NURSES' KNOWLEDGE, CHALLENGES, AND SOLUTIONS ON THE CARE OF PREMATURE INFANTS: A MIXED METHOD STUDY IN THE REFERRAL AND TERTIARY HOSPITALS IN DAR ES SALAAM

Mwajuma Mwikali Mwamtenda (MD)

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By

Mwajuma Mwikali

A Dissertation Submitted in (partial) Fulfilment of the Requirements for the Degree of Master of Medicine (Paediatrics and child health) of

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for examination of thesis/dissertation entitled ***Nurses knowledge, Challenges and Solutions on the care of premature infants: a mixed method study in the referral and tertiary hospitals in Dar es salaam,*** in fulfillment of the requirements for the degree of Master of Medicine (Paediatrics and child health) of Muhimbili University of Health and Allied Sciences.

_____

Dr. Emmanuel Munubhi

(Supervisor)

Date: _____

_____

Dr. Nahya Salim

(Co-Supervisor)

Date: _____

_____

Dr. Isabella Sylvester

(Co-Supervisor)

Date: _____

DECLARATION AND COPYRIGHT

I, Mwajuma Mwikali Mwamtenda, declare that this dissertation is my original work and it has not been presented and shall not be presented to any other University for a similar or any other degree award.

Signature..... **Date…….....**

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To my children, thank you for being patient with me as I chase my dreams. I too will be there to see you achieve yours. To my husband thank you for always believing in me when I always doubted myself.

May God bless you for all you have done and may He reward your every support given to me in ways you could never imagine.

DEDICATION

I would love to dedicate my work to my parents Bakari Mwamtenda and Faiza Mwamtenda, my brothers and sisters, my husband and my children. Thank you for everything.

ABSTRACT

Background: There has been an increase in preterm births of about 2% in the past 14 years (2000-2014) mainly from Asia and Sub-Saharan Africa. With prematurity on the rise so will the complications related to it both short term and long term. Nursing care is very crucial in these vulnerable babies and a lack of knowledge of health care providers is a contributing factor to morbidity and mortality. With the increase of preterm births, nurses' knowledge adequacy, challenges and solutions on their care needs to be affirmed.

Objective: Main aim of the study was to assess the nurses' knowledge in the care of premature infants, to determine their challenges and solutions in acquiring the knowledge.

Material and Methodology: A mixed method study was conducted between September 2020 to January 2021 in the neonatal units of four hospitals in Dar es Salaam. A cross sectional study was conducted to determine adequacy of nurses' knowledge on selected domains for the care of premature infants and a phenomenological study design using focus group discussions explored on the perceived challenges and solutions in acquiring the on job training. Self-administered structured questionnaire was used and adequacy of knowledge was set at 50% or more for the three main domains 1) Essential newborn Care 2) Infection prevention and management 3) Special care and monitoring for the preterm infants. Focus group discussion were conducted using a structured interview guide focusing on challenges and solutions towards achieving knowledge on the care of preterm infants. Quantitative data were analyzed using SPSS Version 23 and qualitative data were thematically categorized using pre identified codes. Common emerging themes towards the challenges and solutions were identified in relation to the three main domains.

Results: Among the 52 Neonatal Intensive Care Unit (NICU) nurses who participated in this study, 9 (17%) were from Amana regional referral hospital (RRH), 8 (15%) from Mwananyamala RRH 10 (19%) from Temeke RHH, and25 (48.1%) from Muhimbili National Hospital (MNH), Upanga. At the time of the study, almost 55.8%of the nurses had never received any on job training on care of premature infants. Adequate knowledge among the

studied nurses was found to be 94% in essential newborn care, 80.8% in infection prevention and management and 36.5% on special care and monitoring of preterm infants. Being a female nurse, being older than 41 years old and working in the neonatal unit for at least 1-3 years were more likely to determine adequacy of knowledge in infection prevention and management although not statistically significant. The main challenges in acquiring knowledge were lack of scheduled on job training for both knowledge updates and operation of equipment and work overload for nurses in the unit. Hospital and Government commitment was recommended to ensure frequent continuous medical education (CME) for all nurses and encourage mentorship within and between hospitals. Increasing number of nurses would facilitate participation in training.

Conclusion: Most nurses had not attended training on the care of premature infant, and compared to other domains, special care and monitoring was poorly performed. Nurses that were female, those who were older than 41 years and those who worked for one to three years were more likely to have adequate knowledge on infection prevention and management. One of the major challenges faced by the nurses is not being able to attend training due to limited staffing and lack of scheduled on job training covering all staff.

Recommendations: Continuous medical education should be emphasized specifically on special care and monitoring of premature infants. Nurses older than 41 years,Female Nurses and those with one to three years of experience should be considered when planning for mentorship program within and between hospitals. Observational studies with a larger sample size should be conducted to assess both nurse's knowledge and skills concurrently on the care of preterm infants.

MUHTASARI

Utangulizi: kiwango cha watoto njiti wanaozaliwa kimeongezeka asilimia mbili kwa kipindi cha miaka kumi na nne.Wengi wao wanatoka bara Asia na Africa(jangwa la Sahara). Kadri watoto hawa njiti wanapoongezeka nazo changamoto wanazokuwa nazo (za mda mfupi na mda mrefu) kwa sababu ya hali yao, nazo zinaongezeka. Wauguzi wana nafasi kubwa katika kuwahudumia watoto hawa. Kutokuwa na Elimu saa hiihii ya kuwahudumia, inachangia sana pakubwa katika kuumwa kwao na vifo vyao. Elimu ya waaguzi katika kuwahudumia watoto hawa njiti lazima ithibitishwe kuwa ya kutosha na zaidi ni kuweza kujua changamoto wanazopata na suluhisho wanazopendekeza kuboresha elimu yao.

Lengo la utafiti: kujua kiwango cha elimu ya waaguzi katika kuwahudumia watoto njiti, kufahamu changamoto wanazopitia and suluhisho katika kuboresha elimu yao.

Mbinu na ukokotoaji wa twakimu: Mchanganyiko wa utafiti kwa kutumia maswali na mjadala na wauguzi ulitumika.Hospitali husika zilikuwa za rufaa(Temeke, Mwananyamala na Amana) na ya kitaifa(Muhimbili) zilioko Dar es Salaam. Ulifanyika kati ya mwezi wa septemba 2020 na January 2021. Utafiti kwa kutumia maswali lilikuwa kwa ajili ya kutambua elimu ya wauguzi kuhusiana na huduma wanazotoa kwa watoto njiti. Kwa kila kitengo(huduma muhimu za watoto wachanga,mbinu za kuzuia na kutibu magonjwa ya maambukizi na utunzaji maalum na ufatiliaji wa watoto njiti). Waliopata maswali saa hiihii zaidi ya maswali asilimia hamsini kwa kila kitengo ,walitambulika kuwa na elimu ya kutosha. Tulitumia kiwango cha uwiano kutambua viashiria vya elimu ya kutosha kwa wauguzi kwa kutumia SSPS toleo la 23. Majadiliano baina ya mtafiti na wauguzi yali tambua changamoto na suluhisho wanazopata kuboresha elimu yao kwa kutumia maswali yalioyoundwa kutokama na maswali waliyojibu awali.

Matokeo: Wauguzi 52 wanaofanya katika kitengo cha watoto wachanga waliweza kushiriki katika utafiti wa kujibu maswali. 9(17%) walitoka hospitali ya rufaa ya Amana, 8(15%) walitoka Mwananyamala, 10(19%) walitoka Temeke na 25(48.1%) walitoka hospitali ya taifa Muhimbili. 55.8% kati ya wauguzi hawa, walikuwa hawaja hudhuria mafunzo ya watoto njiti. Wauguzi 94%

walikuwa na elimu ya kutosha ya huduma muhimu za watoto wachanga, 80.8% walikuwa na elimu ya kutosha ya kuzuia na kutibu magonjwa ya maambukizi na 36.5% walikuwa na elimu ya kutosha ya utunzaji maalum na ufatiliaji wa watoto njiti. Muuguzi aliye na umri zaidi ya arubaini, aliye mwanamke na aliyefanya kazi kwa wodi ya kuwahudumia watoto njiti kwa miaka moja hadi tatu walikuwa na uwezekano zaidi wa kuwa na elimu ya kutosha ya kuzuia na kutibu magonjwa ya maambukizi. Changamoto zilizogunduliwa katika utafutaji wa elimu ni kutokuwepo kwa mafunzo ya kutosha wakati wanapokuwa kazini, kutokuwa na elimu ya kisasa ya kutumia vifaa vilioko wodini, na upungufu wa waaguzi kulingana na kazi nyingi. Walipendekeza ushirikiano wa hospitali na serikali kuhakikisha uendelezaji wa elimu kwa waaguzi. Kuwahusisha waaguzi katika kuhakikisha uendelezaji wa mafunzo baina ya wauguzi na kuongeza idadi ya wauguzi kazini.

Hitimisho: Wauguzi wengi walikuwa hawaja hudhuria mafunzo ya kuwahudumia watoto njiti walipokuwa kazini. Waaguzi wengi walikuwa na upungufu wa elimu ya utunzaji maalum na ufuatiliaji wa karibu wa watoto njiti. Waaguzi wa kike, waliokuwa na umri zaidi ya arubaini na moja na waliofanya kazi kuwahudumia watoto njiti kwa mwaka mmoja hadi miaka mitatu walikuwa na uwezo wa kuwa na elimu ya kutosha ya kutibu na kuzuia magonjwa ya maambukizi. Kati ya changamoto wanazopata wauguzi ni kutoweza kuhudhuria mafunzo ya kutosha kwa sababu ya upungufu wa wauguzi na kutokuwa na mpangilio mzuri wa kuwawezesha wauguzi wote kuhudhuria mafunzo haya.

Mapendekezo: Mafunzo endelezi ya utunzaji maalum na ufuatiliaji wa watoto njiti yanapendekwa kwa wauguzi wote. Waaguzi wakike, waliofanya kazi kati ya mwaka mmoja na miaka mitatu na waaguzi zaidi wa umri arubaini na moja wanafaa kuhusishwa katika mafunzo haswa ya kuzuia na kutibu magonjwa ya maambukizi ndani na kati ya hospitali nyengine. Uchunguzi kwa uangalifu wa wauguzi zaidi ya waliohusika kwa utafiti huu unahitajika ili kuwezesha kujua elimu wanayo pamoja na utenda kazi saa hiihii katika kuwahudumia watoto njiti

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ANO	Assistant Nursing Officer
CCBRT	Comprehensive Community Based Rehabilitation in Tanzania
CNS	Central Nervous System
CPAP	Continuous Positive airway pressure
EN	Enrolled nurse
ENC	Essential Newborn Care
FGD	Focus Group Discussion
GA	Gestational Age
IPM	Infection Prevention and Management
IVH	Intraventricular Hemorrhage
KMC	Kangaroo Mother Care
LBW	Low Birth Weight
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
NEC	Necrotizing Enterocolitis
NGT	Nasogastric Tube
NICU	Neonatal Intensive Care Unit
NMR	Neonatal Mortality Rate
NO	Nursing Officer
RRH	Regional Referral Hospital
SDG	Sustainable Developmental Goals
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

DEFINITIONS OF TERMS

Premature infant	live-newborn delivered before 37 weeks from the first day of last menstrual period
Adequate knowledge	when more than 50% of questions in each domain is answered correctly
Inadequate knowledge	when less than 50% of questions in each domain are answered correctly.
Special care	extra care provided to the premature infants while admitted in the neonatal unit to detect and manage short-term complications.
Essential newborn care	comprehensive strategy designed to improve the health of newborns soon after birth

1.0 INTRODUCTION

1.1 Background

According to WHO a preterm is a baby born less than 37 weeks of gestation. This can further be classified into *extremely preterm* infants (those born less than 28weeks gestational age), very *preterm (*infants born between 28 and 31weeks and 6 days), and *moderate to late preterm (*infants born between 32 and 36weeks and 6 days) (1).

Common causes of preterm birth include multiple pregnancies, illness of the mother either infectious causes or non-infectious, genetic influence, and sometimes no causes can be linked to it. (1) This can cause premature labor hence causing the birth of preterm. In Tanzania, the most common cause of preterm birth in Dar es salaam is UTI and incompetent cervix (2).

There has been an increase in preterm births according to a systematic review of 2014. The preterm birth rate was 9.8% in 2000 and 10.6% in 2014 with 12 million (81.1%) of these preterm births from Asia and Sub-Saharan Africa (3).

1.1.1 Complications in premature infants

Premature infants are prone to both short-term complications (those that occur in the neonatal period) and long-term complications (in patients who survive and are discharged from Neonatal Inpatient Care Unit (NICU) (4). Some of the short-term complications are hypothermia, hypoglycemia, respiratory distress syndrome (RDS), bronchopulmonary dysplasia (BPD), apnea, sepsis, necrotizing enterocolitis (NEC), periventricular leukomalacia, intraventricular hemorrhage (IVH) and hypoxic-ischemic encephalopathy. Long-term complications include cerebral palsy with feeding difficulty, visual and hearing problems (5)(6)(7). The risk of complication increases with prematurity.

Approximately 1 million of the 15 million born prematurely globally die each year due to complications of preterm birth (8) and most common cause of death are RDS, neonatal infections and asphyxia (9). In low-resource settings, factors that contribute to neonatal

mortality are substandard care, inadequate training, low competence of staff and a lack of resources, including equipment and medication (10).

1.1.2 Pathogenesis of short term complications

One of the most common short-term complications is hypothermia. This occurs due to rapid heat loss attributed to their large body surface area and inability to produce enough heat. Some of the risk factors for hypothermia are delivery room temperature <25 degree Celsius, maternal temperature <36 degrees Celsius, lack of heat loss preventive measures.

Hypoglycemia in premature babies occurs mainly due to decreased glycogen stores in the liver.

Some of the respiratory-related complications are RDS which is mainly attributed to surfactant deficiency. Bronchopulmonary dysplasia (BPD) occurs due to the premature lungs which are susceptible to damage by a surfactant or even oxygen administration, mechanical ventilation, and infection. This leads to disruption of the late canalicular phase of lung development, airway injury, inflammation, and parenchymal fibrosis. Apnea on the other hand occurs due to immature respiratory control.

Sepsis occurs mainly due to an immature immune system of the premature that is why late-onset neonatal sepsis occurs frequently among these infants.

The mechanism of NEC is unknown but available evidence supports a multifactorial mechanism. Its occurrence is attributed to the immature intestinal tract and immune system which leads to dysbiosis which results in increased growth of potentially pathogenic bacteria.

