Addis Ababa University

College of Health Sciences

Department of Pediatrics and Child Health

Research thesis

Title-: Barriers and self-reported practices towards the use of continuous positive airway pressure (CPAP) machine in newborns among Pediatrics' residents in tertiary hospital, Addis Ababa, Ethiopia: A Cross Sectional Study

A research thesis submitted to department of Pediatrics and Child health, College of Health Science, Addis Ababa University for the partial fulfillment of the requirements for the specialty certificate in Pediatrics and Child Health

Investigator: - Gashaw Arega, MD, Pediatrics and Child Health resident

Advisor: Asrat Demtse, MD, Pediatrician and Neonatologist

December, 2021 G.C

NAME OF THE PRINICPAL INVESTIGATOR	Dr. Gashaw Arega, Pediatrics and Child Health Resident
NAME OF ADVISOR	Dr. Asrat Demtse, Pediatrician, Neonatologist
TITLT OF THE REASERCH	Barriers and self-reported practices towards the use of continuous positive airway pressure (CPAP) machine in newborns among Pediatrics' residents in tertiary hospital, Addis Ababa, Ethiopia, 2021
DURATION OF THE REASERCH	From May – November 2021 G.C
STUDY AREA	Tikur Anbessa Specialized Hospital
TOTAL COST OF THE PROJECT	26, 480 ETB
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Declaration

Title: Barriers and self-reported practices towards the use of continuous positive airway pressure (CPAP) machine in newborns among Pediatrics' residents in tertiary hospital, Addis Ababa, Ethiopia, 2021

NAME OF THE PRINICPAL INVESTIGATOR: Gashaw Arega, MD, Pediatrics and Child Health resident

A. Declaration by the student

I do hereby declare that this research thesis submitted to the department of Pediatrics and Child health, College of Health Science, Addis Ababa University for the partial fulfillment of the requirements for the specialty certificate in Pediatrics and Child Health is my original work and has not previously been submitted elsewhere.

Also, I do declare that a complete list of references is provided indicating all the sources of information quoted or cited.

Date and signature of student

December 16, 2021

B. Authority to submit the thesis

Name of Advisor: Dr. Asrat Demtse, Pediatrician, Neonatologist

In my capacity as an advisor, I do hereby authorize the student to submit his thesis.

Date and signature of the Advisor

December 16,2021

Acknowledgments

First would like to thank the Department of Pediatrics and Child health for giving me this chance to do this research. Special thanks to my advisor Dr Asrat Demste for her constructive comments in the whole process of the research. And also, I would like to thank staff senior's in the DPCH for their constructive comments and suggestions while presenting the proposal. My special thanks goes to Dr.Henok Tadele .

Finally, I express my deep sense of gratitude to the resident physicians who participated and spent their time filling the self-administered questioner's.

Acronyms

NICU-----Neonatal Intensive care unit

RDS-----Respiratory Distress Syndrome

LBW----- low birth Weight

VLBW----- very Low birth Weight

PTB- -----Preterm birth

CPAP------ continuous positive Air way pressure

PEEP----- Positive End Expiratory Pressure

FRC----- functional residual capacity

FIO2- ----Fraction of inspired oxygen

WHO- ----- world health organization

FMOH----- Federal ministry of Health

TASH- ---- Tikur Anbessa Specialized Hospital

LMICS------ low- and middle-income countries

HRICS------ high income countries

HCW------ health care workers

PI-------- Principal Investigator

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Abstract

Introduction: - Child survival should remain at the heart of global health and development goals. The leading causes for neonatal death in Ethiopia are prematurity, asphyxia, and neonatal sepsis. Premature newborns with RDS can be managed effectively with breathing support, such as mechanical ventilation or continuous positive airway pressure (CPAP), as well as surfactant replacement therapy. CPAP is strongly recommended by the World Health Organization (WHO) for the treatment of preterm newborns with RDS.

Objective: The objective of this study is to assess barriers and self-reported practices towards the use of Continuous Positive Airway Pressure (CPAP) machine in newborns among Pediatrics Resident's at Tikur Anbessa Specialized Hospital

Methods: Cross sectional study was conducted from July 1 – September 30, 2021 G.C to assess barrier's and self-reported practices towards the use of Continuous Positive Airway Pressure (CPAP) in newborns among Pediatrics Resident's at Tikur Anbessa Specialized Hospital in Addis Ababa, Ethiopia. Self-administered questionnaire used to collect data among Pediatrics residents of TASH. Data was analyzed using descriptive statistics by SPSS version 25.

Result: Of the total 112 participants **57.1%** (64/112) have any form of formal teaching, learning or training session on CPAP in their Newborn care practice. **80.4 % of** Participants used improvised water bottle system. The most common reported barriers to the usage of CPAP at NICU are availability of CPAP machine, availability of oxygen, availability of nasal prong and shortage of staff. There was significant difference in the practice of CPAP safety check lists between residents with different year of residency.

Recommendation: - The current findings suggest that there is significant room for improving CPAP usage in NICU by optimizing teaching and training session on CPAP, by enhancing and increasing the knowledge and practice of health care workers, tackling perceived barrier's that hamper the practice of using CPAP, preparing manuals that can be a guide for fostering CPAP usage and creating a smooth working environment for experience sharing among health workers practicing in NICU.

Introduction

1.1 Background

Child survival should remain at the heart of global health and development goals. Globally, 2.4 million children died in the first month of life in 2019, approximately 6,700 neonates die every day – with about a third of all neonatal deaths occurring within the first day after birth, and close to three-quarters occurring within the first week of life [1].

Globally, there have been significant declines in infant mortality but rates of neonatal mortality are declining at a slower pace than among older infants and children [2]. Although the third Sustainable Development Goal (SDG-3) aims to reduce under-five mortality rates to fewer than 25 per 1000 live births and neonatal mortality rates to fewer than 12 per 1000 by the year 2030, a recent study found that if the slow trend in neonatal mortality reduction continues, only two out of the 31 sub-Saharan African countries are predicted to achieve SDG-3 targets [3]. Among newborns in sub-Saharan Africa, one in every 36 neonates die within the first month, a staggering inequality compared to one in 333 in high-income countries (HICs) [4]. Preterm birth complications are a leading cause of neonatal death [2] and a review found that nine of the 11 countries globally with estimated preterm birth rates of 15% or more were in sub-Saharan Africa [5]. With an estimated average pre-term birth rate at 12.3% across the sub-Saharan Africa region (12.3%), there is a need to effectively address accompanying complications in order to reduce the burden of neonatal deaths [2, 5]. Preterm newborns often have underdeveloped respiratory systems, with more than 50% of infants born before 31 weeks gestation developing respiratory distress syndrome (RDS) [6].

