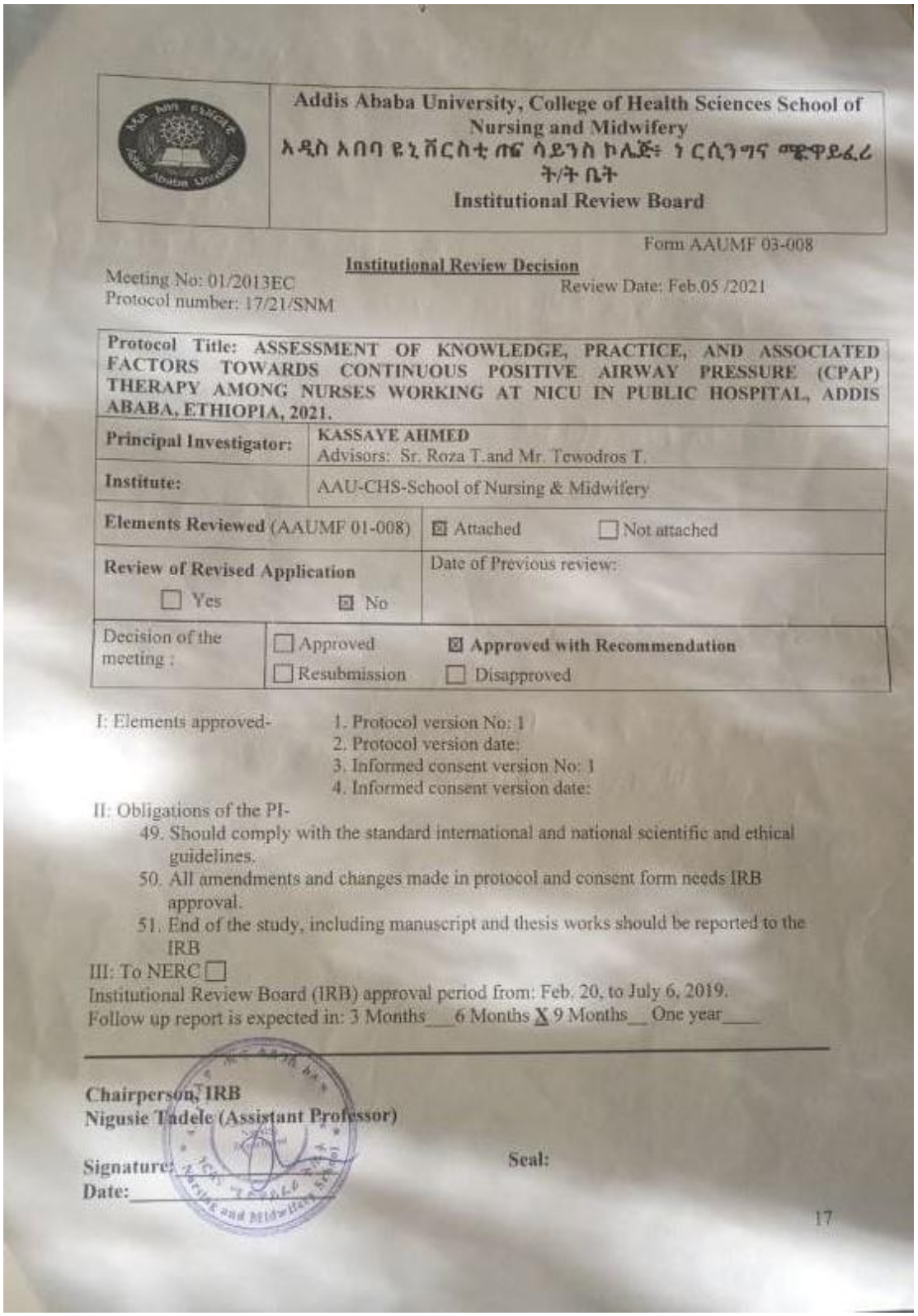
2.3	Turn on the CPAP concentrator			
2.4	Fill the bubble bottle with clean water to fill line			
2.5	Fill the humidifier with clean water between minimum and maximum level indicated			
2.6	Connect inspiratory limb to the main gas outlet			
2.7	Connect expiratory limb to bubble bottle			
2.8	Dial up the level of CPAP required (5-10cmH2O)			
3	Preparing the Baby for CPAP			
3.1	Position the baby with the head of the bed elevated about 30◦.			
3.2	Position the neonate in neutral supine position			
3.3	Place a small firm roll up nappy or towel under the baby's shoulders to support the baby's head			
3.4	Prepare sterile saline nasal drops for irrigation			
3.5	Ensure clear airway-suction the nares as needed			
3.6	An orogastric tube is inserted through the baby's mouth.			
4	Connect the nasal prong system to the neonate			
4.1	Choose appropriate size nasal prongs and attach them to corrugated tubing Size 0: Infants <700 g Size 1: Infants 700–1250 g Size 2: Infants 1250–2000 g Size 3: Infants 2000–3000 g Size 4: Infants >3000 g Size 5: Infants >3500 g			
4.2	Attach corrugated tubing to both sides of prongs			
4.3	Set CPAP pressure by submerge expiratory limb to the appropriate depth			
4.4	Test the system by occluding the ends of the nasal prongs			
5	Bonnet with Ties			
5.1	place the bonnets/cap on patient's head, centering the securement line indicator.			