Intraventricular hemorrhage occurs due to disturbance of cerebral blood flow which is attributed to hypoxia-ischemia and reperfusion, elevated arterial blood flow, elevated venous pressure, and impaired cerebral autoregulation (11).

1.1.3 Clinical manifestation

Some of these complications have no obvious manifestation. Monitoring of these premature infants is vital in detecting these complications.Health care providers, especially through careful monitoring, can detect these changes.

Hypoglycemia occurs when random blood glucose measured within 2 hours of delivery is <2.6mmol/l.

Hypothermia is diagnosed when the temperature measured is below 36.4 degrees centigrade.

Respiratory distress syndrome mostly is noticed within minutes to hours after birth with signs of tachypnea, chest wall in drawing, grunting, cyanosis, and nasal flaring.

Signs of sepsis are not specific and may include signs of RDS, hypoglycemia, and hypothermia.

Initially, NEC presents as intolerant to feeding with abdominal distension. This means the infant starts to vomit bilious content. Abdominal distension is usually tender with rectal bleeding. Some other nonspecific signs as respiratory distress, instability of random blood glucose together with temperature may occur.

CNS manifestation in the case of IVH can be of slow progress which occurs in hours or days. Presents as altered level of consciousness, hypotonia, decreased spontaneous movement, subtle eye position, and movement. In the catastrophic type of IVH, it occurs in minutes to hours with stupor or coma, irregular respiration, decerebrate posture, generalized seizures with bulging anterior fontanelle.

1.1.4 Management and care of the premature infants

The care of these premature infants is a task for both the nurses and medical doctors. Nurses play the biggest role in the care of preterm since close monitoring and family support is the backbone of good outcome (12).

According to WHO every premature has the right to get both essential care and special care (13). The most common causes of mortality in preterm infants is asphyxia, sepsis and RDS (9) so their care revolves around essential newborn care, infection prevention and management and special care and monitoring. All these are measures of preventing and treating their short term complications.

The essential care involves protection from infection which is attained through hand washing and rubbing, wearing protective gowns and gloves, safe disposal of sharps and waste products, using clean and sterilized equipment. Once delivered the preterm low birth weight (LBW) newborn should receive routine care. This mainly consists of the warm chain, proper assessment using the Apgar score, cutting the cord, and helping the baby breathe if no effective breathing is established during the golden minute (i.e. the first minute of life).

Special care involves treating the short-term complications that they manifest. Most of the short-term complications are noted through careful monitoring done especially by the nurses as they care for these premature infants upon admission at the neonatal unit.

Measuring and monitoring of random blood glucose and temperature is done within the first few hours after delivery. Management of hypothermia by ensuring warm room temperature, covering the baby especially the head with a cap and socks at the feet, and most importantly Kangaroo Mother Care (KMC). In case of hypoglycemia, initiation of breastmilk either via cup, NGT or even breastfeeding for those who can.

For the very sick preterm with respiratory distress starting an IV infusion of 10% dextrose is more appropriate and also placing them on CPAP to support breathing. Surfactant is administered to those who have severe RDS with impending respiratory failure despite CPAP.

For those that develop NEC putting them nil per oral is the first step of conservative management impending perforation. Placing the child on ceftriaxone and metronidazole is recommended. Careful monitoring is crucial while administering total parenteral nutrition.

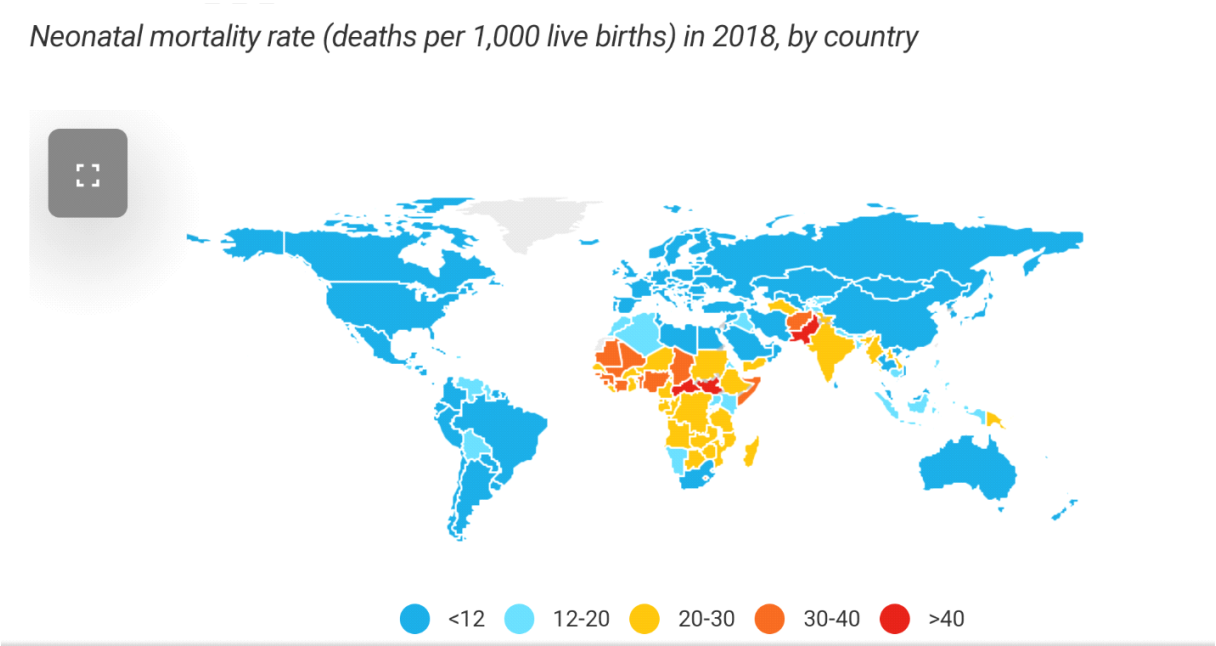
When preterm develops IVH, only symptomatic management is required.

If preterm develops nonspecific signs and clinical deterioration, this is an indication of repeating our laboratory investigation especially our blood cultures, and start our antibiotics empirically. Late-onset neonatal sepsis could be the main cause of the deterioration.

Failure to properly monitor and manage these premature infants will lead to long-term morbidity and even mortality. Newborn mortality is a sensitive indicator of the quality of care provided during the antenatal period, delivery, and immediate postnatal period (18). Nurses are the backbone service providers to these preterm newborns (12).

1.2 Problem Statement

Neonatal mortality accounted for 47 percent in under five mortalities globally in 2018 and Sub-Saharan Africa accounts for 37 percent of under-five mortality (15). Figure 1 shows the global burden of neonatal mortality by country.



Source; unicef

Figure 1: Neonatal Mortality Rate (deaths per 1000 live births) in 2018 by country

While Tanzania has made significant progress in reducing its neonatal mortality rate (NMR) now 25 deaths per 1,000 live births (2015-2016) (14), it is still above the level according to Sustainable Development Goals (SDG) target of 3.2 – 12 deaths per 1,000 live births (16). The Government of Tanzania aims to reduce the NMR to 16 per 1000 live births by 2020 (17).

Up to 50% of neonatal deaths occur in the first 24 hours of life, with over 75% of them arising in the first week of life. According to modeled estimates for Tanzania, 79% of newborn deaths are due to three main preventable causes: infections including sepsis/pneumonia (29%), birth

asphyxia (27%); and complications of preterm birth (23%). Eighty-six percent (86%) of neonatal deaths in Tanzania are due to low birth weight, many of whom are preterm (18).

According to WHO, in low-income settings half of the babies born at or below 32 weeks (2 months early) die due to a lack of feasible, cost-effective care, such as warmth, breastfeeding support, and basic care for infections and breathing difficulties.

In high-income countries, almost all of these babies survive since they have enough workforce and facilities (1). The workforce is mainly provided by the nurses since they are the backbone of inpatient care of these premature infants (12).

The neonatal period is the most vulnerable time for a child (15) and newborn mortality (NM) is a sensitive indicator of the quality of care provided during the antenatal period, delivery, and immediate postnatal period (18). Contributing factors to neonatal mortality include inadequate training and low staff competence among other causes (19).

A study done in Northern Tanzania showed prematurity was the most common cause of mortality in low birth weight infants but they did not look into the causal factors associated with their mortality mainly nurses knowledge on the care provided to these newborns (20). No local data is available that shows the adequacy of nurses' knowledge in the care of premature infants. With the growing numbers of preterm birth, and the mortality rate that is still on the rise, it is essential to assess the backbone care providers ‘nurses’ on the adequate knowledge on the care for premature infants since mortality, inadequate care and inadequate knowledge are interlinked.

1.3 Rationale

Nurses are the backbone care providers of premature infants and their knowledge while in service is mostly unknown. Most of the available studies have assessed nurses' knowledge, neither challenges nor solutions have been identified. Understanding the level of knowledge in caring for the infants and the factors affecting them will be a step closer to improving care considering the burden of prematurity in terms of both morbidity and mortality. This study assessed nurses' knowledge on the care of premature babies and their experiences including challenges and suggested solutions in acquiring the knowledge.

1.4 Conceptual Framework

With premature birth rates on the rise, so are the short-term complications and requirement of knowledge to identify, manage and monitor these infants. Nurses are the healthcare providers to these newborns and what determines the care they provide is the social demographic factors and the knowledge they have. Here we assume that the knowledge they have could either be adequate or inadequate considering various domains of care (21).

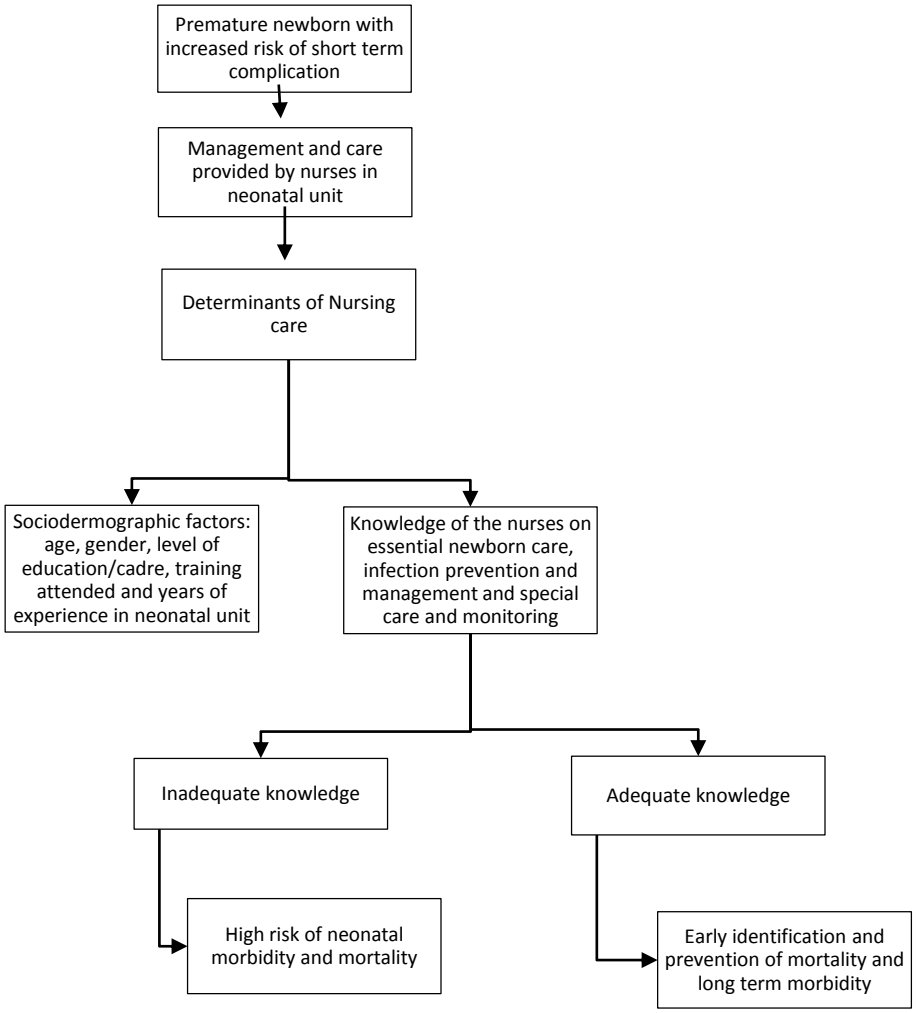


Figure 2: Conceptual Framework narrating impact of nurses' knowledge

1.5 Research Question

The assumption for the study was ‘nurses need to be knowledgeable in the care of the premature infants, and the research questions were;

1. Do the nurses have adequate knowledge in the care of premature infants?
2. Are there factors besides the level of education that determine their adequacy of knowledge in the care of premature infants?
3. Do they have adequate knowledge in different aspects when providing care to premature infants?
4. What are the nurses’ experiences in terms of challenges and solutions in acquiring knowledge on the care of premature infants?

1.6 Objectives of the Study

1.6.1 Main Objective

To assess nurses’ knowledge on the care of premature infants, their challenges and solutions in acquiring the knowledge

1.6.2 Specific Objectives

1. To assess the nurses' knowledge on essential newborn care, infection prevention, management, and special care for premature infants based on the Tanzanian national guideline on neonatal care.
2. To determine factors affecting the knowledge of the nurses on the care of premature infants.
3. To explore the nurses’ general experience in acquiring on-the-job training on the care of premature infants.
4. To identify challenges and probable solutions in acquiring on job nurses’ knowledge in the care of preterm infants.

2.0 LITERATURE REVIEW

Reports and studies that are related and are in line with the study's main objective from a local perspective, regional perspective, and international perspective to expose study gaps have been conducted. Data on the adequacy of Nurses' knowledge in the care of premature infants is limited with no data found based on the developed world. Available data is from Low and middle-income countries.

2.1 Empirical Studies

2.1.1 to assess the nurses' knowledge on the care of premature infants

A study done in Iraq assessing nurses' knowledge in different hospitals showed that all the nurses, the forty-four nurses that participated, had adequate knowledge in caring for premature infants although the variables of the study were unknown (22)**.** While another study done in Uganda Masindi, on primary healthcare worker knowledge on prenatal and immediate newborn care, showed 60/143(41.9%) of the nurses and assistant nurses had adequate knowledge on essential newborn care, 19/143(13.3%) had adequate knowledge on infection management and in specific care of premature infants,77/143(53.8%) had adequate knowledge (21). Both these studies defined adequate knowledge as attainment of more than 50% marks from their structured questionnaires. In Tanzania, no studies are available to show adequacy in the nurses' knowledge in relation to the care of premature infants.

