

**CARE OF REFERRED NEONATES DURING TRANSPORT TO THE
NEWBORN UNIT AT MOI TEACHING AND REFERRAL
HOSPITAL, ELDORET-KENYA**

BY

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SM/PGCHP/04/14

**A Thesis Submitted in Partial Fulfillment of Requirements of Master of
Medicine (Child Health and Paediatrics) of School of Medicine, Moi
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DECLARATION

Student's Declaration

I declare that this research thesis is my original work and that it has not been presented for a degree in any other university. No part of this thesis may be reproduced without prior written permission of the author and or Moi University.

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DEDICATION

I would like to dedicate this study to my parents and siblings for their prayers and support throughout the course of my studies.

ACKNOWLEDGEMENT

I wish to thank my supervisors Dr. Peter Gisore and Dr. Eric Ngetich for their guidance and support. I also acknowledge my research assistants and staff of the newborn unit. Lastly, I thank my family and the entire pediatrics and child health fraternity for their moral, intellectual and material support.

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LIST OF ABBREVIATIONS

ANC	Antenatal clinic
AVD	Assisted vaginal delivery
CME	Continuous medical education
EBM	Expressed breast milk
ELCS	Elective caesarean section
EMCS	Emergency caesarean section
EMT	Emergency medical technician
HCP	Health care professional
HIV	Human immunodeficiency virus
IREC	Institutional Research and Ethics Committee
IVF	Intravenous fluids
KDHS	Kenya Demographic Health Survey
KMC	Kangaroo Mother Care
MTRH	Moi Teaching and Referral Hospital
NBU	Newborn unit
NETS	Neonatal Emergency Transport Systems
NGT	Nasogastric tube
NNF	National Neonatology Forum
SBD	Spontaneous breech delivery
SVD	Spontaneous vertex delivery
WHO	World Health Organization

OPERATIONAL DEFINITIONS

Appropriate escort-a health professional for example a nurse, doctor or paramedic/emergency medical technician who accompanies the sick referred neonate during transport and is trained in patient transport.

Care-activities carried out to ensure the maintenance of the normal physiology of the neonate during transport such as the provision of warmth, feeds and monitoring.

Condition of neonate on admission -temperature, random blood sugar, pulse rate, respiratory rate.

Hypothermia- axillary temperature of less than 36.5 degrees celsius.

Hypoglycemia- a random blood sugar of less than 2.5mmol/l.

Indication for referral-the referral diagnosis and the reason for referral from the referring hospital.

Neonate-an infant less than 28 days old.

Neonatal mortality-death occurring within the first 28 days of life.

Neonatal period-the first 28 days of life.

Neonatal transport- the process of moving a neonate from a health facility to the newborn unit, MTRH.

Outcome-hypothermia, hypoglycemia

Referral- a neonate who is sent from a peripheral health facility to the newborn unit at MTRH for further management or specialized care.

Self-referral- where a mother brings a sick neonate directly to MTRH having bypassed lower levels of health care.

Transport characteristics- mode, duration, and escort during transport, factors that influenced choice of transport and condition of the neonate on admission.

**CARE OF REFERRED NEONATES DURING TRANSPORT TO THE NEWBORN
UNIT AT MOI TEACHING AND REFERRAL HOSPITAL, ELDORET, KENYA
ABSTRACT**

Background: Globally, one percent of neonates require transport from one health facility to another with a third of this transfer occurring within twenty four hours of birth. The principles of neonatal transport include: assessment, stabilization before and during transport and care during transport. Care during transport is essential to ensure that the neonate's hemodynamic status is maintained.

Objective: To describe the care offered to referred neonates during transport to the newborn unit at Moi Teaching and Referral Hospital, Eldoret, Kenya.

Methods: This was a cross-sectional study carried out at the newborn unit, Moi Teaching and Referral Hospital. Neonates referred from peripheral health facilities were recruited and a consecutive sampling was done. Data were collected from February 2016 to July 2016 with the use of questionnaires, structured data checklists (patient and ambulance) and the patients' file. The condition of the neonate on admission (temperature, respiratory rate, pulse rate and random blood sugar) was obtained from the file. Data were analyzed using statistical package for social sciences (SPSS®) version 20 at 95% confidence interval. Descriptive statistics were generated for continuous and categorical data. Frequency tables were used to summarize the data. Chi Square tests were used to test for associations. Logistic regression was done to test for independent association. Results were presented in form of graphs, tables and text.