In Ethiopia, the neonatal mortality is decreasing at a slower rate and now accounts for 41% of under-five deaths [2, 7]. The neonatal mortality decreased from 39 to 29 between the 2005 and 2016 EDHS, but has remained stable since the 2016 EDHS, which were 30 per 1000 live births [7]. The leading causes for neonatal death in Ethiopia are prematurity, asphyxia, and neonatal sepsis [8, 9, 10, 11]. Neonatal mortality rate is a standard indicator for evaluation of health status of a country. Therefore, it is important to explore the factors that contribute to neonatal death. Moreover, identifying the cause of death and

cause-specific contributions to neonatal mortality is important in selecting strategies to further reduce newborn deaths [16,17].

Newborns with RDS can be managed effectively with breathing support, such as mechanical ventilation or continuous positive airway pressure (CPAP), as well as surfactant replacement therapy [12]. CPAP is strongly recommended by the World Health Organization (WHO) for the treatment of preterm newborns with RDS [13]. CPAP is a simple, non-invasive form of respiratory support requiring less advanced technical expertise than mechanical ventilation, an invasive procedure involving endotracheal intubation or tracheostomy tube insertion [14, 15, 16, 17]. Continuous Positive Airway Pressure (CPAP) is a noninvasive method for applying a constant distending pressure level (above atmospheric) during inhalation and exhalation to support spontaneously breathing newborn infants with lung disease. CPAP is an “open-lung approach” used to manage newborn infants predisposed to developing airway instability, edema, and atelectasis (19, 20). Nasal continuous positive airway pressure (CPAP) is the most widely used non-invasive continuous distending airway pressure modality and a cornerstone of modern neonatal care. Whereas there has been emphasis on understanding which devices and pressure sources best implement CPAP, the optimal duration of this therapy is less well studied. At birth, premature infants have life-threatening anatomic and physiologic immaturities of the respiratory system. CPAP attenuates this pathophysiology until sufficient stability develops and continuous distending pressure is no longer needed (21).

CPAP is easy to initiate, but to be effective; CPAP needs to be used continuously for hours or days. This implies continuous supplies of electricity and medical gases, continuous clinical monitoring for timely detection of acute complications and long-term follow-up for chronic complications. Consequently, the WHO recommends considering the wider context of care prior to introducing and scaling-up CPAP use in LMIC [20].

2. Statement of the Problem

Preterm birth (PTB) is a public health issue worldwide. Preterm birth complications are a leading cause of neonatal death and preterm birth rates of 15% or more were in sub-Saharan Africa and it is the leading cause of neonatal and under-five mortality in Ethiopia.

In Ethiopia the neonatal mortality decreased from 39 to 29 between the 2005 and 2016 EDHS, but has remained stable since the 2016 EDHS, which were 30 per 1000 live births, but currently the neonatal mortality increased to 33 per 1000 live births according to mini EDHS 2020. And this is an alarming issue for the country.

Preterm newborns often have underdeveloped respiratory systems, with more than 50% of infants born before 31 weeks gestation developing respiratory distress syndrome (RDS) [6]. Deficiency of pulmonary surfactant is one of the most important factors contributing to the development of respiratory distress syndrome (RDS) (20). And non-invasive ventilation strategy with CPAP from birth has similar outcome as routine intubation in the delivery room as well. Early continuous positive airway pressure (CPAP) from birth is feasible and safe in preterm infants. In resource limited countries, in which there is no mechanical ventilation and surfactant, CPAP is a recommended strategically feasible way of treatment for preterm newborns.

The major cause of death in preterm infants as seen in selected hospitals in Ethiopia revealed that the main primary cause of death was RDS (45%), followed by Sepsis (30%), and asphyxia (14%). And the highest mortality occurred in infants younger than 28 weeks of gestational age, followed by infants (28-31 weeks), 32-34 weeks and 35-36 weeks.

There is no any published data regarding the use of CPAP in newborns in Ethiopia. Based on observation though bubble CPAP or locally improvised water bottled systems are efficacious, safe, cost-effective device to support neonatal breathing, there is still a lack of knowledge on the practice and there are Barrier's on implementing the use of Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit. And there are gaps in the use, initiation, follow-up and weaning of CPAP among preterm newborns with Respiratory Distress Syndrome. There is also barrier's that hamper the use of CPAP that has to be addressed and need interventions for ongoing usage.

This raises the question as to whether the use of CPAP in newborn is given attention in TASH NICU which at least in part depends on Pediatrics and Child Health Resident's knowledge, understanding of the importance of CPAP and identifying the barrier's that restrict from the continues usage of it.

Thus, my purpose in this descriptive cross-sectional study is to examine this issue specifically in Neonatal Intensive Unite at Tikur Anbessa Specialized Hospital. As a starting point, this study sought to describe Pediatrics resident's knowledge and identify barriers regarding the use of CPAP in NICU at TASH. And by identifying the gaps and barriers among pediatrics residents, who are going to be Pediatrician in the coming few years, it will be feasible and CPAP can be widely used throughout the country, in a place where these pediatricians serve.

1.3 SIGNIFICANCE OF THE STUDY

Preterm birth (PTB) is a public health issue worldwide. It is the leading cause of neonatal and under-five mortality in Ethiopia as well. According to SDG -3 which stated “Ensure healthy lives and promote wellbeing for all at all ages”, the goal by 2030 is to reduce neonatal mortality to at least as low as 12 per 1000 live births. To achieve this target goal Neonatal intensive care Unit staff needs to have the knowledge regarding the initiation, follow up and weaning of CPAP while treating newborns having Respiratory Distress Syndrome. It is prudent to have tangible evidences regarding barrier’s that hamper the use of CPAP while in need of it and to suggest relevant interventions for better outcomes.