2.1.2 To determine nurses' knowledge and factors affecting their adequacy in knowledge

Factors that have been associated with nurses' adequacy in knowledge on the care of premature infants are mainly the level of education including current training attended, years of experience in the neonatal unit, the level of the hospital the nurses work in, and the age of the nurses.

One study done in Iraq by Issa et al that was evaluating nurses' knowledge in the management of premature infants showed that the level of education had no impact on the knowledge the nurses had in caring for these premature infants with 2 tailed significant value of 0.134 (22).

Whereas a study conducted in Uganda by Ayiasi et al showed that level of education determined the adequacy of nurses' knowledge in the care of premature infants (21). Nurses (50/72) and midwives (26/40) had adequate knowledge compared to nursing assistants (27/71) (21). This was similar to a study done in Mosul by Qusay et al whereby nurses with higher levels of education had more knowledge on the care of premature infants but no associated factors were determined (23).

In a study done by Issa et al in Iraq showed there was no association seen between nurses' knowledge and training attended with 2 tailed significant value of more than 0.05 (22). In another study done in Kenya (24) showed that training had an impact on nurses' knowledge of the care of LBW babies, whereby it improved their knowledge.

Studies showed that those who worked for more years had adequate knowledge compared to those with fewer years of experience. Issa et al found a correlation of 0.045 between nurses' knowledge and those with more years of experience (22). Study done by Qusay et al in Mosul found a correlation between adequacy in nurses' knowledge with more years of experience (p=0.00)(23). While Ayiasi et al found that there was no statistical signifance in knowledge between nurses' with more than six years' experience compared to those with less (21).

In Uganda, a cross-sectional study conducted in Masindi on primary healthcare worker knowledge on prenatal and immediate newborn care showed there was no statistical significance in knowledge among nurses deployed in different levels of the hospital (21).

In terms of age, one study done in Mosul by Mohammed et al showed those who were aged between 40-49 years had more knowledge compared to those who were younger with p value of 0.00 (23).

2.1.3 To explore the nurses' general experience in acquiring on the job training for the care of premature infants

In a qualitative study done by Campbell et al on educational barriers of nurses caring for sick and at-risk infants in India, learning needs identified in the study were that of clinical skills, basic management, and correct use of equipment. As a matter of attaining knowledge, it was stated that there was various on job training upon being hired in the NICU across different hospitals, and also other ongoing training in different facilities. The greatest sources of acquiring knowledge by the nurses in NICU were found to be experienced nurses and doctors (25).

2.1.4 To identify challenges and probable solutions in acquiring nurses on job knowledge on the care of premature infants

Based on the study done by Campbell et al on educational barriers of nurses caring for sick and at-risk infants in India, it was noted that challenges in knowledge were seen in three main areas, lack of access to training, limited resources and equipment, and also a shortage of staff. The suggested solutions were to get a standardized orientation program for providing essential knowledge and skills to improve care, the need for competency-based orientation, to assign nurses who will coordinate educational opportunities and maintain qualified nurses in the unit (25).

3.0 METHODOLOGY

The chapter outlines the methodology adopted by the study to realize the study's main objective. The section explains and describes design adopted by study, study area, and population, data collection techniques.

3.1 Study Design

A mixed-method was used combining both descriptive cross-sectional study with qualitative phenomenological study design. The quantitative component was determining the nurses' knowledge and association factors whereas the qualitative component was an additive to the study to determine general experience, challenges, and solutions in acquiring knowledge on premature infant care among the neonatal unit nurses.

3.2 Study Site

This study was conducted in the Dar es Salaam region, the largest city in Tanzania with a population of 6.7 million. In Tanzania, there are approximately 336,000 preterm births in a year (41). Dar es Salaam has five districts including kinondoni, Ilala, Temeke, Ubungo, and Kigamboni. There are three regional referral hospitals (RRH) namely Amana, Mwananyamala and Temeke. All the three RRHs refer newborns to two tertiary hospitals, Muhimbili National Hospital (MNH), Upanga, and Mloganzila branch. This study was conducted in the three RRHs and one of the tertiary branches, MNH- Upanga. MNH-Upanga alone accounts for approximately 369 preterm deliveries per month not accounting for the referral ins (42) with bed capacity of approximately 100 in the specific premature ward. In the regional referral hospitals, preterm deliveries can be approximately 42 per month in all the hospitals (2) with a bed capacity of approximate 15 to 20 which is for both term and preterm newborns. Premature newborns weighing less than 1.8kg and those that are sick irrespective of their weight are admitted to the neonatal unit. Each facility has a neonatal intensive care unit (NICU) that offers special service and care for these premature infants. Since both facility levels provide newborn care, it gave room for comparability in terms of the level of knowledge.

3.3 Study Population

Nurses in the neonatal units who provide care to premature infants in Temeke, Amana, and Mwananyamala regional hospitals and Muhimbili National Hospital, Upanga in Dar es Salaam were the main participant of the study. Nursing cadre that takes part in the care include enrolled nurse (EN), assistant nursing officer (ANO), and nursing officer (NO). During the time of the study, the total number of nurses in each regional hospital that took part in the care of preterm newborns was 9 except for Temeke regional referral hospital that had 10 nurses making a total of 28 in the regional hospitals. The neonatal unit in RRHs is not subdivided into term and preterm ward so all the nurses take part in caring for both the term and preterm infants admitted. Whereas at MNH, Upanga, there are 2 separate units i.e. nurse who care for the sick and term newborns (ward 36) and those that care for the premature infants (ward 37). and. The number of nurses that specifically care for premature infants was 26 in total at the time of the study.

3.4 Sample size determination for quantitative data

Based on the study done in Uganda (21), the proportion of nurses that had adequate knowledge in identifying and caring for LBW infants was 69%. Using this proportion, with a margin of error (Ɛ) of 0.05 in the Kish Leslie formula (40):

Ɛ = margin of error

Z = z-score

P = proportion

n0 = sample size

$$n0 = \frac{Z^2 P (1-P)}{\varepsilon^2}$$

$$\frac{1.96^2 \times 0.69 (1-0.69)}{0.05^2} = 328$$

Then I used the formula for a finite population correction for proportion to acquire a feasible sample size (40). The total population of nurses in MNH, Mwananyamala, Amana, Temeke is approximately 26,9,9,10 respectively. Making it a total of 54.

n= adjusted sample size

n0 =sample size=328

N=population size=54

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

n= 328/ (1+ (328-1/54))

n=46

Based on the proportion of the population recruited nurses from MNH were 25 (48%), Temeke 10 (19%), Mwananyamala 8 (15%), Amana 9 (17%).

3.4.1 Sampling Procedure for Quantitative Data

Consecutive sampling was done in each facility until the required sample size was achieved. The duration of the study was between September 2020 to January 2021 and more than one visit was made in each facility during data collection because the nurses that were on night duty or off were to be included in the study.

Inclusion criteria included All nurses in the neonatal unit of Temeke, Amana, and Mwananyamala regional hospitals and Muhimbili National Hospitals (MNH) in Dar es Salam who were involved in the care of the premature newborns. Those that did not consent were excluded.

3.4.2 Sampling Procedure for Qualitative Data

Purposive sampling was used whereby homogenous sampling was done of the nurses who worked in the neonatal unit specifically those that were involved in the care of premature infants. Focus group discussions (FGD) were done after the completion of the quantitative data collection. The number of FGD was held based on saturation attainment. The aim was to conduct FDG in both the national hospital and regional hospital in order to get their experiences based on the 2 different levels of hospital. From the regional hospital, the hospital with most nurses with inadequate knowledge in special care and monitoring was selected. Two FDG were done, one was conducted in Temeke regional referral hospital and the other at MNH, Upanga. Those eligible for the FGD were those with experience of a year and more in the neonatal unit. Five nurses together with the principal investigator composed each FGD making a total of 6 for each FGD. Discussion was held in each of the respective hospitals educational room in the neonatal ward.

3.5 Data Collection

3.5.1 Data Collection for Quantitative Data

Data was collected using a self-administered questionnaire with the tool adopted from a study done in Masindi Uganda (21). Questionnaire was originally designed in English (Appendix i) and then translated into Swahili for use (Appendix ii). Questionnaires were filled out at the workplace when they had free time and later collected once completed. Each questionnaire had a unique study identification number and no names were used when filling in the social demographic characteristics. All the nurses preferred to use English version of the questionnaire.

The questionnaire had four domains. The first part was the social demographic factors fill-in section which captured their age, sex, cadre, level of education, years of experience and last training attended. The other 3 domains were questions that assessed knowledge on essential newborn care, infection prevention and management, and special care and monitoring.

It took approximately ten to fifteen minutes for the nurse to fill out the questionnaire. The nurses had no access to any information when answering the questionnaire. All the nurses were taught how to properly fill in the questionnaire

A written consent form, English version was developed for the purpose of the study (Appendix iii). Consent forms were signed before quantitative data with the indication of the gender, age, cadre, years of experience noted. Verbal confirmative consent was obtained prior to the onset of recording.

3.5.2 Data Collection for Qualitative Data

Data was collected through focus group discussion (FGD). FDG was used preferably because the main objective of the study was to get collective experience that will spur a conversation among the nurses.

Questions for the FDG were adapted from a study by Campbell et al (25).

Before the FGD began, participants were provided with standard information about the conduct of the study, and participation numbers were assigned to each one of the participants based on the FGD interview guide. Before the FGD began, rules were defined, that before anyone spoke they would mention their participation number then speak thereafter. They would switch off their phones and that the discussion will be led by the moderator who was the principal investigator.

FGD was recorded using an application installed on the phone. The discussion was led by the PI using the Swahili version interview guide for FGD (Appendix vi). Probing was used where participants failed to have a response to the question. During the FGD, PI wrote down the important points that felt might need to pay close attention to during transcribing and analysis. FGD was conducted mainly in Kiswahili and English was used whenever necessary. FGD in Temeke regional referral hospital took thirteen minutes while that in Muhimbili national hospital took twenty-five minutes. Each FDG took place in their respective hospitals. FDG was conducted until saturation was attained. Saturation was determined once objective questions were answered and no new information was attained when comparing this study and that done in India (25).

At the end of the FGD refreshments were offered to the participants.

3.6 Study Instrument and Personnel

3.6.1 Study Instrument and Personnel for Quantitative Data

The tool that was used is a self-administered questionnaire with multiple choices adopted from a study done in Masindi Uganda (21) which was initially adapted from a study done in Vietnam that was based on the national guidelines and WHO recommendation of newborn care (26). The tool from Uganda was modified based on different sources and pretested then corrected before initial data collection. After seeking permission to adapt the tool from the Ugandan study, the tool in this study was modified using Tanzanian national guidelines on neonatal care launched by the Ministry of Health, September 2019 which was the most recently published guideline for neonatal care (27).

A pilot was done on 5% of the required sample size on nurses working in MNH Upanga caring for term infants. After the pretest, the questionnaire was improved before actual data collection.

Questionnaires were distributed by assigned nurses in each regional hospital that assisted in data collection. At Muhimbili data was collected by the principal investigator.

3.6.2 Study Instrument and Personnel for Qualitative Data

Data was collected through FGD. Questions for the focus group discussion were adapted from a study by Campbell et al (25) after permission was sought to adapt the interview guide and modified based on the study objectives and quantitative findings whereby a few questions were eliminated from the original interview guide. English version of FGD interview guide (Appendix v) was then translated into Swahili version for use (Appendix vi). Since it was an already used interview guide, the pilot wasn't done prior conducting the FDG.

The questions in the guide mainly focused on the nurses' needs in the type of knowledge, care of premature infants, their main source of knowledge while working, challenges they face while working and those specific in attaining knowledge together with the solutions to the work-related challenges and knowledge needs.

3.7 Data Management and Analysis

3.7.1 Data Management and Analysis for Quantitative Data

Quantitative data was entered and cleaned in SPSS Version 23. No missing data was found. The dependent variables were knowledge on three main domains: 1. Essential newborn care 2. Infection prevention and management and 3. Special care and monitoring. The independent variables were sociodemographic factors (age, gender, cadre), institutional factors (either working in the regional hospital or the national hospital), level of education, years of experience, and when was the last training/workshops on preterm care attended. Frequency tables were generated to determine the social demographic distribution of the nurses. Ranges were generated in the variables of age and years of experience.

The questions were computed and each question was graded as 1 and 0 and dichotomized as correct and incorrect responses respectively. For each of the themes, nurses were judged to have adequate knowledge if they mentioned correctly two or more than two of the essential newborn care questions, two or more of infection prevention and management, and seven or more questions answered correctly in special care and monitoring section which was equivalent to more than 50% in each domain (21).

Chi-square or Fischer's test p-value was used for the categorical variables against adequate and inadequate knowledge in each domain to determine association factors and any p-value of < 0.2 in any variable was significant and entered into binary logistic regression. Upon doing the bivariate analysis, a p-value of <0.2 in any of the variables and those which are of clinical importance underwent further multivariate analysis. A p-value of < 0.05 was determined as statistically significant in the association of nurses' knowledge in the care of preterm newborns.

3.7.2 Data Management and Analysis for Qualitative Data

The recordings were listened several times by PI while transcribing to ensure it was done correctly thereafter translated to English.

With the assistance of an expert in qualitative data analysis, the transcribed notes were read several times to determine codes using the codebook created. The codes were written in MS Excel then made into categories, subthemes, and themes. Themes derived included general experience in acquiring knowledge, challenges perceived, and solutions to perceived challenges

3.8 Ethical Clearance and Considerations

In line with ethical issues, ethical clearance was sorted from the Muhimbili University of Health and Allied Sciences Research and Publication committee prior to the study with the ethical approval number MUHAS-REC-06-2020-307 (Appendix vii) Then permission was attained from each hospital research directorate and thereafter from the consecutive sampling of the nurses' neonatal unit of each hospital that cares for the premature babies. Participants were informed of the research and the main objectives. Autonomy, voluntary participation, and withdrawal from the study at any time in the course of the research were stated and determined throughout data collection. Confidentiality was maintained during the entire course of the study by using serial numbers during the administration of the questionnaires and only the principal investigator had access to the data. After data collection and analysis done, it was obvious that less than 50% of the nurses from the regional referral hospitals knew how to resuscitate using the help baby breath protocol. This was communicated to the in charges of neonatal ward from the respective hospitals in order ensure continuous medical education was conducted.