Results: A total of 122 neonates were recruited and analyzed. Majority were males 71(58%) and most 60(49%) were referred on the day of birth. The main indication for referral was the lack of a newborn unit at the referring hospital 56(46%) and the main referral diagnosis was prematurity 39(32%). Majority, 96(79%) were transported with an ambulance and were escorted by a health care worker 95(78%). Warmth was provided mainly through the use of clothing in 110(90%) and majority 42(34%) did not receive either enteral feeds or intravenous fluids during transport. On ambulance equipment, none was equipped with transport incubators, 46(48%) had resuscitation equipment, 64(67%) had monitoring equipment and 75(79%) had oxygen cylinders. Majority of the neonates 54 (44%) had hypothermia on admission which was positively associated on bivariate analysis with birth weight of less than 2.5kgs ($p=0.034$), prematurity ($p=0.029$) and hypoglycemia ($p=0.007$). Hypoglycemia was found in 25(21%) of the neonates which was associated on bivariate analysis with prematurity ($p=0.002$) and lack of enteral feeding or intravenous fluids during transport ($p<0.001$). On logistic regression, prematurity (OR 2.251; 95% CI 1.078-4.705; $p=0.046$) and hypoglycemia (OR 3.445; 95% CI 1.353-8.776; $p=0.014$) were associated with hypothermia. Lack of enteral feeding or intravenous fluids during transport (OR 7.82; 95% CI 2.9-20.9; $p<0.001$), prematurity (OR 4.121, 95% CI 1.61-10.544; $p=0.014$) and hypothermia (OR 3.446, 95% CI 1.353-8.776; $p=0.014$) were associated with hypoglycemia on logistic regression.

Conclusions: Prematurity was the main referral diagnosis. Despite ambulances being the key mode of transport, the care received by the neonates was inadequate.

Recommendations: Care and monitoring of neonates during transport should be improved. Ambulance should be equipped adequately for neonatal transport with transport incubators, resuscitation and monitoring equipment.

CHAPTER ONE: INTRODUCTION

1.1: Background information

Neonatal transport entails the movement of sick neonates from one health facility which lacks the specialist intensive care facilities to a facility that has intensive neonatal care. One percent of neonates require transport from one health facility to another for continuation of neonatal care [Kumar P et.al, 2008] [Cornette. L et.al, 2004]. One third of neonatal transport occurs within 24 hours and the rest within the first week [Lilley C.D et.al, 2005]. In developed countries, organized neonatal transport was initiated in the 1960's so that care could be accessible to neonates that required specialized care [Cornette. L et.al, 2004]. Neonatal transport services such as neonatal emergency transport systems (NETS) are designed to ensure uninterrupted care of the neonate during transfer. Neonatal care during transportation is essential to ensure that their hemodynamic stability is maintained. Ideally, during transportation there should be provision of the same level of monitoring and quality of care available at the advanced care setting. Care during referral includes regular monitoring of the airway, breathing and circulation so that appropriate interventions can be carried out in case of any derangements.

The most ideal way to transport a neonate to a health facility should be in utero to ensure that the neonate enters the health facility under optimal conditions which has been shown to result in improved neonatal survival [Ricardo Martinez et.al, 2011]. However, this requires predicting possible morbidities including preterm delivery which is not always possible hence the need for transfer of neonates post-delivery [Seghal. A et.al, 2001] [Kempley ST et.al, 2004]. Neonates delivered from lower level health facilities may develop complications, have diseases that require advanced care such as surgery or assisted

ventilation that will necessitate transfer. The chance of survival is enhanced when emergency care can be provided during the transfer of the neonate.

The common indications for neonatal referral include: respiratory distress, prematurity, birth asphyxia, neonatal sepsis, surgical conditions, need for intubation or assisted ventilation among others [NNF, 2011].

In Kenya, the neonatal mortality rate is at 22 per 1000 live births according to the Kenya Demographic Health Survey 2013-2014 [KDHS, 2013]. Referral is an essential component of the health care system in Kenya and plays a role in ensuring that a patient who requires further management can be transported to a higher level health facility [Ministry of Health, 2013] [Kenya Health Policy, 2012]. Delays in referral of the neonate to a center with more expertise has been shown to contribute to neonatal mortality. In addition, delays in recognizing the illness, its severity and in initiating care also play a role in contributing to the neonatal mortality rate.