Thus, to improve the quality of care, it is desirable to assess the knowledge, practice and perceived barriers regarding the use of CPAP care among Nurses and pediatrics residents in NICU at TASH. This will help in devising appropriate strategies to improve the knowledge and practices of healthcare professionals regarding CPAP usage and to deal with the barriers that impede optimal neonatal CPAP care.

The results of this study can be used as an input for the policy makers/FMOH to increase the vigilance for early identification of these gaps and to address barriers for better outcomes timely. Also, the findings of the study will help as baseline data for further researches in the future.

2. Literature Review

Preterm newborns often have underdeveloped respiratory systems, with more than 50% of infants born before 31 weeks gestation developing respiratory distress syndrome (RDS) [6]. Newborns with RDS can be managed effectively with breathing support, such as mechanical ventilation or continuous positive airway pressure (CPAP), as well as surfactant replacement therapy [12]. CPAP is strongly recommended by the World Health Organization (WHO) for the treatment of preterm newborns with RDS [13]. CPAP is a simple, non-invasive form of respiratory support requiring less advanced technical expertise than mechanical ventilation, an invasive procedure involving endotracheal intubation or tracheostomy tube insertion [14, 15, 16, 17]. Continuous Positive Airway Pressure (CPAP) is a noninvasive method for applying a constant distending pressure level (above atmospheric) during inhalation and exhalation to support spontaneously breathing newborn infants with lung disease. CPAP is an "open-lung approach" used to manage newborn infants predisposed to developing airway instability, edema, and atelectasis (19). CPAP is employed in infants with acute respiratory failure to correct hypoxemia. It permits higher inspired oxygen content than other methods of oxygen supplementation, increases mean airway pressure, and will improve ventilation to collapsed areas of the lung. The recruitment of under ventilated lung is similar to the use of positive end expiratory pressure (PEEP) in the intubated mechanically ventilated patient (20).

Although CPAP is widely recommended for managing respiratory distress and has been utilized in high-income countries (HICs) for decades, hospitals in resource-limited settings still experience challenges in its implementation. Conventional CPAP machines, while less costly than mechanical ventilation, are still not economically sustainable in most low- and middle-income countries (LMICs). Bubble CPAP provides a potential solution, as a safe and cost-effective way for delivering CPAP in LMICs [4]. Bubble CPAP safely regulates air pressure by submerging the end of the expiration tubing into water, with the depth of the tube in the water determining the pressure in the system [14, 15, 16,17,18]. This maintains a volume of air in the lungs (functional residual lung capacity) to support the newborn's spontaneous breathing [14,15,16,17,18]. Measured physiological effects of CPAP include increased functional residual capacity, decreased intrapulmonary shunting, increased tidal volume, and decreased

airway resistances [22]. A systematic review demonstrated that when bubble CPAP is utilized effectively, it can reduce the need for mechanical ventilation by 30–50% with no increase in mortality [14].

In the research done at Iraq about 'Assessment of nurses' knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit, a descriptive study was carried out at Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals During the period from December 26th -2016 to the 15th of May -2017. A non-probability (purposive) sample of (24) nurses, who worked at Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals. The tool of the study included a questionnaire, which had five main parts. The data were analyzed through the application of descriptive frequencies, percentages, mean of score and the inferential statistical analysis. The study revealed that there is no statistically significant association between nurses' age, nurses' gender, nurses' level of education; years of service in nursing field, nurses' years of services in NICU, nurses' training course and their knowledge toward the Continuous Positive Airway Pressure (CPAP) Machine follow up. The study recommended the necessity to develop the nurses' skills; policy should be initiated to providing a special educational course about Neonates with Continuous Positive Airway Pressure (CPAP) Machine and providing updating booklets, pamphlets and boosters for nurses to upgrading their knowledge about Continuous Positive Airway Pressure (CPAP) Machine [24].

In a systemic review regarding barriers and facilitators to implementing bubble CPAP to improve neonatal health in sub-Saharan Africa seventeen studies that discussed using bubble CPAP at a health facility in sub-Saharan Africa with neonates were found. Reliable availability of equipment, effectively informing and engaging caregivers and staffing shortages were frequently mentioned barriers to the implementation of bubble CPAP. Understaffed neonatal units and high turnover of nurses and doctors compromised effective training. Affordability and cost-effectiveness of innovative bubble CPAP systems were identified as frequently mentioned facilitators of implementation of CPAP in newborns.

In the other research done to describe the operational aspects of continuous positive airway pressure (CPAP) use in newborn care in Kenya, there were ongoing nationwide survey of all health facilities in Kenya that use CPAP in

newborn care. The mixed method approach used includes a standard questionnaire to describe CPAP use; key informant interviews and focus group discussions with the health care providers, to explore facilitators and barriers to CPAP use in newborn care.

Descriptive statistics are used to analyze the quantitative data and a thematic framework is used to analyze the qualitative data. Only (78%) of the newborn care units had a doctor or nurse who had received training on the use of CPAP, and this was often on the job clinical training. The main barriers to CPAP use in newborn care were inadequate training of health care providers on the use of CPAP, health care provider strikes and staff shortages, and inadequate support with management of equipment when donor support ended. The main facilitators were good leadership both at the unit and facility level that supported the sustainability of CPAP use in newborn care and peer support from careers whose newborns had survived following CPAP use [26].

3. RESEARCH OBJECTIVES

3.1 General objective

- To identify Barriers and self-reported practices towards the use of CPAP machine in newborns among Pediatrics resident's at Tikur Anbessa Specialized Hospital

3.2 **Specific objectives: -**

- To assess the knowledge about CPAP usage in NICU among resident's
- To describe perceived barriers affecting usage of CPAP in NICU
- To address the self-reported practices of CPAP safety Check lists in NICU.

4. Methodology

4.1. Study Area: The study will be conducted in Tikur Anbessa specialized Hospital at Addis Ababa, Ethiopia.

Addis Ababa is the capital city of Ethiopia. Tikur Anbessa Specialized Hospital (TASH) is the country's largest teaching and the tertiary hospital. TASH is situated at the heart of the capital city on Churchill Avenue. The hospital is the largest teaching hospital in the country providing undergraduate as well as postgraduate teaching service in addition to other two pillars of teaching hospital such as clinical service for patients from all corners of the country and problem-solving researches on thematic areas. It hast more than 900 beds and offers diagnosis and treatment for approximately 500,000 patients a year.