4.0 RESULTS, FINDINGS, AND DISCUSSION

4.1 Results and Findings

4.1.1 Quantitative Results

4.1.1.1 Study Recruitment and Sampling of Participants

There is a total of 76 nurses working in the neonatal unit s in all the regional and tertiary hospitals. Those eligible to participate in the quantitative part of the study are those that specifically took part in the daily care of premature infants. At MNH, Upanga 22 of the nurses were not eligible because they only cared for the term newborns. Among the eligible nurses, 2 were excluded because they did not consent to it.

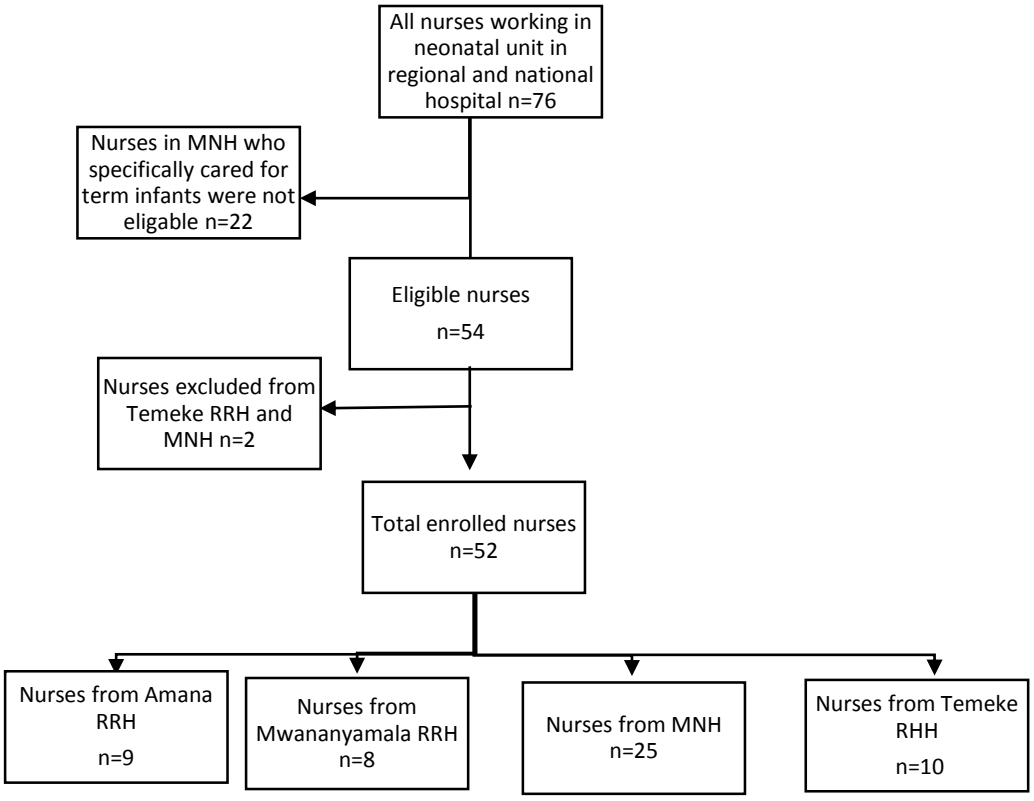


Figure 3: Flow diagram of all nurses included from the four hospitals

4.1.1.2 Social Demographic Characteristics of the participants

Out of the 54 nurses enrolled; 9 (17%) were from Amana, Mwananyamala 8 (15%), Temeke 10 (19%), and the MNH, Upanga 25 (48.1%). Almost 85% (44/52) of the nurses were female and 40% (21/52) of the nurses in the study were between 21 to 30 years of age.

Overall assistant nursing officers 46% (24/52), were the main cadre of nurses that participated in the study. 44% (23/52) of the nurses who participated had 1- 3 years of experience in caring for premature infants. At the time of the study, 56% (29/52) of the nurses had never had the privilege to attend training on the care of premature infants.

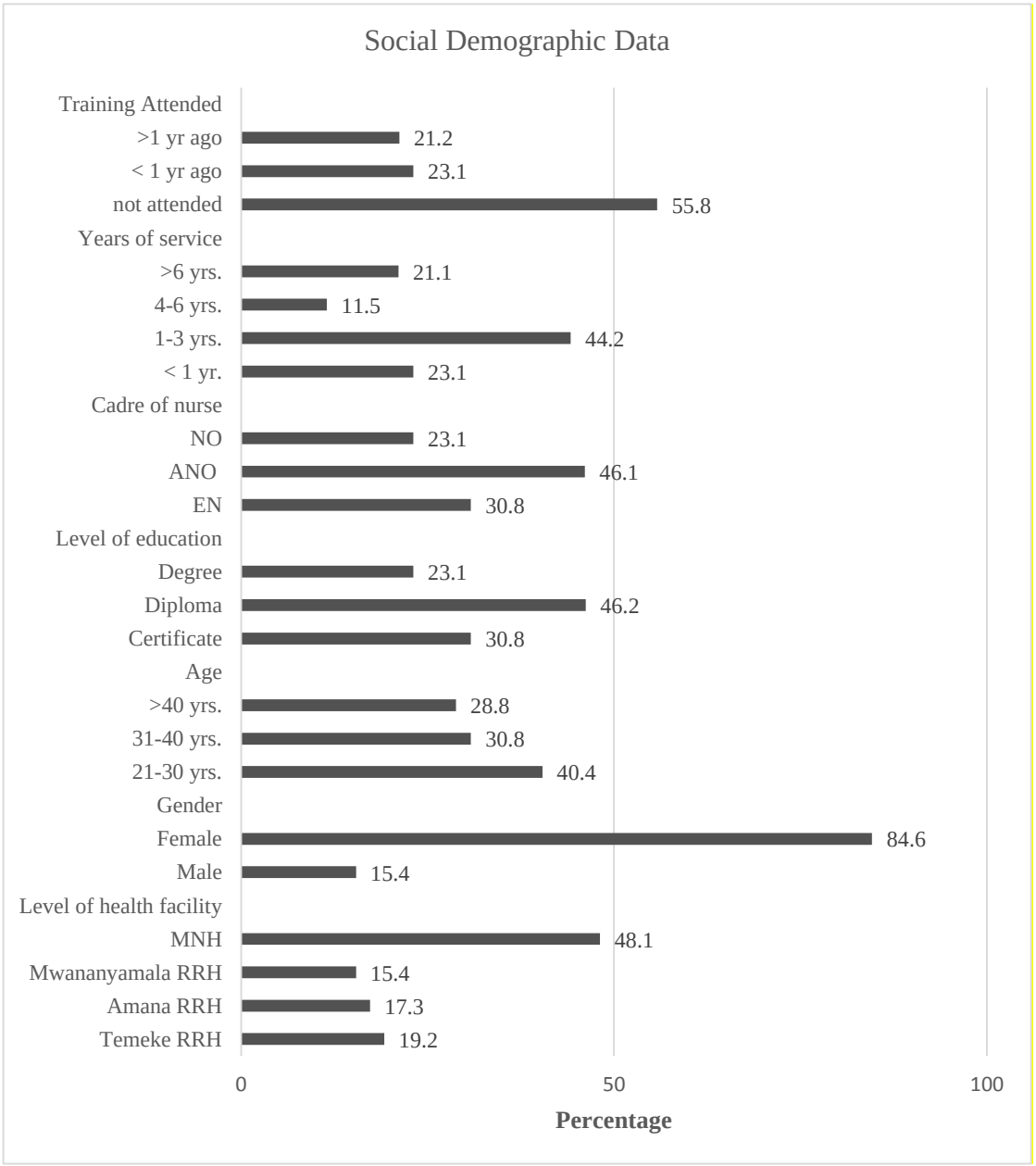


FIGURE 4 : SOCIAL DEMOGRAPHIC CHARACTERISTICS

4.1.1.3 Nurses knowledge on the care of premature infants

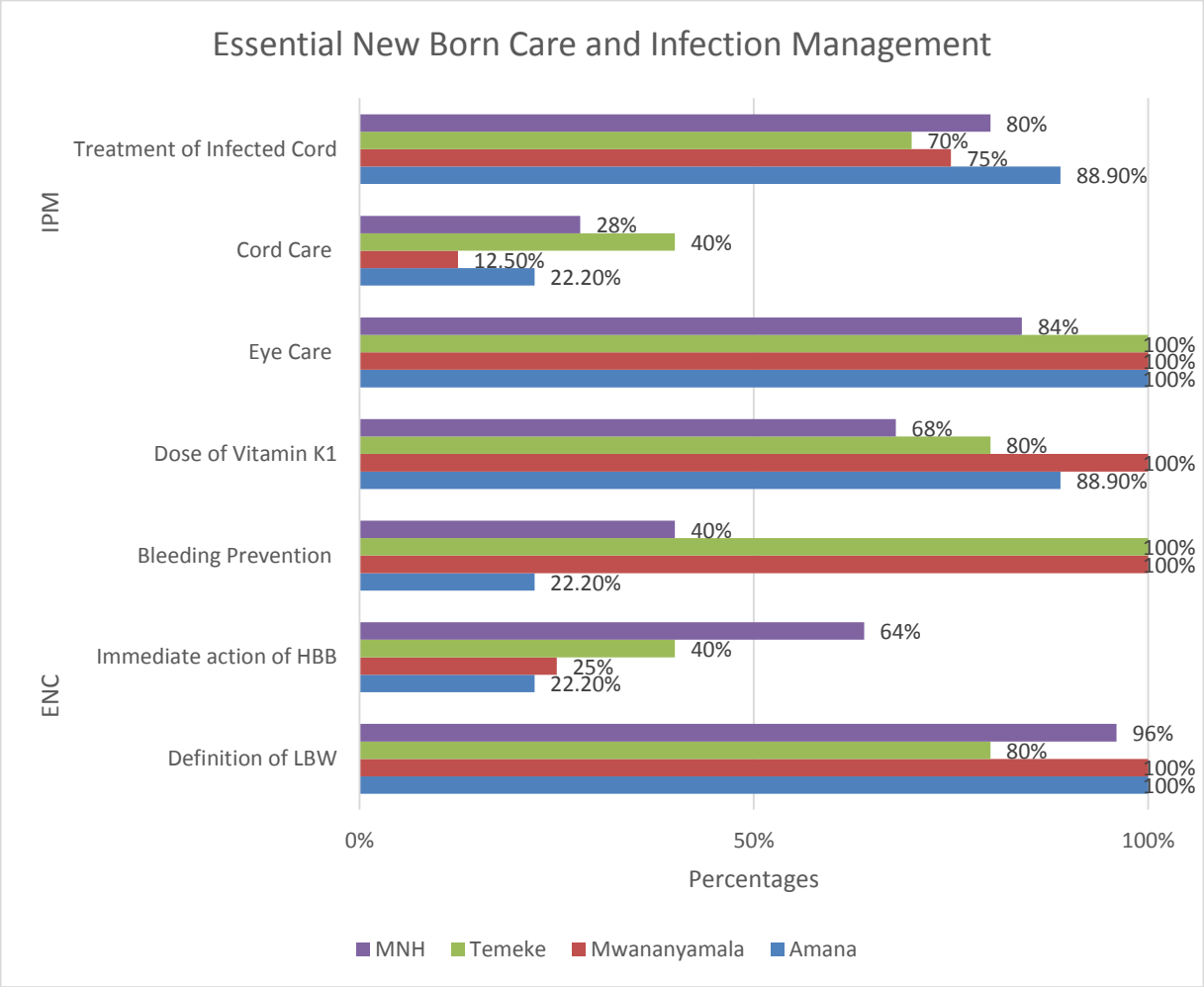


Figure 5: Nurses' knowledge on Essential New Born Care (ENC) and Infection Prevention and Management (IPM) domain by hospitals.

HBB(help baby breath), LBW (low birth weight)

In essential newborn care, overall all hospitals had a poor response on HBB question compared to other questions in the same domain. In infection prevention and management, overall umbilical cord care response was poor compared to other questions in this domain as shown in Figure 4

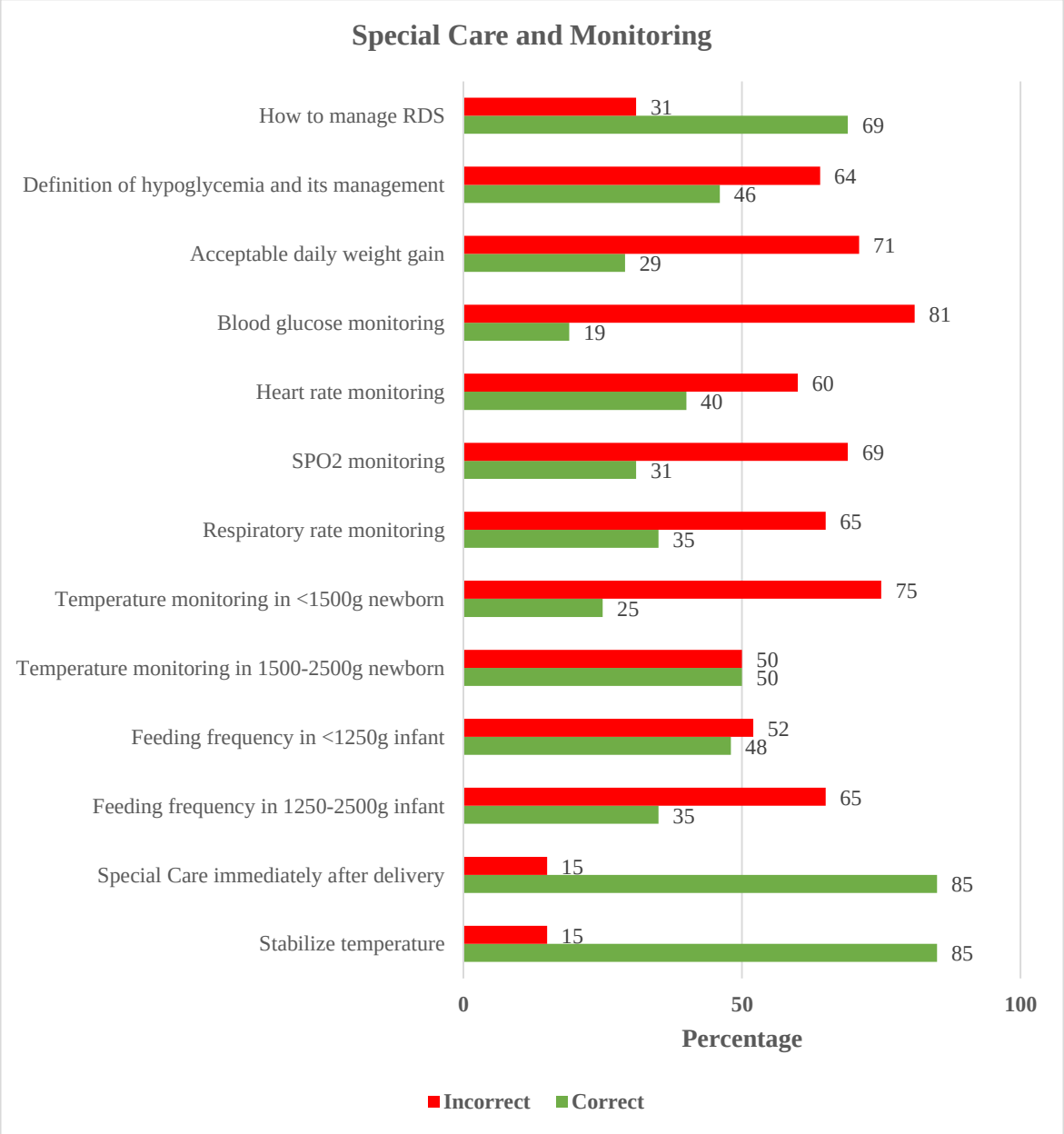


Figure 6: Nurses' knowledge on Special Care and Monitoring domains in all hospitals

RDS(respiratory distress syndrome)

Knowledge on special care and monitoring provided to the premature infants was poorly responded in the following questions; 19% knew how to do blood glucose monitoring within the first 24 hours after delivery, temperature monitoring in the preterm newborn with less than 1500 g weight with 25% of the nurses having a correct response and Only 29% of the nurses knew the acceptable daily weight gain.