5.2	Put snug-fitting woolen cap/hat or adult cotton sock on baby's head.			
5.3	with the bonnet centered at the nape of neck, place remaining bonnet on infant.			
5.4	close the top of bonnet by twisting bonnet until tightly secured to head crown.			
6	Methods of Securing CPAP device			
6.1	Secure the CPAP tubing with ribbon provided or to the hat or safety pins and rubber bands			
6.2	cut self-adhesive Velcro/fastener in half and secure to the bonnet			
6.3	Attach chin strip to the infant and secure to the Velcro/fastener or Tie the tapes of the nosepiece to the woolen cap with sticking plaster			
6.4	Place the nasal prong curve side down into the infant's nostril without pressing on the nasal septum.			
7	**Performing safety check for Troubleshooting in CPAP**			
7.1	Verify nasal prong size and placement: Prongs of the correct size fit into the nares snuggly without excessive movement or blanching of the nares			
7.2	Assess for blockage of tube by observing and consider suctioning			
7.3	Oxygen and air flow rates sum is set 10 L/min.			
7.4	Check corrugates CPAP tubing is connected and fixed in place.			
7.5	Verify water level in bubble bottle is fixed to the zero.			
7.6	Verify CPAP pressure, submerge expiratory limb to the appropriate depth (Oxygen/Air mixing Chart available on the machine)			
7.7	Test the CPAP system for bubbling by occluding the ends of the nasal prongs.			
7.8	Observe for water in CPAP tubing is empty			
8	**Monitor of CPAP/ Ongoing assessments**			
8.1	Oxygen saturation probe placed on a pre-ductal site at right arm or wrist continuously to maintained at 90-95%.			

8.2	Record heart rate continuously with pulse oximetry			
8.3	Respiratory rate 30- 60 breath/min			
8.4	Downes score > 7 after 15 to 20 minutes of CPAP after initiation of therapy			
8.5	CPAP pressure adjusted as the baby's condition indicates by pulse-oximetry			
8.6	Record body temperature maintained between 36.5°Cand 37.5°C			
8.7	Record abdominal girth increment every 2-4 hours			
8.8	Humidify airway - 1 drop saline per nares every 2 to 3 hours			
8.9	keep 0.2-0.3 cm space between the tip of the septum and the prongs to maintain the integrity of nasal septum			
8.10	suctioning nostrils every 3 hr to maintain airway patency			
8.11	Neonate on CPAP is repositioned every 2–4 hr to maintain the integrity of skin			
8.12	The proximal end of the orogastric tube is closed for 30 minutes after each feeding and then kept open until the next feed.			
8.13	Documentation of all activities performed			