TASH NICU is located in the sixth floor of the building. It is staffed with consultants, pediatricians, residents, interns, nurses, nursing residents and other supportive stuffs. The unit has 41 beds at NICU (preterm, term, kangaroo care) with more than 250 inpatient cases/month being managed. Outpatient services are given in high-risk infant clinic with average 300 patients/month and EPI clinic.

4.2. Source Population: - Pediatrics' residents practicing in TASH.

4.3. Study Population: Those pediatrics residents who practiced in NICU at TASH in their specialty training and involved in health care service for neonates during the study period.

4.4. Study Subjects: All pediatrics residents' practicing in TASH during the study period that fulfills the inclusion criteria.

4.4.1. Inclusion criteria: - Those Pediatrics residents practicing in TASH who are involved in health care service for neonates and give informed consent.

4.4.2. Exclusion criteria: Those Pediatrics residents who cannot give informed consent.

4.5. Study Design

Cross sectional study design will be to assess barrier's and self-reported practices towards the use of Continuous Positive Airway Pressure (CPAP) in newborns among Pediatrics Resident's at Tikur Anbessa Specialized Hospital in Addis Ababa, Ethiopia.

4.6.1 Sample Size

was determined using a sample size for small populations formula based on the assumption mentioned below.

$$n = \frac{N z^2 pq}{\left(E^2 (N-1) + z^2 pq\right)}$$

P = 14.8 % (proportion of Health care workers who used CPAP machine in NICU practice.) Since the population is small a sampling size for small population used. A confidence level of 95 %, E is 0.05 Z is set to 1.96 and the required sample size equals to 112.

4.6.2 Sampling Procedure

Since there are total of 113 Pediatrics and Child Health resident's and all were included in the study.

4.7. Data Collection tool

Self-administered standardized questionnaire were prepared after extensive literature review on the topics and was revised to fit into our setup. Data was collected from pediatrics and Child Health residents of TASH by the Principal investigator and two assistant Intern Doctors. The data collection was supervised by the Principal Investigator.

4.8. Data quality assurance

The completeness of questionnaires was checked every day by investigator before actual data analysis and interpretation.

4. 9. Data Analysis

Data were cleaned and entered in to a computer. All analysis was conducted using SPSS for windows version 25. Continuous data reported as the mean and standard deviation and categorical data, in percent. Descriptive statistics was used to describe the frequencies, percentages and rate to calculate the mean and Standard deviation.

4. 10. Study variables

4.10.1. Dependent variable

- Knowledge, self-reported practices and barriers regarding CPAP usage

4.10.2. Independent variables

- Age, Sex, Job training on neonatal CPAP usage

- Year of experience in Neonatal care

- Extra training and lectures

-Year of residency/specialization

- Practice in NICU before residence

4.11. Operational definitions

Knowledge status of residents: -

The respondents' overall knowledge was assessed using Bloom's cutoff point method, and classified into: -

High level of knowledge if the score was between 80 and 100%, moderate level of knowledge if the score was between 60% and 79% and poor knowledge if the score was <60%.

Practice of CPAP also assessed using Bloom's cutoff point method into high, moderate and low level of practice.

The practice of CPAP safety checklists was computed using five-point Likert scale. The respondents' overall practice was then categorized using Bloom's cutoff point method into Good, moderate and Poor practice accordingly.

4.12. Ethical Approval

Ethical approval was obtained with written permission from the Department Research and Publication Committee, at Addis Ababa University College of Medicine and health science so that the department of pediatrics and child health to carry out the study.

The data were collected anonymous which do not include names of individual participant and any other personal identifiers. The objectives of study were explained to the participants and a consent obtained from each respondent prior to data collection. The participation was entirely voluntary and confidentiality of the responses are duly maintained.

4.13. Dissemination of Result

The findings of the study will be shared with the staff, authorities and officials in the department of Pediatrics and Child Health at TASH in order to enhance appropriate interventions.

It will be presented on the annual research conference of the department. Finally, the result of the study will be attempted to be published in medical journals.

5. RESULT

5.1 Socio-demographic characteristics of participants

Of **113** Pediatrics and Child Health residents whom we approached at Addis Ababa University School of medicine who are actively enrolling,**112** were willing to participate in the study, which gave the response rate of **99.1** %.
Of this **112** Responses were complete and are valid for analysis. And so, one hundred and twelves Pediatrics and Child Health residents participated in the study with mean age of 28.93 years.

Eighty-nine respondents (79.5%) were between 25 and 30 years-old. Males accounted 71% and female accounted 63.4% with male: female ratio of 1.7:1. Among the participants 51 were Pediatrics first year resident accounted for 45.5%, Second year accounted for 32.2 and the rest 25.3 % contributed by third year residents. One hundred and six (94.6%) of the respondents had less than one year of working experience in neonatal intensive care unit before residence.

Table 1: Socio demographic Characteristics of Resident's

Description	Category	Frequency (n=112)	Percent (%)
Sex	Male	71	63.4
	Female	41	36.6
Age	25- 30 years	89	79.5
	31- 35 years	18	16.1
	Above 35 years	5	4.5
Religion	Orthodox	19	71.2
	Muslim	9	8
	Protestant	21	18.8
	Catholic	1	
	Others	2	
Marital Status	Single	71	63.4
	Married	40	35.7
	Divorced	1	
Years of Residency	1st Year	51	45.5
	2nd Year	36	32.2
	3rd Year	25	22.3
Year of Experience in NICU	Less than 1 year	106	94.6
	1 – 3 years	2	
	> 3 Years	4	

5.2 Participants' knowledge on CPAP in newborn

The research showed that **34.8%** of the Pediatrics residents have high level of knowledge where as **7.1%** of Pediatrics residents have poor knowledge.

Table 2: Knowledge of CPAP in newborns among Resident's using bloom's original cutoff points.