4.1.1.4 Adequacy and factors associated with nurses' knowledge in the care of preterm infants

Table 1: Factors associated with nurse's knowledge

Domains		**ENC**		**IPM**			**SCM**	
Variables	**Adequate Frequency 49(94.2%)**	**Inadequate Frequency 3(5.8%)**	**Adequate Frequency 42(80.8%)**	**Inadequate Frequency 10(19.2%)**	**COR (95% CI)**	**AOR (95% CI)**	**Adequate Frequency 19(36.5%)**	**Inadequate Frequency 33(63.5%)**
Age groups								
21-30 yrs.	19(90.5)	2(9.5)	14(66.7)	7(33.3)	1	1	6(28.6)	15(71.4)
31-40 yrs.	15(93.8)	1(6.2)	14(87.5)	2(12.5)	3.5(0.62-19.88)	1.5(0.18-12.94)	5(31.2)	11(68.8)
> 41 yrs.	15(100)	0	14(93.3)	1(6.7)	7(0.75-64.61)	2.3(0.11-48.10)	8(53.3)	7(46.7)
Hospital Levels								
RRH	26(96.3)	1(3.7)	24(88.9)	3(11.1)	1	1	9(33.3)	18(66.7)
MNH	23(92.0)	2(8)	18(72)	7(28)	0.32(0.07 – 1.41)	0.35(0.04 – 2.61)	10(40)	15(60)
Gender								
Male	8(100)	0	4(50)	4(50)	1	1	3(37.5)	5(62.5)
Female	41(93.2)	3(6.8)	38(86.4)	6(13.6)	6.33(1.23-32.37)	3.5(0.60-20.70)	16(36.4)	28(63.6)
Cadre								
EN	16(100)	0	15(93.7)	1(6.3)			7(43.7)	9(56.3)
ANO	23(95.8)	1(4.2)	17(70.8)	7(29.2)			8(33.3)	16(66.7)
NO	10(83.3)	2(16.7)	10(83.3)	2(16.7)			4(33.3)	8(66.7)
Years of service								
< 1 yr.	11(91.7)	1(8.3)	7(58.3)	5(41.7)	1	1	3(25)	9(75)
1- 3 yrs.	21(91.3)	2(8.7)	19(82.6)	4(17.4)	3.39(0.70-16.38)	2.3(0.36-14.28)	7(30.4)	16(69.6)
4- 6 yrs.	6(100)	0	5(83.3)	1(16.7)	3.57(0.31-40.75)	1.18(0.04-33.08)	3(50)	3(50)
> 6 yrs.	11(100)	0	11(100)	0	1		6(54.5)	5(45.5)

Training attended						
not attended	27(93.1)	2(6.9)	23(79.3)	6(20.7)	9(31.1)	20(68.9)
attended < 1 yr. ago	11(91.7)	1(8.3)	10(83.3)	2(16.7)	5(41.7)	7(58.3)
attended > 1 yr. ago	11(100)	0	9(81.8)	2(18.2)	5(45.5)	6(54.5)
Level of Education						
certificate	16(100)	0	15(93.7)	1(6.3)	7(43.7)	9(56.3)
diploma	23(95.8)	1(4.2)	17(70.8)	7(29.2)	8(33.3)	16(66.7)
degree	10(83.3)	2(16.7)	10(83.3)	2(16.7)	4(33.3)	8(66.7)

AOR- Adjusted Odds Ratio, ANO-Assistant Nursing Officer, COR- Crudes Odds Ratio, EN- Enrolled Nurse, ENC-Essential Newborn Care, IPM-Infection Prevention and Management, MNH- Muhimbili National Hospital, NO- Nursing Officer, RRH-Regional Referral Hospital

Note: There was no statistical significant P value after doing univariate and logic regression on any of the variables

As shown in table 2, 94.2% (49/52) of the nurses had adequate knowledge on essential newborn while 80.8% (42/52) and only 36.5%(19/52) had adequate knowledge on infection prevention and management and special care and monitoring respectively. There was no statistical significance association between adequacy in knowledge in different domains with the different independent variables.

93.3%(14/15) of the nurses who were more than 41 years of age had adequate knowledge on infection prevention and management (IPM) with adjusted odds ratio (AOR) of 2.3 and 95% confidence interval (CI) 0.11-48.1. Nurses who were between 31 and 40 years old, 87.5% (14/16) had adequate knowledge on IPM with AOR of 1.5 and 95% CI 0.18-12.14.

From the regional referral hospitals, 88.9% (24/27) of the nurses had adequate knowledge on IPM where as 72% (18/25) of nurses from MNH had adequate knowledge with AOR 0.35 and 95% CI 0.04-2.61.

From the female nurses, 86.4% (38/44) had adequate knowledge in IPM with AOR 3.5 and 95% CI 0.60-20.7.

All the nurses who have worked in neonatal unit for more than 6 years had adequate knowledge on IPM while those who had worked between 1 to 3 years, 82.6%(19/23) had adequate knowledge with AOR of 2.3 and 95% CI 0.3-14.28 and those that worked between 4 to 6 years, 83.3% (5/6) had adequate knowledge with AOR 1.18 and 95% CI 0.04-33.08.

4.2.2 Qualitative Findings

4.2.2.1 Participants demographics

A total of two FGD were conducted with 10 nurses as participants. The majority were female nurses (90%). The participant's age ranged from 29 to 56 years with the mean age of 42.4 years. The nurse who had worked in the neonatal unit the longest had 17 years of experience while those who had worked the shortest time had one year of experience. Out of the total, enrolled nurses were 4, nursing officer were 3 and assistant nursing officer were 3. Six of the participants had at least attended the training of preterm care within the last five years while working in the neonatal unit. Nurses from Temeke RRH were chosen to represent the three regional hospitals based on the overall knowledge adequacy and environmental similarities.

4.2.2.2 General experience in acquiring knowledge

The general nurses' experience in acquiring knowledge was based on their 1) specific knowledge needs and 2) sources they use to acquire knowledge.

Specific knowledge needs

When asked about what were their specific knowledge needs, two main subjects were mentioned, 1) to understand how to use the equipment 2) current updates on the care of premature infants. The need to know how to operate equipment was common among nurses working in both the regional and national hospitals:

> "…*How to educate one another on proper care of this equipment and the updates that are available on this equipment that don't reach many of the nurses*…" (P2 MNH, Upanga)

> "…*knowledge that we need most is how to operate the machines (i.e. concentrator) that are brought. We are not taught how to use them. They just show us the parts. The only thing we understand is when it doesn't bubble but we don't know how to operate them…"* (P2 Temeke RRH)

The participants in both hospitals stated their need to get current updates on the care of premature infants:

> "…*We understand that there are current updates in managing them. We feel we need to be informed on these current updates…"* (P4 MNH, Upanga)

> "…*May be we should have Continuous Medical Education (CME) on helping baby breath (HBB)..."* (P5 Temeke RRH)

Source of knowledge

Means through which the nurses used to acquire knowledge whenever they needed it while at work were through senior nurses, doctors, guidelines, and CME held amongst themselves.

> *"…. We assist one another as nurses, we use neonatal national guideline and national infection prevention and control guideline. We do have guidelines…"* (P2 Temeke RRH)

> *"…I usually ask a senior nurse who is more experienced than me to assist me first. Then I ask a doctor to assist me or when need be we do teamwork with the nurses and doctors…"* (P5 MNH, Upanga)

> *"…We usually hold CME whereby one is assigned a topic based on standard operating procedures (SOP) or guideline to teach each other in our departments…"* (P2 MNH, Upanga)

4.2.2.3 Perceived challenges

Challenges that were started by the participants were mainly in two areas, 1) while at work and 2) while acquiring knowledge.

Challenges perceived while working

The main challenges attributed to working environment were; 1) inadequate staffing, 2) work overload, 3) inadequate resources, and 4) inability to use the available equipment.

Inadequate resources were mentioned as not having enough equipment and the lack of medication. These were perceived in both regional hospitals and the national hospital:

> *"…For instance, when a newborn is brought in sick you will find that one bed can have two or even three or even four babies…"* (P2 Temeke RRH)

> *"Another challenge is that we have few warmers…"* (P3 Temeke RRH)

> *"Medication is still an issue to be dealt with by the government…"* (P2 MNH, Upanga)

Work overload was an emphasized perceived challenge that was associated with inadequate staffing. Surprisingly, this seems to be a challenge perceived mainly by nurses working at the national hospital. Some of the participants stated that:

> *"…The biggest problem right now is the lack of nursing staff. The number of nurses doesn't correspond to the number of admitted premature infants so the close monitoring and care provided isn't sufficient…"* (P2 MNH, Upanga)

> *"…in these coming months of January and February we expect an increase in delivery of newborns and with the understaffing issue at hand, it becomes a big challenge …"* (P1 MNH, Upanga)

On the issue of the inability to use the equipment while at work, this was a challenge shared from both the regional and national hospitals among the nurses:

> *"… Most of the nurses don't know how to care for the equipment as needed so that becomes a challenge…"* (P2 MNH, Upanga)

> *"…. We are not taught on how to use them. They just show us the parts. The only thing we understand is when it doesn't bubble but we don't know how to operate them…"* (P2 Temeke RRH)

Challenges perceived while acquiring knowledge

These were attributed mainly to 1) lack of support system, 2) poor selection process for attending training and 3) the inadequate number of training being held.

The support system was mainly referred to the government, the hospital, and fellow nurses. Both at the regional and national hospital, participants felt like the government played little role in necessitating training among the nurses:

> *"One of the nurses mentioned that stakeholders (CCBRT) play a big part in helping us acquiring the knowledge but not much cooperation from the ministry…"* (P5 Temeke RRH)

> *"…Mostly I have never heard of the hospital making arrangements on training to be done or maybe we are misinformed but most of the time its foreigners from other countries through CCBRT who come and teach us the updates on the management of these preterm but not the hospital…"* (P2 MNH, Upanga)

Nurses mostly learn from each other but challenges persist for those working at the national hospital:

> *"…The senior nurses are busy because they might also have twenty children to care for, resuscitation to do, and many other things…"* (P1 MNH, Upanga)

> *"…It all depends on the mood of the person you are seeking assistance from. The response you get sometimes isn't good…"* (P2 MNH, Upanga)

Unfortunately, nurses both in the regional and national hospitals are faced with the challenge of attending training since most of them can't go at the same time and the number of training being held isn't enough to enable most of them to attend:

> *"Most of the time stakeholders assist us in getting the training but it is not that frequent…"* (P5 Temeke RRH)

> *"when it comes to training, not all are selected to attend but just a few of the nurses …"* (P5 MNH, Upanga)

> *"…When it comes to deciding who goes for training, it's the task of the in-charge nurse of the ward. But the issue isn't with just the in-charge nurse, the issue is the number of nurses that could be released to go for training…"* (P2 MNH, Upanga)

4.2.2.4 Solutions to the perceived challenges

Solutions suggested to tackle work-related challenges and those when acquiring knowledge are summarized below

The solution to work-related challenges

The participants suggested that to deal with challenges while working, 1) on job training should be provided for any new nurse working in the department and 2) there should be an increase in nurse staffing to ensure proper care for the newborns:

> *"…But if given a few patients, I will be more efficient by using the knowledge I acquired from the university…"* (P2 MNH, Upanga)

> *"…Those who are new to the assigned ward either newly employed or just a volunteer or even a doctor, they should undergo an on job training on how to care for the preterms…"* (P5 MNH, Upanga)

The solution to improving knowledge

Solutions that were suggested in improving knowledge included additional of more training and increasing the number of CME being held:

> *"...More frequent training should be conducted" "...maybe four times a year…"* (P3 Temeke RRH)

> *"…At least learning should be continuous in that every nurse should get the chance to attend training so each one of us could learn…"* (P3 MNH, Upanga)

> *"…The weekly CME should be consistent maybe every Monday they should take place and that anyone assigned to teach a certain topic should be arranged based on their duty Rota to ensure no one is assigned a topic while they are off…"* (P2 MNH, Upanga)

Some of the participants advocated learning from other nurses.

> *"…Amongst the nurses at our workplaces can teach one another about something new they learned…"*(P1 Temeke RRH)

> *"…Maybe allowing nurses from other facilities with experience to come and teach us at our workplace…"* (P5 Temeke RRH)

> "*…We should ensure that they are held every week like Mondays to stimulate us. It will benefit even the newly employed nurses like how to put in an IV line and how to maintain it…"* (P2 MNH, Upanga)

Among the nurses at national hospital advocated for the availability of guidelines at the workplace.

> *"…That we should have a treatment guideline not only for the doctors but also the nurses need it during their duties especially the new nurses…"* (P4 MNH, Upanga)

4.3 Discussion

In this study, our main objective was to assess adequacy of nurses' knowledge in the care of premature infants with respect to three main domains; essential newborn care, infection prevention and management, and special care and monitoring, its associated factors, challenges and solutions in four neonatal units, Dar es Salaam - Tanzania. Data were collected between September 2020 to January 2021.