Part V: Baseline characteristics of neonates undergoing CPAP ventilation		
	Characteristics of neonates	Response
501	Sex of neonate	1.Male 2. Female
502	Gestational age in weeks	……
503	Admission Weight in grams	…….
504	Age in hours	……..
505	Diagnosis of indication for CPAP connection	1. RDS 2. Apnea of prematurity 3. MAS 4. other……(specify)

ANNEX IX. ETHICAL APPROVAL FROM HOME INSTITUTION



Addis Ababa University, College of Health Sciences School of Nursing and Midwifery
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Institutional Review Board

Form AAUMF 03-008

Institutional Review Decision

Meeting No: 01/2013EC
Review Date: Feb.05 /2021
Protocol number: 17/21/SNM

Protocol Title: ASSESSMENT OF KNOWLEDGE, PRACTICE, AND ASSOCIATED FACTORS TOWARDS CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) THERAPY AMONG NURSES WORKING AT NICU IN PUBLIC HOSPITAL, ADDIS ABABA, ETHIOPIA, 2021.	
Principal Investigator:	**KASSAYE AHMED** Advisors: Sr. Roza T.and Mr. Tewodros T.
Institute:	AAU-CHS-School of Nursing & Midwifery
Elements Reviewed (AAUMF 01-008)	☒ Attached ☐ Not attached
Review of Revised Application ☐ Yes ☒ No	Date of Previous review:
Decision of the meeting :	☐ Approved ☒ **Approved with Recommendation** ☐ Resubmission ☐ Disapproved

I: Elements approved-
1. Protocol version No: 1
2. Protocol version date:
3. Informed consent version No: 1
4. Informed consent version date:

II: Obligations of the PI-
49. Should comply with the standard international and national scientific and ethical guidelines.
50. All amendments and changes made in protocol and consent form needs IRB approval.
51. End of the study, including manuscript and thesis works should be reported to the IRB