Variables	Frequency	Percentage
High	39	34.8
Moderate	65	58.1
Poor	8	7.1

Table 3.1: Knowledge assessment questionnaires and resident's responses

General information and uses of CPAP for newborns		Frequency (n=112)	Percentage
Maintenance of an increased trans pulmonary pressure during the inspiratory & expiratory phase of respiration.	yes No No idea	97 8	86.6 7.1
It is used for patients with respiratory distress syndrome.	Yes No	112 -	100 -
The Machine uses for treat Apnea of premature babies.	Yes No	100 12	89.3 10.7
It can be used in case of premature baby with respiratory dysfunction and bradycardia movement.	Yes No No idea	93 15 4	83.0 13.4 3.6
If the child has bleeding in the upper gastrointestinal tract CPAP can used.	Yes No No idea	26 61 25	23.2 54.5 22.3
It works to increase the effort during the process of breathing	Yes No No idea	66 44 2	58.9 39.3
It Conserves surfactant	Yes No No idea	72 36 4	64.3 32.1
It Increase the lung compliance	Yes No No idea	102 9 1	91.1 8
Early initiation of CPAP has comparable efficacy with Exogenous Surfactant therapy in neonate with RDS	Yes No No idea	105 2 5	93.8
The machine is not effective in the case of meconium aspiration.	Yes No No idea	45 63 4	40.2 56.3
Feeding shouldn't be initiated while newborn is on CPAP	Yes No No idea	20 90 4	17.9 80.4
Nasogastric tube should be inserted while the newborn is on CPAP	Yes No	96 16	85.7 14.3

Table 3.2 Contraindications and complications to CPAP device usage

Contraindications and complications to CPAP device usage	Frequency (n=112)		Percentage
There is no mind to use the machine despite of the certain birth defects in the respiratory tract of a child its present, such as cleft lips or cleft palate.	Yes	33	29.5
	No	64	57.1
	No idea	15	13.4
It can be used in case of severe cardiovascular instability, such as low blood pressure	Yes	41	36.6
	No	61	54.5
	No idea	10	
If the child is unconscious and does not respond to stimuli cannot use the CPAP machine in this condition.	Yes	60	53.6
	No	49	43.8
	No idea	3	
If the child has surgery in the stomach it does not affect the use of CPAP machine.	Yes	31	27.7
	No	70	62.5
	No idea	11	
CPAP cannot be used together with the Nebulizer.	Yes	22	19.6
	No	68	60.7
	No idea	22	
It contraindicates the use of machine in the case of congenital pneumonia.	Yes	13	11.6
	No	86	76.8
	No idea	13	
Abdominal distention is one of the most complications that can be happen.	Yes	105	93.8
	No	7	

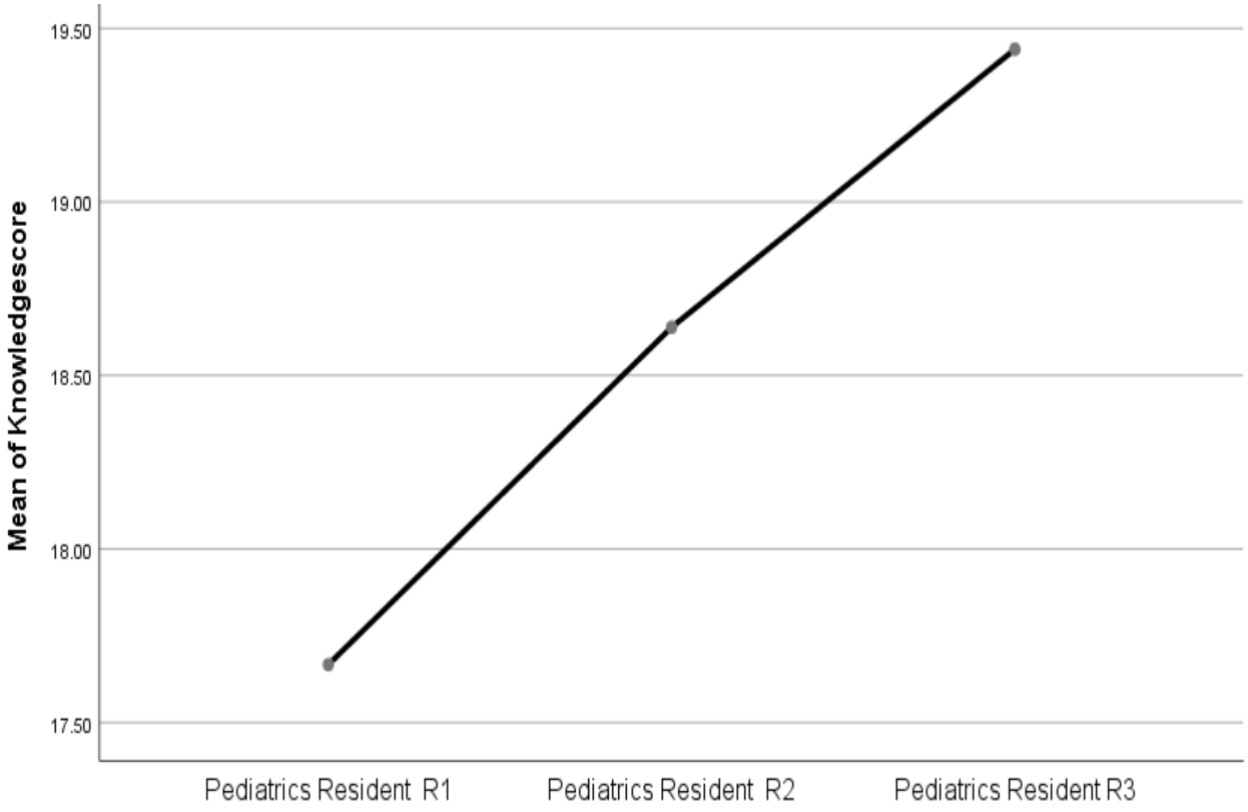
Table 3.3: - Fundamentals in the use of CPAP machine in newborn

Fundamentals in the use of CPAP machine	Frequency (n=112)		Percentage
Pressure for treatment of RDS should be start at 4 Cm H2O	Yes	35	31.3
	No	75	67.0
	No idea	2	
Pressure for treatment of Apnea of Prematurity should be start at 5 Cm H2O.	Yes	93	83.0
	No	16	14.3
	No idea	3	
The sign for CPAP failure in the treatment of RDS is worsening respiratory distress or hypoxemia.	Yes	109	97.3
	No	3	
Recurrent episodes of apnea are not a sign for CPAP failure in the treatment of Apnea of prematurity.	Yes	29	25.9
	No	76	67.9
	No idea	7	
The appropriate position while using the CPAP should be lifting the head and put a pillow under it.	Yes	61	54.5
	No	49	43.8
	No idea	2	
There is no need to match the size of the probe with a premature baby's nose.	Yes	111	99.1
	No	1	

One-way analysis of variance (ANOVA) was done to explore differences in Knowledge score with age, sex, marital status, year of residency and year of experience in NICU before residence.