Essential Newborn Care

Essential newborn care is universal to both term and premature infants. In our study most of the nurses (94%) had adequate knowledge in essential newborn care unlike the study done in Masindi Uganda whereby only 41.9% of nurses had adequate knowledge (21). This would be explained by the fact that 45% of the nurses, which was the majority number from the study in Uganda, were mainly those from outpatient and did not do daily inpatient care for newborns. An observational study done in Ethiopia showed 54% of nurses had adequate knowledge and about 63% had a good practice on essential newborn care (31). This is to show the importance of combining an observational component of a cross-sectional study. Overall in our study, there was low knowledge on step wise management of help baby breath (HBB) algorithm which was consistent in the study done in Uganda where 21.9% of the nurses had the knowledge (21). In the study done in Ethiopia, 52.8% had knowledge on how to assess a baby's breathing immediately after delivery while 59.7% of these nurses hadn't received any training in immediate newborn care which could explain the low level of knowledge (31). In our study 55.8% of the nurses had also not had the privilege to attend any training on premature infant care due to the COVID pandemic prohibition of social gatherings. This would explain the low level of knowledge in HBB algorithm which is usually provided through training by CCBRT every six months. All newborns at birth need simple care which includes the help baby breath protocol which is sufficient for 80-90 % of the time when done appropriately. When intervention is done correctly, most of them will respond to drying, warmth, providing stimulation, or even clearing of the airway and only 8 – 10% will require active bag and mask ventilation This means if essential care is provided in a step-wise manner during birth as emphasized, many babies can be saved (29).

Infection Prevention and Management

80.8% of the nurses had adequate knowledge on infection prevention and management in our study compared to the study from Uganda, 13.3% (21). Umbilical cord care by ensuring the use of a clean blade when cutting the cord as means of prevention of infection was the most poorly answered question in this domain. Whereas in the study done in Uganda this similar question had a better response with 72.1% having a correct response (21). While the study from Ethiopia, 61% of the nurses had a correct response (31). In a cross-sectional study with an observational component including 6 sub-Saharan African countries including Tanzania showed that 94% of the health care workers used a clean blade to cut the cord (32). Despite cord care having the poorest response, the practiced care is known by many health care workers. In our study the poor response might be explained by the fact that initial cord care, which was what the question was assessing, is provided by labor ward nurses and the midwife. In our study the nurses who participated were mainly neonatal nurses, who didn't practice daily initial cord care.

It is essential to have proper care of the umbilical cord to avoid bacteria colonization which will end up being a source of infection and thus causing sepsis and even delays in cord separation. With 9.3% of omphalitis being associated with sepsis in a study done in Pakistan (30), it is crucial to emphasize proper care as a way of prevention of sepsis.

Special Care and Monitoring

In our study, 36.5% of the nurses had adequate knowledge of special care and monitoring. While in a cross-sectional observational study done in Pakistan, 46%-54% of the nurses in the neonatal unit performed vital signs monitoring as required (39). This study didn't assess knowledge directly like in our study so comparability with our study is questionable. The results from our study would be explained by the fact that nursing staff ratio to number of infants is low. Regular and scheduled monitoring becomes a challenge when few nurses are available to provide care. Vital signs monitoring in neonates is the most integral part of their care whereby in modern medicine, continuous vital signs monitoring is being preferred instead of intermittent monitoring (34).

It is known that trends in vital signs can predict some of the complications that the preterm newborns are at risk of such as sepsis, NEC, brain injury, BPD, and even mortality. This emphasizes the importance of constant monitoring of vital signs.

Among the poorly answered questions was the monitoring of blood glucose with 19.2% of the nurses having correct responses. This is very crucial in the management of premature infants because impaired glucose control in very preterm newborns has been associated with an increase in morbidity, poor neurologic outcome, and even mortality. This has enabled studies done to compare continuous glucose monitoring which was found to be better in terms of glucose control than intermittent monitoring (35). Findings in our study could be due to the inability to frequently monitor random blood glucose due to inadequate supply of strips. This limits the practice of frequent monitoring.

Monitoring of temperature in those premature infants with weight less than 1500g was not well known with only 25% of the nurses having the correct response. Lack of adequate nursing staff might contribute to lack of proper monitoring. This might also be due to the availability of continuous temperature monitoring for premature infants placed on a servo machine. This might not be the case for every premature infant admitted to the neonatal unit. Only the high-risk premature infants are placed under the servo machine and every preterm irrespective of being high risk or not needs monitoring. Newborns who are at risk of hypothermia are those with very low weight and those with low gestational age at the time of birth. This has a detrimental effect on their neurodevelopment or even leads to death (36). The importance of proper temperature monitoring in these premature infants and the need to improve knowledge should be prioritized.

About 28.1% of the nurses knew acceptable daily weight gain of the premature infant despite being a daily routine practice done in the neonatal unit. Weight monitoring is crucial since it is an indicator of the energy intake and expenditure (internal heat loss through basal metabolism and physical activity) and enables one to decide on how to intervene when there isn't adequate weight gain i.e. the use of parenteral nutrition. Poor growth during admission in the neonatal unit has been linked to poor neurodevelopmental outcomes (37). So there is a need to emphasize the proper daily weight monitoring to ensure proper action is put in place.

Difference in knowledge among the nurses

Nurses who were older than 41 years of age were 2.3 times more likely to have adequate knowledge on infection prevention and management compared to those who were less than 30 years old. This was similar to a study done in Mosul whereby nurses aged 40-49 years had more knowledge on general care of premature infants compared to the younger nurses (23).

Nurses at the national level were 0.35 less likely to have adequate knowledge in infection management compared to those in regional referral hospitals. The study done in Uganda showed those who work on a higher level of the hospital were 1.1 times more likely to have adequate knowledge in infection management (21). This was inconsistent with our study where more nurses from the regional hospital had adequate knowledge. The nurses in the regional hospitals that participated in this study did care for both premature and term infants so they were aware of proper cord care which was the most poorly responded question in the national hospital. Prevalence of cord sepsis among premature infants is not known currently. This cannot be linked with the knowledge the nurses from the national hospital have in respect to cord care in premature infants.

Females nurses were 3.2 times more likely to have adequate knowledge in infection prevention and management compared to male nurses. This could be explained by the high numbers of female nursing staff compared to the males.

Females nurses were 3.2 times more likely to have adequate knowledge in infection prevention and management compared to male nurses. This could be explained by the high numbers of female nursing staff compared to the males.

Nurses that worked for 1-3 years were 2 times more likely to have adequate knowledge in infection prevention and management compared to those with more years of experience. This could also be explained by the fact that the nurses with less years of experience in neonatal ward were updated on current cord care available since they were recently from school.

Experience, challenges and solutions in acquiring knowledge among nurses

Based on the qualitative part of the study, the general experience in acquiring knowledge is based on their learning needs when caring for the premature infants and the sources of knowledge available for them. The learning needs stated by the nurses is knowing how to operate the equipment at work and being up to date on the management of premature infants. Their main source of knowledge while at work was fellow nurses and doctors.

These findings were similar to those found in the Indian study (25). When considering about training, perhaps in house mentorship should be considered and strengthened in the neonatal ward. This will contribute to better care of these infants (43)

In our study, challenges that were perceived by the nurses were those related to work which included understaffing, work overload, and lack of equipment at work. This was consistent with the study done in India by Campbell et al. (25). These factors affect the overall care the preterm newborns receive. Challenges perceived while acquiring knowledge included not having a standard selection process for those attending training, this being similar to a study by Campbell et al (25). In the quantitative data from this study most of the nurses had not attended any training on premature infant care and this could be explained by the poor selection process and lack of on job training plan.

As part of the solution to the challenges faced, it was suggested that senior nurses and doctors should be tasked to teach other nurses. Team work among health care workers has been seen as an integral part in providing care (44). In terms of challenges faced while working some of the solutions implicated were the availability of on job training for every new employee and to have a training schedule that will allow all nurses to attend. According to WHO's a new roadmap on human resources to ensure all newborns survive and thrive, on-the-job training has been suggested as one of the strategies for improvement (38). All these findings were similar to the study by Campbell et al. (25). This study was done before the implementation of the Newborn Essential Solutions and Technologies (NEST 360) program in Dar es Salam which is currently

in place to ensure training on how to manage newborns using the current technology not forgetting the basic care.

4.4 Strength of the study

Using quantitative data, we captured the inadequate knowledge in special care and monitoring while the added component of the qualitative part of the study was able to highlight challenges in acquiring knowledge and suggested solutions to these challenges.

4.5 Study limitations

1. In the public health center in Dar es Salam only the regional and national hospitals had neonatal intensive care units.

   The number of employed nurses working in the NICU from all 4 hospitals was approximately 54 at the time of the study. The sample size is too small to enable the generalizability of the data.
2. There is no standard tool that can be used for assessing nurses' knowledge on premature infant care. A questionnaire was adopted and modified. The questionnaire was then pretested with corrections made but validation was not done similar to the previous studies done that the tool was adapted from. Perhaps for future use, validation of the tool is advised.
3. The level of knowledge wasn't compared to the skills the nurses have. Some studies done have shown skills of the nurses were better in comparison to knowledge. Concluding that the nurses aren't competent based on their inadequate knowledge isn't possible perhaps a study that has both cross sectional and observational component should be done based on assessing premature infant care.
4. The FGD conducted was inconsistent and despite probing some participants didn't share much information. So maybe some information was missed during the FGD.
5. After FGD, transcripts were not returned to participants for comments and correction. The participants of the FGD were not able to provide feedback on the transcripts for verifying accuracy and clarification of results. There was a possibility of missed out information. Although the practice of verification of transcripts is still questionable and might not add any value to the data.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

1. 55.8% of the nurses had not attended any training on premature infant care after employment in neonatal unit. Less than 50% of nurses from the regional referral hospitals knew the HBB algorithm management. Less than 50% of the nurses in all the hospitals knew proper cord care. More than 80% of the nurses had adequate knowledge on essential newborn care and infection prevention and management but only 37% of the nurses had adequate knowledge in special care and monitoring which is a vital part in the care of premature infants.
2. Female nurses and working in the neonatal unit for at least 1-3 years were more likely to determine adequate knowledge in infection prevention and management.
3. Nurses preferred to learn from one another and there was a need for updates on how to use the neonatal equipment and general care for the premature infants.
4. The main challenge faced, is not being able to attend training as frequently as expected. This was contributed by low staff numbers and suggested frequent training should be held to allow continuity on learning.

5.2 Recommendations

1. Continuous medical education should emphasize more on HBB algorithm management, cord care and the special care and monitoring of premature infants.
2. On job training plan should be in place to allow effective coverage on the knowledge to care for premature infants. Hospitals and Government commitment is needed to ensure effective implementation plans.
3. Mentorship should be utilized as a means of ensuring knowledge gain within and between hospitals.

5.3 Area for further research

1. Other studies should be done with both the cross sectional and observational component to assess knowledge and skills of the nurses on premature infant care.
2. Other qualitative studies to include stakeholders to understand challenges and solutions in providing knowledge to the nurses is advised.

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APPENDICES

Appendix i. A Self-Administered Structured Questionnaire English version

Questionnaire #.....Name of your facility……

Circle and fill in appropriately

Gender:

Male

Female

Age:

Cadre of health worker:

Highest level of education you hold?

Certificate

Diploma

degree

How many years have you served as a neonatal nurse in caring for the premature LBW babies? (Completed years)

When did you last attend a training or workshop on premature LBW newborn care?

Essential Newborn Care

1. What is the definition of low birth weight for newborn child?

a) Weight is less than 3000 grams,

b) Weight is less than 2500 grams,

c) Weight is less than 1500 grams,

d) Weight is less than 1000 grams,

2. Shortly after birth a premature LBW newborn baby should be able to: cry loud, have a pink color to the skin, breathe evenly and have a respiratory rate of 40 – 60 breaths per minute. what is the first thing you would do in the care of a baby that does not have these signs shortly after birth?

a) Dry baby with cloth,

b) Use bag and face mask to help baby with respiration,

c) Suction of nose and mouth if necessary,

d) Slapping baby,

3. What can be done to prevent premature LBW newborn baby from bleeding?

a) Breastfeeding the child,

b) Not necessary to give any drugs,

c) Give Vitamin K,

d) Give Vitamin K_1,

4. Do you know what dose of Vitamin K_1 to give to a Low birth weight baby according to recommendations in the National Guidelines?

a) 0.5 mg, b) 1 mg, c) 2 mg, d) 5 mg,

Infection management

5. A premature LBW newborn child can get eye infections after delivery. Which of the following would you use to prevent this from occurring?

a) Do not apply anything,

b) Apply breast milk in the babies' eyes,

c) Clean eyes with sterile water,

d) Apply tetracycline eye ointment after cleaning eyes,

6. Taking care of the umbilical cord of a premature LBW newborn after delivery is important. Which of the following alternatives would you consider as important?

a) Always clean your hands before touching the cord,

b) Cut the cord with a clean instrument (for example, a razor blade),

c) Use any sharp instrument for cutting the cord,

d) After cutting the cord, apply traditional herbs/medicines,

7. What approach would you use to handle an umbilical cord that has any of the following signs: bad smell, oozing blood, small rashes around the umbilical area?

a) Leave to dry,

b) Clean with water and soap,

c) Clean with iodine solution,

d) Apply antibiotic powder,

Special care and monitoring

8. What is, in your opinion, the best way to stabilize the temperature of a premature LBW newborn baby?

a) Bathing the baby in water of appropriate temperature,
b) By putting on clothes and cover head,
c) Having the baby skin-to-skin with her/his mother,
d) Keep the baby in a room with a temperature of 28-30°C,

9. What action is important when taking care of a premature low birth weight baby immediately after birth?

a) Bath the baby often,
b) Start breastfeeding early and frequently,
c) Keep the child warm,
d) Prevent infection from developing,

10. How frequent should low birth weight babies be fed when weight is between 1250g-2500g

a) Every 2 hours
b) Every 3 hours
c) Every 4 hours
d) Every 1 hours

11. How frequent should low birth weight babies be fed when weight is less than 1250g

a) Every 2 hours
b) Every 3 hours
c) Every 4 hours
d) Every 1 hours

12. How frequent should the temperature be taken in 1500-2500 g babies in the first 24 hours

a) Every hour in the first 8hrs then every 12hrs
b) Every 6hrs then every 12hrs
c) Every 12hrs then every 24hrs
d) Every 2hrs then every 4hrs

13. How frequent should the temperature be taken in newborns below 1500 in the first 24hrs
    a) Every hour in the first 8hrs then every 12hrs
    b) Every 6hrs then every 12hrs
    c) Every 30 min for 4hrs then hourly for 24hrs.
    d) Every 2hrs then every 4hrs
14. How often should the respiratory rate be taken
    a) Every 4hrs
    b) Every 6hrs
    c) Every 12hrs
    d) Every 2hrs
15. How frequent should the oxygen saturations be taken?
    a) Every 4hrs
    b) Every 6hrs
    c) Every 12hrs
    d) Every 2hrs
16. How often should the heart rate be counted
    a) Every 4hrs
    b) Every 6hrs
    c) Every 12hrs
    d) Every 2hrs
17. How often should the blood glucose be taken?
    a) 2hrs within delivery then 6hrly until infant getting enough feeds
    b) 30mins within delivery then 12hrly until infant getting enough feeds
    c) 4hrs within delivery then 24hrs until infant getting enough feeds
    d) 1hr within delivery then 4hrly until infant is getting enough feeds

18. What is the acceptable daily weight gain for a premature?

a) More than 10g per day

b) More than 15g per day

c) More than 25g per day

d) More than 30g per day

19. A premature LBW is considered to have hypoglycemia when RBG is …….and should be given a bolus of…….?

a) Less than 3.3mmol/l, 5ms/kg of D10 IV stat

b) Less than 2.6mmol/l, 5ms/kg of D10 IV stat

c) Less than 3.3mmol/l, 2ms/kg of D10 IV stat

d) Less than 2.6mmol/l, 2ms/kg of D10 IV stat

20. A LBW premature admitted to your unit with fast breathing >60breaths/minute, sever chest wall in drawing, grunting and cyanosis. what is the best management for this child?

a) Put the preterm on oxygen via nasal prone

b) Put the preterm on oxygen via face mask

c) Put the preterm on CPAP

d) Put the preterm on ventilation

Appendix ii. A Self-Administered Structured Questionnaire – Swahili Version
NAMBA YA DODOSO.....