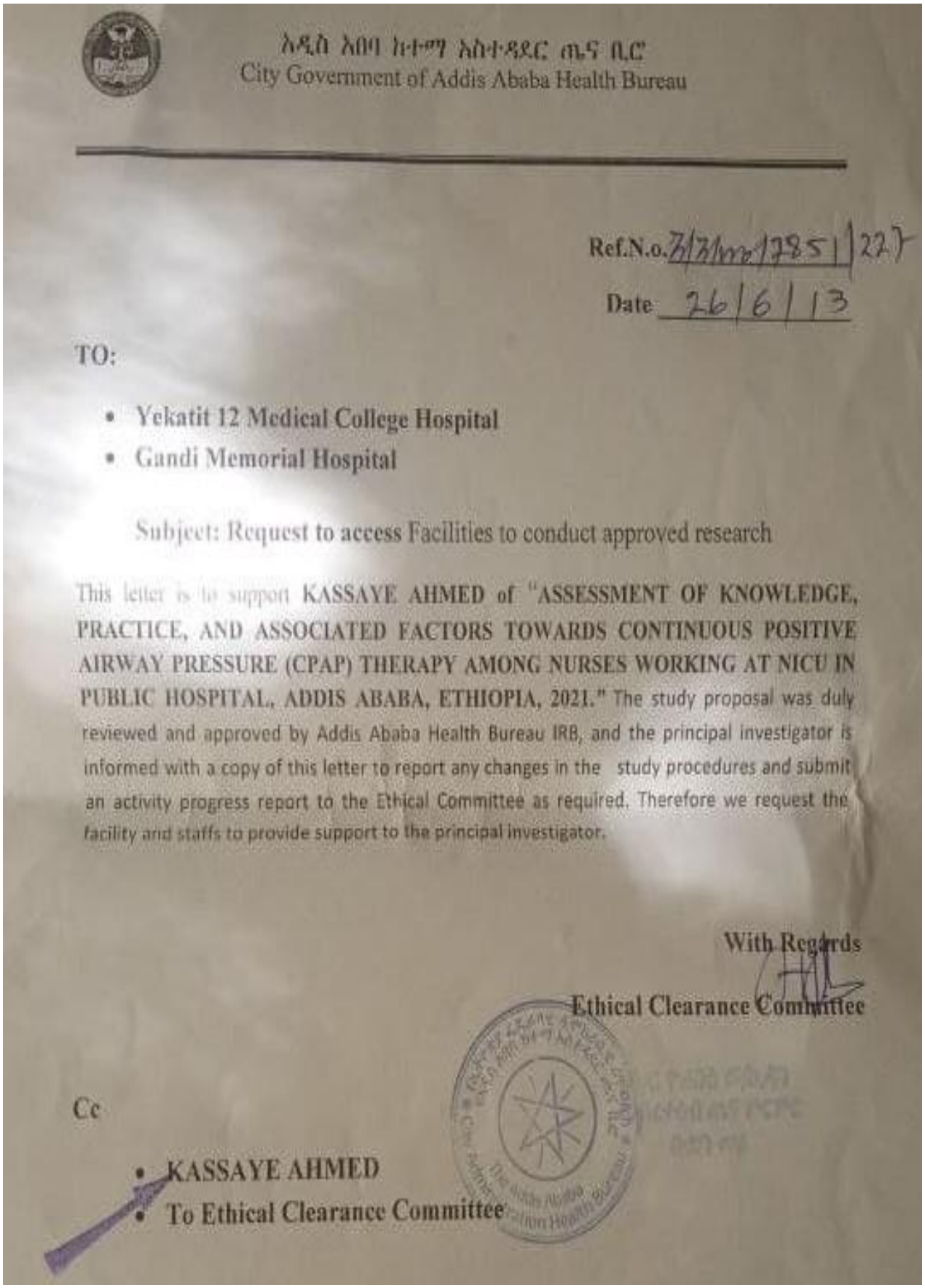
III: To NERC ☐
Institutional Review Board (IRB) approval period from: Feb. 20, to July 6, 2019.
Follow up report is expected in: 3 Months___ 6 Months X 9 Months__ One year____

Chairperson, IRB
Nigusie Tadele (Assistant Professor)

Signature: **Seal:**
Date:

17

ANNEX X. SUPPORT LETTER FROM HOME INSTITUTION



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City Government of Addis Ababa Health Bureau

Ref.N.o. ጤ/ጥ/ሚ/1785/227

Date 26/6/13

TO:

- Yekatit 12 Medical College Hospital
- Gandi Memorial Hospital

Subject: Request to access Facilities to conduct approved research

This letter is to support KASSAYE AHMED of "ASSESSMENT OF KNOWLEDGE, PRACTICE, AND ASSOCIATED FACTORS TOWARDS CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) THERAPY AMONG NURSES WORKING AT NICU IN PUBLIC HOSPITAL, ADDIS ABABA, ETHIOPIA, 2021." The study proposal was duly reviewed and approved by Addis Ababa Health Bureau IRB, and the principal investigator is informed with a copy of this letter to report any changes in the study procedures and submit an activity progress report to the Ethical Committee as required. Therefore we request the facility and staffs to provide support to the principal investigator.

With Regards

Ethical Clearance Committee

Cc

- KASSAYE AHMED
- To Ethical Clearance Committee

ANNEX XI. PLAGIARISM REPORT

Document Information

Analyzed document	CPAP thesis 2nd draft commented.docx (D106530010)
Submitted	5/26/2021 2:43:00 PM
Submitted by	Roza
Submitter email	roza.teshome@aau.edu.et
Similarity	12%
Analysis address	roza.teshome.aauni@analysis.urkund.com

Sources included in the report