There was significant difference in knowledge score between residents with different Year of residency (: F (2, 109) 4.23**, p= 0.011)**

Sex, age, marital status and year of experience in NICU before residence had no significant association with knowledge score with P values (**P = 0.426, 0.746, 0.36,0.56**) respectively, but year of residency had significant association with level of knowledge of CPAP (**p= 0.011**).



5.3 Barrier's and self-reported practice's in the use of CPAP in NICU

57.1% (64/112) of participants have any form of formal teaching, learning or training session on CPAP in their Newborn care practice. And Only **15.2 %** (17/64) thought the teaching or training session on CPAP is adequate for treating preterm with RDS in their newborn practice. 80.4 % of residents used improvised water bottle system (locally made), 19.6% use commercial CPAP machine and the use of mechanical ventilation in Neonatal intensive care unit is nil.

The main barrier's for using improvised water bottle system (locally made) is lack of Commercial bubble CPAP machine in NICU which accounts for 88.4%. Availability of CPAP machine, availability of oxygen and availability of nasal prongs are the main perceived barrier's affecting the use of CPAP in NICU. **95.5%** of participants thought that the available commercial bubble CPAP machine in NICU is not adequate for treating newborns in their practice.

Table 4: - Barrier's in Practicing CPAP in NICU

		Frequency	Percentage
Used CPAP	Improvised water bottle system (locally made)	90	80.4
	Commercial CPAP machine	22	19.6
	Mechanical Ventilation CPAP mode		
Reasons to use Improvised water bottle system			
	Lack of Commercial CPAP machine	77	88.4
	Lack of Commercial CPAP and Easy to prepare	11	
	Easy to prepare	2	
	Others	1	
Factors affecting the use of CPAP			
	Availability of Oxygen	4	3.6
	Availability of CPAP Machine	19	17
	Availability of nasal prong		
	Shortage of staff and work load	2	1.8
Availability of Oxygen + Ava. of CPAP +Ava. of nasal prong		23	20.5
Availability of Oxygen + Availability of CPAP Machine		17	15.2
Combination all		12	10.7
Usage appropriate size nasal prong for preterm	yes	69	61.6
	No	43	38.4
Reasons for not using appropriate size Nasal prong			
	Unavailability of appropriate size	37	86
	Unavailability of appropriate size and Searching is time consuming	4	
	Searching is time consuming	2	

5.4 The practice of CPAP safety checklist

Results showed that **58.9%** of the respondents have high level of practice and **4.5%** have poor practice about addressing CPAP safety check lists.

Table 5. 1 Practice of CPAP Safety Checklists in newborns among Resident's using bloom's original cutoff points.

Variables	Frequency	Percentage
Practice level		
High	39	34.8
Moderate	65	58.1
Poor	8	7.1

Table 5.2 Frequency of CPAP safety checklists

Frequency of use of CPAP safety Check Lists (n-112)					
CPAP safety check Lists	Never	Rarely	Sometimes	Usually	Always
Checking oxygen and air flow rate is set correctly	4		15	48 42.9%	45 40.2%
Assessing RR, breathing pattern and saturation hourly	6	11	36 32.1%	40 35.7 %	19
Verifying appropriate nasal prong size and placement	4	10 8.9%	30 26.8%	33 29.5%	35 31.3%
Assessing nares blockade and consider suctioning	3	1	15 13.4 %	54 48.2%	39 34.8%
Checking for water in CPAP tubing	3		17	52 46.4%	40 35.7%
Check for CPAP bubbling in the chamber	3		11	36 32.1%	62 55.4%
Check auto corrugated CPAP tubing is connected and fixed in place	3	4	22 19.6	38 33.9 %	45 40.2%

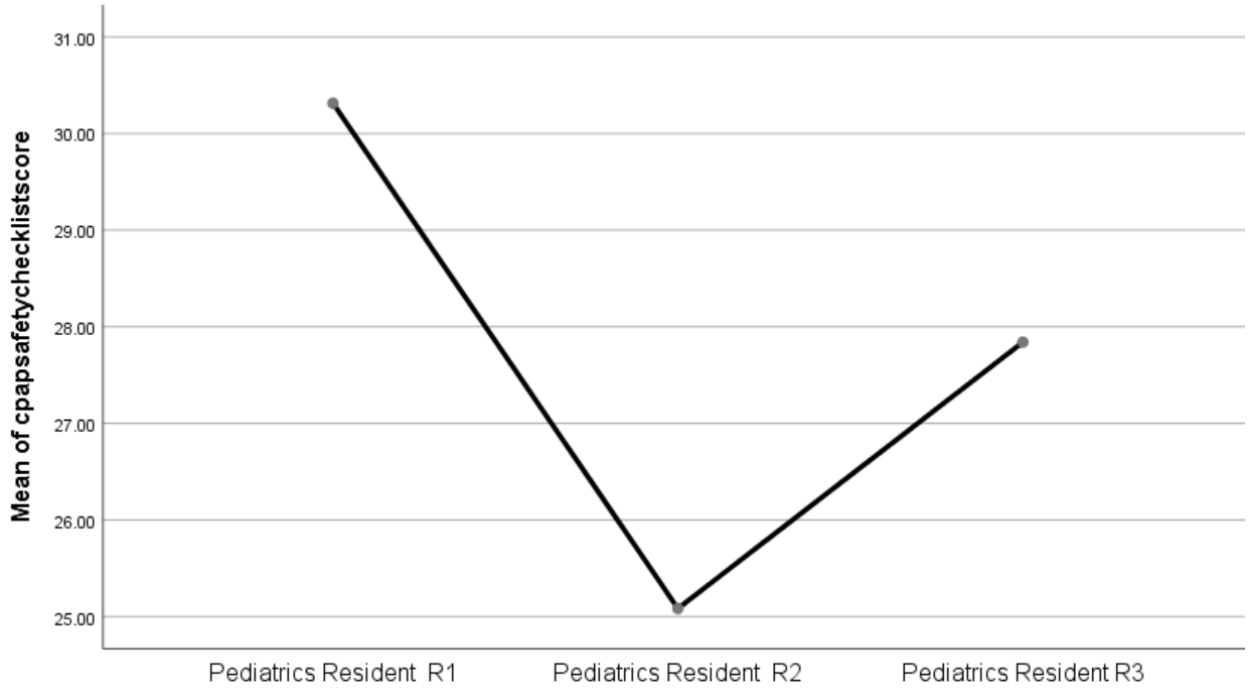
Results revealed that **t**here was significant difference in the practice of CPAP safety check lists between residents with different Year of residency (: F (2, 109) = 12.836 P = 0.001). And there was no significant difference in the practice of CPAP among residents with Knowledge level (: F (11, 100) = 0.891 P= 0.413).