Jina la kituo chako cha kazi ni……

jinsia:

- Mme
- Mke

una umri gani?

Cheo chako kama mfanyakazi wa afya

Kiwango cha juu cha elimu yako?

- Cheti
- Stashahada
- Shahada

Umefanya kazi miaka mingapi kama Muuguzi katika idara ya watoto wachanga haswa kuwahudumia walio njiti? (Miaka iliyokamilika)

Lini mwisho ulihudhuria mafundisho ya kuwahudumia watoto njiti?

Huduma muhimu za watoto wachanga

1. Ni yupi mtoto njiti?

a)Uzito chini ya gramu 3000

b)Uzito chini ya gramu 2500

c)Uzito chini ya gramu 1500

d)Uzito chini ya gramu 1000

2. Pindi tu mtoto njiti anapozaliwa anapaswa kuwa wa rangi nyekundu,kulia,kupumua vizuri kwa kila dakika anapumua mara 40-60.utamhudumia vipi mtoto anayeshindwa kufanya vyote hivi baada ya kuzaliwa?(chagua majibu yote yalio sahihi)

a)Kumkausha mtoto na nguo

b)Kumsaidia mtoto kupumua kwa kutumia begi na maski

c)Kumvuta maji yaliyoko puani na mdomoni

d)Kumchapa mtoto

3. Kipi kinaweza kufanyiwa mtoto njiti kuzuia utokaji wa damu?

a)Kumnyonyesha

b)Asipewe dawa yoyote

c)Achomwe vitamin K

d)Achomwe vitamin K1

4. Kiwango kipi cha vitaminK1 anapaswa kuchomwa mtoto njiti kulingana na mwongozo wa kitaifa?

a) 0.5 Miligramu

b) 1 Miligramu

c) 2 Miligramu

d) 5 Miligramu

Kuzuia na kutibu maambukizi

5. Mtoto njiti anaeza pata maambukizi ya jicho pindi anapozaliwa.ni ipi mbadala zifuatazo ambazo ungetumia kuzuia hii kutokea?(chagua majibu yote yalio sahihi)

a) Usipake chochote

b) Paka maziwa ya mama kwenye macho

c) Safisha macho na maji masafi

d)Paka dawa(Tetracycline eye ointment)baada ya kusafisha

6. Baada ya kuzaliwa,ni muhimu kutunza kitovu cha mtoto njiti.kipi chengine baadhi ya hizi ni muhimu pia?(chagua majibu yote yalio sahihi)

a)Kusafisha mikono yako kabla ya kugusa kitovu

b)Kata kitovu na chombo kisafi kama makasi

c)Tumia chombo chochote chenye makali kukatia kitovu

d)Baada ya kukata kitovu,paka dawa za kienyeji

7. Ukipata kitovu chenye harufu mbaya,kinatoa damu,na kuna vipele kando yake,unapaswa kufanya nini? (chagua majibu yote yalio sahihi)

a) kiache kikauke

b) safisha na maji na sabuni

c) safisha na iodine

d) paka poda ya antibiotiki

utunzaji maalum na ufatiliaji wa mtoto njiti wodini

8. Kwa maoni yako ni ipi njia bora kuhakikisha joto la usawa kwa watoto njiti? (chagua majibu yote yalio sahihi)

a) kumuogesha mtoto kwa maji yaliyo na usawa wa joto

b) kumvalisha nguo na kofia

c) kumueka mtoto kifuani kwa mama ngozi kwa ngozi

d) kumueka mtoto kwenye chumba chenye ujoto wa 28c-30c

9. Kipi chengine ni muhimu kuzingatiwa wakati unamhudumia mtoto njiti?(chagua majibu yote yalio sahihi)

a) kumuosha mtoto mara kwa mara

b) kuanza kunyonyeshwa mapema na mara kwa mara

c) kuhakikisha mtoto ana ujoto wa sawa

d) kuzuia magonjwa ya maambukizi kutokea

10. Mtoto aliye na uzito wa gramu 2500-1250 anafaa kupewa maziwa kila baada ya masaa mangapi?

a) masaa 2

b) masaa 3

c) masaa 4

d) saa 1

11. mtoto aliye na uzito wa chini ya gramu 1250 anafaa kupewa maziwa kila baada ya masaa mangapi?

a) masaa 2

b) masaa 3

c) masaa 4

d) saa 1

12.mtoto aliye na uzito kati ya gramu 1500-2500 anapaswa kupimwa joto kila baada ya masaa mangapi ndani ya masaa 24 ya siku ya kwanza?

a) kila baada ya saa moja chini ya masaa 8 alafu kila baada ya masaa 12

b) kila baada ya masaa 6 alafu kila baada ya masaa 12

c) kila baada ya masaa12 alafu kila baada ya masaa 24

d) kila baada ya masaa 2 alafu kila baada ya masaa 4

13. mtoto aliye na uzito chini ya gramu 1500 anapaswa kupimwa joto kila baada ya masaa mangapi ndani ya masaa 24 ya siku ya kwanza?

a) kila baada ya saa moja chini ya masaa 8 alafu kila baada ya masaa 12

b) kila baada ya masaa 6 alafu kila baada ya masaa 12

c) kila baada ya dakika 30 chini ya masaa 4 alafu kila lisaa kwa masaa 24

d) kila baada ya masaa 2 alafu kila baada ya masaa 4

14. Unapaswa kupima kiwango cha kupuma kila baaada ya masaa mangapi?

a) masaa 4

b) masaa 6

c) masaa 12

d) masaa 2

15. Unapswa kupima kiwango cha oksijeni mwilini kila baada ya masaa mangapi?

a) masaa 4

b) masaa 6

c) masaa 12

d) masaa 2

16.Unapaswa kupima mipigo ya moyo kila baada ya masaa mangapi?

a) masaa 4

b) masaa 6

c) masaa 12

d) masaa 2

17.Unapaswa kupima sukari ya mwilini saa ngapi?

a) chini ya masaa 2 baada ya kuzaliwa alafu kila baada ya masaa 6 hadi mtoto anapata maziwa ya kutosha

b) chini ya dakika 30 baada ya kuzaliwa alafu kila baada ya masaa 12 hadi mtoto anapata maziwa ya kutosha

c) chini ya masaa 4 baada ya kuzaliwa alafu kila baada ya masaa 24 hadi mtoto anapata maziwa ya kutosha

d) chini ya lisaa 1 baada ya uzaliwa alafu kila baada ya masaa 4 hadi mtoto anapata maziwa ya kutosha

18. Kila siku mtoto njiti anapaswa kuongeza uzito wa kiasi ngapi?

a) Zaidi ya gramu 10 kwa siku

b) Zaidi ya gramu 15 kwa siku

c) Zaidi ya gramu 25 kwa siku

d) Zaidi ya gramu 30 kwa siku

19. Mtoto njiti huzingatiwa kuwa na sukari ya chini ya mwilini ikiwa itakuwa chini ya…….na anapaswa kupatiwa…….?

a) Chini ya 3.3mmol/l, 5ms/kg D10 IV bolus

b) Chini ya 2.6mmol/l, 5ms/kg of D10 IV bolus

c) Chini ya 3.3mmol/l, 2ms/kg of D10 IV bolus

d) Chini ya 2.6mmol/l, 2ms/kg of D10 IV bolus

20. Mtoto njiti kazaliwa ameletwa wodini ila anapumua kwa haraka(zaidi ya mara 60 kila dakika)anatoa sauti isiyo ya kawaida wakati anapumua,ana rangi ya kijivu,na kifua cha chini kinaingia ndani sana.utamtibu vipi?

a) Utampa oksijeni kwa kupitia mpira wa puani

b) Utampa oksijeni kwa kupitia maski

c) Utampa CPAP

d) Utamueka kwa mashine ya kumsaidia kupumia(mechanical ventilation)

Appendix iii: Consent Form -English Version
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS, MUHAS

No …… Date ……..……

Introduction

Greetings! My name is Dr.Mwajuma Mwikali.I am doing my Mmed in peadiatrics at Muhimbili University of Health and Allied sciences. I am conducting a research to assess the knowledge of nurses in caring for the premature LBW babies in the regional and national hospitals in Dar es salaam.

Purpose of the Study

The aim of this is to assess knowledge among the nurses involved in the care of premature infant together with their challenges and solutions in acquiring it.

You have been selected among many other nurses who work in the NICU of the regional and National hospitals in Dar es Salaam, to participate in the study.

What Participation Involves

If you agree to join this study, you will be required to sign this consent form and return a dully

filled questionnaire to the interviewer. If eligible you might be selected to participate in a focus group discussion.

Benefits

Your participation in the study will enable us to understand the gaps in the services provided and see areas that need improvement.

Confidentiality of the information collected during the research is assured. All the information collected in the questionnaire forms, and FGD will be entered in the computer with only the study identification number.

Risk

Your participation in the study will not pause any harm to anyone.

Right to withdraw

Taking part in this study is totally voluntary, that is, you can decide to participate or not. You can stop participating in this study at any time, even if you have already given your consent. Refusal to participate or withdrawal from the study will not involve penalty or loss of any benefits to which you are otherwise entitled.

Who to contact

In case of any queries about this study, you can contact the researcher, Dr. Mwajuma Mwikali of

Muhimbili University of Health and Allied Sciences, P. O. Box 65001, Dar es Salaam, mobile no. 0769167769.Email address bejummer@gmail.com or Dr. Bruno Sunguya Director of Research and Publications Muhimbili University of Health and Allied Sciences (MUHAS)

Telephone: + 255 22 2152489 email:drp@muhas.ac.tz.

I, ……. Have read the contents of this consent form and my questions have been adequately answered. I therefore agree to participate in this study.

Signature of the participant ……. Date ……

Signature of the interviewer …… Date ……

Appendix IV: Consent Form --Kiswahili Version

FOMU YA IDHINI

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

NAMBA YA DODOSO……TAREHE……..……

UTAMBULISHO

Habari! Naitwa Dr.Mwajuma Mwikali,ni mwanafunzi washahada ya uzamili ya udaktari wa watoto katika Chuo cha Sayansi Shirikishi cha Muhimbili . Ninafanya utafiti kuhusu namna wauguzi wanavyowahudumia watoto wachanga walio njiti hapa Dar es salaam haswa wanaofanya kazi katika hospitali za mikoa na kitaifa.

Madhubani ya utafiti;

Madhumuni ya utafiti huu ni kuweza kujua ikiwa wauguzi wanaelimu saa hii hii inayohitajika kuwahudumia watoto hawa wanapozaliwa.Tungependa kufahamu changamoto wanazopata wakati wanatafuta elimu na suluhisho zake.

Ushiriki wako katika utafiti huu;

Kama utakubali kushiriki katika utafiti huu utahitajika kusaini hati ya makubaliano na

kumkabidhi mtafiti na pia unaweza kuhitajika kuhusika katika majadiliano.

Faida za Kushi Riki;

Utasaidia sana kuboresha utunzaji wa watoto wachanga njiti na waliowagonjwa.

Endapo utakubali kushiriki katika utafiti huu, habari zote utakazotoa zitatunzwa kwa usiri

mkubwa na mtafiti kwenye Kompyuta na namba itatumika badala ya jina lako.

Madhara;

Ushiriki wako kwenye utafiti huu hautasababisha madhara yoyote kwako.

Haki ya kujiondoa kwenye ushiriki;

Ushiriki wako katika utafiti huu ni wa hiari kabisa na waweza kuamua kujiondoa kwenye utafiti huu hata kama utakuwa umesaini ukubali bila matatizo yoyote. Kutoshiriki au kujiondoa kwako kwenye ushiriki hakutakuathiri kwa namna yoyote ile.

Mawasiliano;

Kama una swali lolote kuhusu utafiti huu usisite kuuliza kwa Dr.Mwajuma Mwikali wa chuo kikuu cha sayansi ya afya Muhimbili S. L. P. 65001, Dar es salaam.namba ya simu 076917769.barua pepe bejummer@gmail.com au mwenyekiti wa kamati ya utafiti na uchapishaji MUHAS Dr. Bruno Sunguya.namba ya simu+ 255 22 2152489,barua pepe drp@muhas.ac.tz S.L.P 65001 Dar es salaam, simu namba 2152489 Dar es Salaam.

Mimi……..……..... Nimesoma na kuelewa vizuri kuhusu utafiti huu na maswali yangu yote yamejibiwa kwa ufasaha. Nimekubali kwa ridhaa yangu kushiriki katika utafiti huu.

Sahihi ya mshiriki……. tarehe……

Sahihi ya mtafiti ……. tarehe……

Appendix v: Focus Group Interview Guide

INTRODUCTION;

1. **Welcome the participants**

Good morning, my name is Dr. Mwajuma Mwikali, I am an MMED student in pediatrics and child health. Currently conducting my research on nurses' knowledge on the care of preterm newborns and their experience in acquiring it in the regional and national hospitals.