Ordinal Regression was done to assess the significance estimate differences in the practice of CPAP by year of residency and knowledge level. The practice of addressing CPAP safety checklists is three times more likely to practice in the first-year pediatrics resident's than third year residents. (Estimates 1.162, **OR-3**).

5.3 Ordinal regression CPAP safety checklists practice vs Year of residency

Location	Estimates	df	Sign.
Year 1 residency	**1.070**	**1**	**0.016**
Year 2 residency	**-0.847**	**1**	**0.069**
Year 3 residency	**0***		
Poor Knowledge	**0.432**		**0.532**
Moderate Knowledge	**0.289**		**0.422**
High Knowledge	**0***		

0*= parameter is set zero – reference.


Mean of cpapsafetychecklistscore
31.00
30.00
29.00
28.00
27.00
26.00
25.00
Pediatrics Resident R1
Pediatrics Resident R2
Pediatrics Resident R3

6. DISCUSSION

This study revealed that **34.8%** Pediatrics and Child Health Residents achieved high Level of knowledge, **58.1%** of the residents have moderate knowledge and **7.1** % have Poor Knowledge about the CPAP in their NICU practice. Most of the TASH Pediatrics and Child Health residents achieved high knowledge scores (34.8%), Moderate Knowledge (58%) when compared to other studies.

Wilson Paulo Lomnyack, Tumbwene Mwansisya, Stewart Mbelwa, Kahabi Isangula and Zephania Saitabau Abraham, 2020 showed that 45 percent of nurses had moderate knowledge about CPAP machine usage. (*Knowledge about continuous positive airway pressure machine usage among nurses at a tertiary hospital in Tanzania, 2020*). And Dr. Afifa Radha Aziz, Murtadha Abbas Abdul-Hamza, 2017 showed that Nurses have Poor Knowledge towards the CPAP machine in NICU at Al-Diwanyia City,Iraq (*Assessment of nurses ' knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit at Al-Diwanyia City,2017*)

The Self-reported practices revealed that 57.1**%** of the respondents have any form of formal teaching, learning or training session on CPAP in their Newborn care practice and only **15.2 %** thought the teaching or training session on CPAP is adequate for treating newborns with RDS.
58.9% of the respondents have high level of practice regarding the addressing the CPAP safety checklists and **4.5%** have poor practice of addressing CPAP safety checklists.

This research while addressing the perceived barriers towards the use of CPAP in NICU showed that **80.4%** of Participants used locally made improvised water bottle system. The main factors/reasons for using improvised water bottle system is lack of Commercial bubble CPAP machine in NICU which accounts for **88.4%.** Availability of CPAP machine, availability of oxygen and availability of nasal prongs are the other combined perceived barrier's affecting the use of CPAP in NICU. According to the research the most common perceived barriers are Availability of Oxygen, CPAP machine and nasal prong accounted for 20.5%, availability of CPAP machine -17%, availability of CPAP Machine and availability of Oxygen accounted 15.2%, availability of Oxygen (alone) accounts 3.6 % and shortage of staff and work load contributed for the 1.8 %.

These barriers are also described by other researchers. Kondwani Kawaza, 2020 showed that reliable availability of equipment, difficulties engaging and informing caregivers and staffing shortages were frequently mentioned barriers to the implementation of bubble CPAP in Sub-Saharan Africa. *(Barriers and facilitators to implementing bubble CPAP to improve neonatal health in sub-Saharan Africa: A systematic review)*

7. CONCLUSION

Most of the residents achieved moderate and high knowledge level about the CPAP usage in NICU. The self-reported practice of addressing CPAP safety check lists were suboptimal. The most common reported barriers to the usage of CPAP at NICU are availability of CPAP machine, availability of oxygen, availability of nasal prong and shortage of staff. Only **15.2 %** resident's thought that teaching or training session on CPAP is adequate for treating preterm with RDS.

8. Limitations of the study

This study was limited by its reliance on self-report. The study was done in only one tertiary hospital and the results may not be reflective of all physicians in Ethiopia. However, the results can be assumed to be the true reflection of the current practice of CPAP in NICU given the fact that the survey was carried out at the nation's biggest teaching tertiary hospital where both surgical and medical service are given for neonates.

9. Recommendations

The current findings suggest that there is significant room for improving CPAP usage in NICU by optimizing teaching and training session on CPAP, by enhancing and increasing the knowledge and practice of health care workers, tackling perceived barrier's that hamper the practice of using CPAP, preparing manuals that can be a guide for fostering CPAP usage and creating a smooth working environment for experience sharing among health workers practicing in NICU.

Finally, future research should entail on comprehensive evaluation of clinical practice through direct observation, interviews, and/or prospective audits.