Hand over the FGD guide with allocated participant numbers on them for identification purposes while introducing the focus group.

2. **Explain the process**

The purpose of this research is to explore the experience of the nurses in acquiring knowledge for the care of preterm newborns. This information will help us understand if there are any challenges you experience while seeking knowledge and your suggested solutions.

The Focus Group Discussion (FGDs) will be approximately 15 -30 minutes where we will discuss freely. We intend to have a friendly environment where you can openly air your views and experiences on the issue at hand. The discussion will be recorded for recollection purposes.

Your participation in this research is entirely voluntary and you have the right to withdraw whenever necessary.

Information about you that was collected during the research will be kept confidential and no one but the researchers will be able to view them

3. **Ground rules**
    - Everyone is encouraged to participate
    - One person should speak at a time
    - Before speaking mention your registration number
    - There are no right or wrong answers
    - You do not have to speak in a particular order
    - Turn off cell phones or put them on silent mode to avoid distractions

Other logistics:

- Feel comfortable discussing openly
- help yourself to refreshments

4. **Turn on the Tape recorder**
5. **Ask the group if there are any questions before the discussion starts and address them.**
6. **Introductions**

- Go around the table: mention years of experience in caring for the preterm newborns

The discussion begins, make sure to give people time to think before answering the questions and don't move too quickly. Use the probes to make sure that all issues are addressed, but move on when you feel you are starting to hear repetitive information

Interview questions

1. Can you describe the challenges you experience when providing care to premature newborns?
2. When you think about your own learning needs, what are the top 3 that you believe is most important?
3. When you consider learning needs in your workplace (unit as a whole), what do you believe is most important?
4. Can you describe what education was available for you as you entered the NICU and what ongoing education is available? For example, a scheduled orientation and ongoing professional development are scheduled regularly. Are these educational opportunities paid for as part of your position or volunteer time?
5. Can you describe or give examples of the educational opportunities offered at your institution after you started working there? Are these opportunities generally for nurses alone or in a multidisciplinary team environment?

6. There are many types of information that we need to care for ill and at-risk newborns. When you are seeking different types of information where do you look?
7. Is there a certain person (people) that you can go to within your hospital to help you find information?
8. Can you describe one or two barriers that you feel make it difficult to meet these priorities?
9. Can you describe how physicians and administration support the need for continuing professional development in your unit? How could his be improved?
10. If you could change one thing to improve your ability to provide care, what would it be?

Appendix vi: Focus Group Interview Guide; Kiswahili Version

1. Unaweza kuelezea ni changamoto zipi munazo kumbatiana nazo wakati munatoa huduma kwa watoto hawa waliozaliwa kabla ya wakati?
2. Mahitaji yapi kuhusu elimu ya huduma kwa watoto waliozaliwa kabla ya wakati mungependelea kujua/kufunzwa?taja tatu za muhimu.
3. Elimu inayohitajika sana kazini/wodini ni zipi?
4. Ulipoanza kazi NICU, ulipata elimu gani and munafanya elimu endelezi? Munapofanya mafunzo haya munalipwa au la?
5. Elezea aina ya mafunzo mulipata wakati umeanza kazi. inawahusu wahudumu au na wengine pia?
6. Wakati munahitaji elimu kuhusu watoto wachanga hawa wanaoumwa munatafuta wapi?
7. Yupo mtu ambaye munafuata ili awape mafunzo ikiwa munahitaji?
8. Changamoto zipi munapata wakati unapo hitaji elimu?
9. Utawala na madaktari wanachukua nafasi gani kuhakikisha munamaendeleo hapa wodini?watarekebishaje?
10. Ungekuwa na fursa ya kuweka mabadiliko kwa ajili ya kuboresha huduma kwa watoto hawa mungependekeza nini?

Appendix vii: Ethical Clearance

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

P.O. Box 65001
DAR ES SALAAM
TANZANIA
Web: www.muhas.ac.tz

Tel G/Line: +255-22-2150302/6 Ext. 1015
Direct Line: +255-22-2151378
Telefax: +255-22-2150465
E-mail: dpgs@muhas.ac.tz

Ref. No. HD/MUH/K.206/2018/02 **18th June 2020**
IRB#: MUHAS-REC-06-2020-307

Mwajuma M. Mwamtenda,
MMed. Paediatrics/Child Health,
School of Medicine,
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED "NURSES' KNOWLEDGE ON THE CARE OF PREMATURE NEWBORN IN CASE OF DAR ES SALAAM NEONATAL UNIT."

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from **18th June, 2020 to 17th June, 2021.** In case you do not complete data analysis and dissertation report writing by **17th June, 2021,** you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. Emmanuel Balandya
ACTING: DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
cc: Dean, School of Medicine, **MUHAS**

Appendix viii: Permission to collect data at Amana Regional Referral Hospital

UNITED REPUBLIC OF TANZANIA
MINISTRY OF HEALTH,COMMUNITY DEVELOPMENT,GENDER, ELDER AND CHILDREN

DAR ES SALAAM REGION
ADDRES: "HEALTH"
PHONE: 022 - 2861903

IN REPLY PLEASE QUOTE

REF.NO. MOHCDGEC/ARRH/R.I/XI/93

AMANA REGIONAL REFERRAL HOSPITAL
P.O.BOX 25411
DAR ES SALAAM.

22/09/2020

Director of Postgraduate Studies,
MMed. Pediatrics/Child Health, School of Medicine,
Muhimbili University of Health and Allied Sciences,
P.O.BOX 65001,
DAR ES SALAAM.

RE: PERMISSION TO CONDUCT RESEARCH AND COLLECT DATA.

Refer to your letter which date 18,June,2020 which requested us to allow Mwajuma M. Mwamtenda to conduct research and collect data in our Institution.

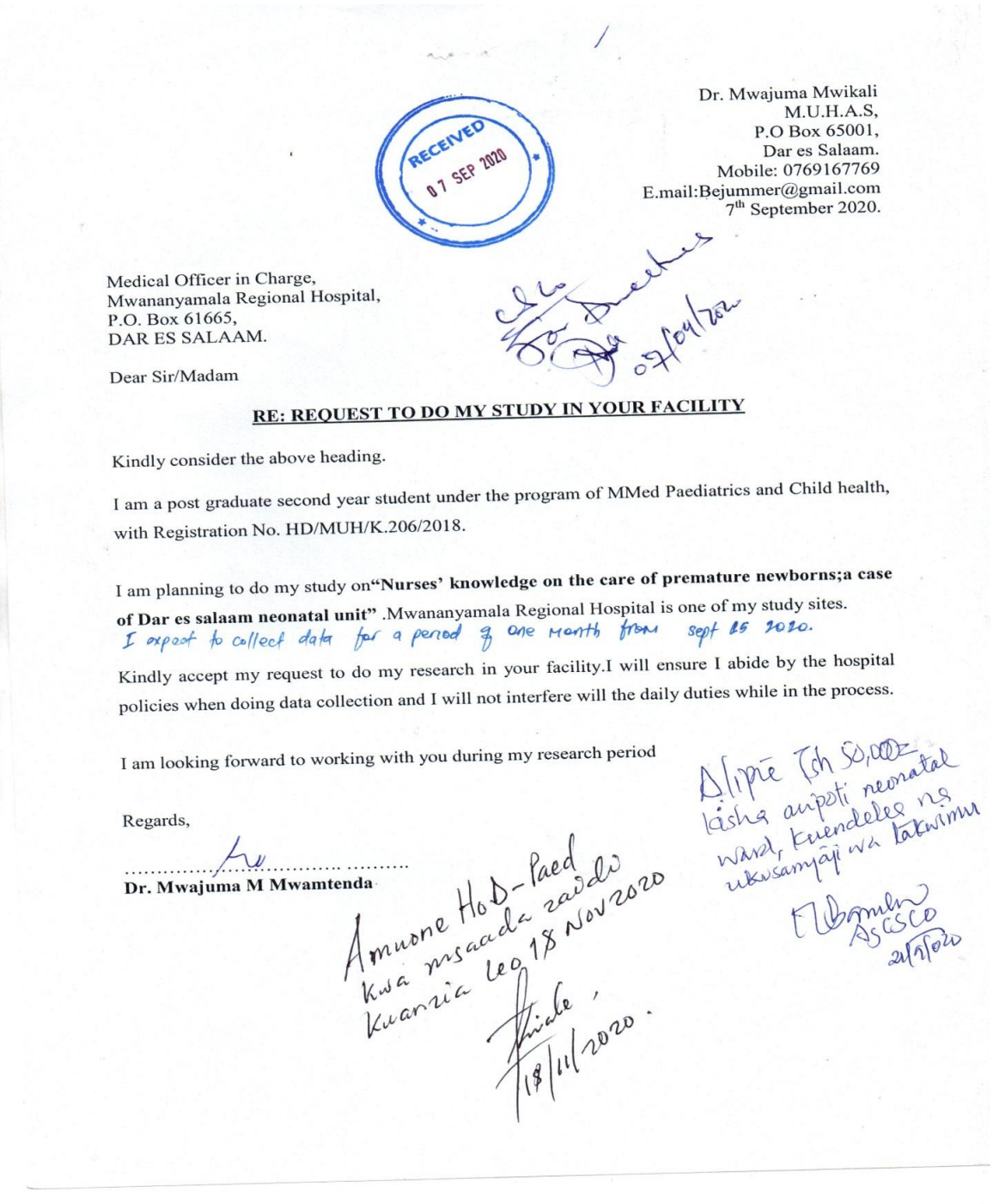
We are here to acknowledge your request with the following conditions, that she must submit the results of her research after completion of analysis in order the hospital to make use of the data's to solve hospital problems.

Regards.

Dr. Rose Ntambuto
FOR: MEDICAL OFFICER INCHARGE
AMANA REGIONAL REFERRAL HOSPITAL

For:
MEDICAL OFFICER INCHARGE
AMANA REGIONAL REFERRAL HOSPITAL
P. O. Box 25411
DAR-ES-SALAAM

Appendix ix: Permission to collect data at Mwananyamala Regional Referral Hospital



RECEIVED
07 SEP 2020

Dr. Mwajuma Mwikali
M.U.H.A.S,
P.O Box 65001,
Dar es Salaam.
Mobile: 0769167769
E.mail:Bejummer@gmail.com
7th September 2020.

Medical Officer in Charge,
Mwananyamala Regional Hospital,
P.O. Box 61665,
DAR ES SALAAM.

Dear Sir/Madam

RE: REQUEST TO DO MY STUDY IN YOUR FACILITY

Kindly consider the above heading.

I am a post graduate second year student under the program of MMed Paediatrics and Child health, with Registration No. HD/MUH/K.206/2018.

I am planning to do my study on**"Nurses' knowledge on the care of premature newborns;a case of Dar es salaam neonatal unit"** .Mwananyamala Regional Hospital is one of my study sites.
I expect to collect data for a period of one month from sept 15 2020.

Kindly accept my request to do my research in your facility.I will ensure I abide by the hospital policies when doing data collection and I will not interfere will the daily duties while in the process.

I am looking forward to working with you during my research period

Regards,

Dr. Mwajuma M Mwamtenda

Amuone HoD-Paed
kwa msaada zaidi
Kuanzia leo 18 Nov 2020

18/11/2020.

Alipe Tsh 50,000/=
kisha anpeti neonatal
ward, kuendelea na
ukusanyaji wa takwimu

DCSCO
21/9/2020

Appendix x: Permission to collect data at Temeke Regional Referral Hospital

UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

Regional: DAR ES SALAAM
Address: 'Health'
Phone No: +255 -758 908110
Telefax Na:
Email: temekerh@afya.go.tz

TEMEKE REGIONAL REFERRAL HOSPITAL
P.O. BOX 45232
TEMEKE
DAR ES SALAAM.

Ref. No. TRRH/RSC/9/2/28 **Date:** 11/9/2020

Name: MWAJUMA MUNIKALI
P.O.Box 65087
Institution: MUHAS

RE: REQUEST FOR RESEARCH

Refer to the letter dated 7/9/2020 with Ref. No HA/muhas/k.26/2018/02 from MUHAS I would like to inform you that your request for a research intends to do study titled NURSES KNOWLEDGE ON THE CARE OF PREMATURE NEW BORNS AT CARE AT DAR ES SALAAM NEONATAL UNIT is accepted Furthermore, there is no financial obligation for this request and you should report to the head of NURSING AND MIDWIFE after receiving this letter for your study.

Also you should copy with rules, laws, regulations and order of Temeke Regional referral Hospital for the period of your study.

Regards.

For: Hospital Director
TEMEKE REGIONAL REFERRAL HOSPITAL

Copy to:
1. The Head of Department
   Research (study)
   P.O. Box 65087
   INSTITUTION: MUHAS.
2. Head of NURSING AND MIDWIFE.
   Temeke Regional Referral Hospital HOR
   Kindly assist for ..... Research

Appendix xi: Permission to collect data at Muhimbili National Hospital, Upanga

MUHIMBILI NATIONAL HOSPITAL

Cables: "MUHIMBILI"
Telephones: +255-22-2151367-9
FAX: +255-22-2150534
Web: www.mnh.or.tz

Postal Address:
P.O. Box 65000
DAR ES SALAAM
Tanzania

In reply please quote:

MNH/TRCU/Permission/ 2020/164 **14th July, 2020**

Head of Department,
Paediatrics
Muhimbili National Hospital

RE: PERMISSION TO COLLECT DATA AT MNH.

Name of Student	**Mwajuma M. Mwamtenda**
Title	**"NURSES KNOWLEDGE ON THE CARE OF PREMATURE NEWBORNS; A CASE OF DAR ES SALAAM NEONATAL UNIT".**
Institution	Muhimbili University of Health and Allied Sciences
Supervisor	Dr. E. Munubhi
Co- Supervisor	Dr.Nahya Salim Dr.Isabella Swai
Period	14th July, 2020, to 25th Sept, 2020

Approval has been granted to the above mentioned student to collect data at MNH.

Kindly ensure that the student abide to the ethical principles and other conditions of the research approval

Sincerely,

HEAD, TEACHING, RESEARCH & CONSULTANCY UNIT
P. O. Box 65000
DAR-ES-SALAAM
MUHIMBILI NATIONAL HOSPITAL

Dr. Faraja Chiwanga
Head of Teaching, Research and Consultancy Unit

c. c DMS
c. c **Mwajuma M. Mwamtenda**

Dr. Isabella Swai to assist.

All Correspondence to Addressed to the Executive Director