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APPENDIX: DATA ABSRACTION SHEET
HOSPITAL NAME: ----------

PART I: Socio demographic characteristics of the respondent's

	Question	Alternative choice of response
1.	Sex	A. Male B. Female
2.	Age	A 25-30 B 30-35 C35-40 D > 4o years
3.	Religion	A. Orthodox B. Muslim C. Protestant D. Catholic E. other
4.	Years of experience before residence	A < 1year B. 1- 5 years C. 5-10 years D. > 10 years
5.	Year of experience in Neonatal intensive care unit	A. Less than a year B. 1-5 years C. 5-10 years D. >10 years
6.	Marital status	A. Single B. Married C. Widowed D. Divorced
7.	Profession	A. Pediatrics Resident R1 B. Pediatrics Resident R2 C. Pediatrics Resident R3

Part II- Knowledge Assessment

Part II- A: - General information and uses of CPAP for newborns

Questions	Yes	No	I have no idea
1.1 Maintenance of an increased (positive) trans pulmonary pressure during the inspiratory & expiratory phase of respiration.			
1.2 It is used for patients with respiratory distress syndrome (RDS).			
1.3 The Machine uses for treat Apnea of premature babies.			
1.4 It can be used in case of premature baby with respiratory dysfunction and bradycardia movement.			
1.5 If the child has bleeding in the upper gastrointestinal tract CPAP can used.			
1.6 It works to increase the effort during the process of breathing			
1.7 It Conserves surfactant			
1.8 It Increase the lung compliance			
1.9 Early initiation of CPAP has comparable efficacy with Exogenous Surfactant therapy in neonate with RDS			
1.10 The machine is not effective in the case of meconium aspiration.			
1.11 Feeding shouldn't be initiated while newborn is on CPAP			
1.12 Nasogastric tube should be inserted while the newborn is on CPAP			

Part II- B- Contraindications to use device (CPAP) for newborn and premature babies

Questions	yes	no	I have no idea
2.1 There is no mind to use the machine despite of the certain birth defects in the respiratory tract of a child its present, such as cleft lips or cleft palate.			
2.2 It can be used in case of severe cardiovascular instability, such as low blood pressure.			
2.3 If the child is unconscious and does not respond to stimuli, cannot use the (CPAP) machine in this condition.			
2.4 If the child has surgery in the stomach, that does not affect the use of CPAP machine.			
2.5 CPAP cannot be used together with the Nebulizer.			
2.6 It contraindicates the use of Machine in the case of congenital pneumonia.			
2.7 Abdominal distention is one of the most complications that can be happen.			

Part II –C- Fundamentals in the use of CPAP

Questions	yes	No	I have no idea
3.1 Pressure for treatment of Respiratory Distress Syndrome (RDS) should be start at 4 Cm H2O.			
3.2 Pressure for treatment of Apnea of Prematurity (AOP) should be start at 5 Cm H2O.			
3.3 The sign for (CPAP) failure in the treatment of respiratory distress syndrome is worsening respiratory distress and/or hypoxemia.			
3.4 Recurrent episodes of apnea is not a sign for CPAP failure in the treatment of Apnea of premature infants.			
3.5 The appropriate position for the child when using the CPAP machine be lifting the head and put a pillow under it.			
3.6 There is no need to match the size of the probe with a premature baby's nose.			

PART III; BARRIERS and self-reported practice's in the use of CPAP

A- General self-reported practices in the NICU

1. Have you had any form of formal teaching, learning or training session on CPAP in your practice?

A. Yes

B. No

1.1 If your answer is 'YES' in the above questions, have you had a practical teaching session with the equipment's?

A. yes B. No

1.2 Do you think the training on CPAP is adequate for treating preterm with RDS in your practice?

A. yes B. No c. neutral

2. Do you use appropriate size nasal prong for preterm while you put on CPAP?

A. Yes B. NO

2.1 If your answer is NO, what is the reason behind?

A. Lack of appropriate size (availability) B. searching is time consuming

C. OTHERS (please Specify)

3. Which CPAP do you use **MOST** of the time?

A. improvised water bottle system (locally made) B. Commercial bubble CPAP machine C. Mechanical ventilation with CPAP mode

3.1 If your answer is 'A' in the above questions, why you use improvised water bottle system?

A. Lack of commercial CPAP machine B. easy to prepare

4. Do you think the available **commercial bubble CPAP** machine at NICU are enough for those in need of it?

A. yes B. NO

5. What factors affect your use of CPAP in your practice (MORE THAN ONE ANSWER IS POSSIBLE?)

A. availability of Oxygen

B. availability of water bottle

C. Availability of CPAP Machine

D. Availability of nasal prong

E. Shortage of staff and work load

5. Do you put ALL preterm newborns on CPAP?

A. yes B. NO

5.1 How often do you use the Downe Scoring System before you put on CPAP?

A) Sometimes B. Usually C. Most of the time D. Always

6. What is your preferred saturation of oxygen while you put on CPAP?

A. 88-95% B. 90- 93% C. 92-95% D. 95-98% E. 97- 100%

7. Did you **usually** inform to the family about the possible acute complications of CPAP?

A. YES B. NO

7.1 If YES in the above complications, which one do you inform to the family (Encircle and more than one answer is possible)

A. Nasal trauma

B. Pneumothorax

c. Abdominal Distention

D. I usually didn't tell to the family

7.2 Have you ever informed the family about the possible Long term complications of CPAP like prematurity of retinopathy, if the newborn stayed on CPAP for long time/more than a week?

A. yes B. No

8. From your experience do you think the use of non-invasive CPAP decreases the chance of being put on invasive support/Mechanical ventilation?

A. yes B. No C. neutral

9. Do you think availing CPAP machine and continuous training on the use of CPAP will help to decrease neonatal mortality in the country?

A. Yes B. No C. Neutral

Part III- Questions specific for CPAP safety Check List

10. Addressing CPAP Safety **check lists**-self reported practice in NICU

parameters	**Never**	**sometimes**	**Usually**	**Often**	**Always**
10.1 Checking oxygen and air flow rate are set correctly					
10.2 Assessing Respiratory rate and breathing pattern and saturation hourly					
10.3 Verifying appropriate nasal prong size and placement					
10.4 Assessing nares blockade and consider suctioning					
10.5 Checking for water in CPAP tubing					
10.6 Check for CPAP bubbling in the chamber					
10.7 Check auto corrugated CPAP tubing is connected and fixed in place					