Physiological disturbances may occur in various body systems during transportation and include hypoxia, hypoglycemia and derangements in body temperature. Thermal control to prevent extremes of temperature is vital. Neonates are at higher risk of hypothermia due to their low body fat stores and large body surface area which increases their risk of neonatal mortality [Kliegman M et.al, 2011]. Furthermore, care should be directed towards preventing hypoglycemia by enteral feeding or through administration of intravenous fluids. Previous studies have shown that hypothermia, hypoglycemia, poor perfusion and oxygenation are associated with higher mortality among transported neonates [Seghal A et.al, 2001] [Mathur NB et.al, 2007]. In addition, birth weight less than 2000 grams and

associated illnesses such as birth asphyxia, neonatal sepsis and respiratory distress syndrome are associated with higher mortality [Mathur NB et.al, 2007]. Preterm birth is noted to be the leading cause of neonatal deaths and the second leading cause of death after pneumonia in children less than five years of age [WHO, 2013] [WHO, 2012]. The referred neonate therefore requires transportation by skilled health personnel as this has been shown to decrease the neonatal morbidity and mortality in comparison to those who came by themselves [Hood J et.al, 1983].

Pre-transport stabilization is vital prior to transport of the sick neonate. This entails ensuring the adequacy of the airway, breathing and circulation. Pre-transport procedures such as intravenous access insertion and nasogastric tube where indicated should be carried out so as to minimize procedures done en-route to the referral hospital [WHO, 2003].

The study aimed at describing the care of neonates referred to the newborn unit at Moi Teaching and Referral Hospital. Furthermore, it aimed to describe their transport characteristics which included their mode of transport, condition of the neonate on arrival, duration of transport and presence of an escort during transport. Furthermore, it aimed to describe the pre-transport preparation of the neonate such as the fixing of an intravenous access or nasogastric tube if indicated prior to transport.

1.2: Problem Statement

Neonatal transport was developed to ensure that sick neonates can be moved from one health facility which lacks pediatric specialists or facilities to one that is able to provide neonatal intensive care. Developed countries for example in Europe and North America have a well-established Neonatal Emergency Transport System (NETS) which was established to ensure the continuation of neonatal care during transportation to a health

facility so as to maintain their hemodynamic stability [Cornette et.al, 2004]. While there is no established network for transporting sick neonates in Kenya, most health facilities have nursing staff, oxygen and ways of providing oxygen, intravenous fluids and blood transfusion. In addition, they may have ambulances that can be equipped so that they can be suitable for neonatal transfer. Kangaroo mother care is a low cost measure that can be utilized in resource limited settings to provide warmth during transport. These resources should be used to stabilize neonates during transportation and how these provisions are utilized to support this transfer to MTRH is unclear.

Anecdotal data indicates that most peripheral health facilities in Kenya such as health centers and sub-county hospitals lack newborn units and specialists to manage sick neonates. As a result a large proportion of sick neonates are referred to a higher level hospitals to receive specialist management and care. Provision of care such as warmth is essential to maintain the neonates' hemodynamic stability as they are usually at risk of preventable morbidity such as extremes of temperature [Kliegman M et.al, 2011].

We don't fully understand how neonatal transport is done to the newborn unit, MTRH, what care is offered and the approaches to neonatal transport in our setup. The study aims to identify and describe the approaches to neonatal transport in view of assessing its appropriateness and its influence on neonatal outcomes.

1.3: Justification for the Study

Most peripheral centers in Kenya are not well equipped to manage neonates and most of them refer neonates to facilities with more expertise and facilities [Ministry of Health, 2013]. Currently, there are no studies in Kenya that have focused on describing the care of neonates during transport and their transport characteristics.

This study will help in characterizing the referred neonate, the common indications for referral, care offered during transport and the appropriateness of the neonatal transport. It will aid in recognizing how they are transported and whether optimal care is being offered to them or not and to identify any gaps in the transport process.

MTRH is the second largest public referral hospital in Kenya and receives neonates referred for specialist care and management. The newborn unit at the hospital receives an average of 30 referred neonates per month and thus referred neonates form a significant proportion of admissions to the newborn unit [MTRH records, 2014]. It was therefore important to study how these neonates are transported and how appropriate their transportation is to the newborn unit, MTRH.

The findings of the study will inform the design of an intervention that can aid in improving the neonatal transport process.

1.4: Research Question

What is the care offered to referred neonates during transport to the newborn unit, Moi Teaching and Referral Hospital?

1.5: Objectives

1.5.1: Primary Objectives

1. To describe the care offered to referred neonates during transport to the newborn unit, Moi Teaching and Referral Hospital.

1.5.2: Secondary Objectives

1. To describe the indications for referral of neonates to the newborn unit, MTRH.
2. To outline the transport characteristics of neonates referred to the newborn unit, MTRH and the factors associated with neonatal outcome.
3. To describe the thermoregulation and feeding practices of referred neonates during transport to the newborn unit, MTRH.

CHAPTER TWO: LITERATURE REVIEW

2.1 Definition

Neonatal transport refers to the process of moving a sick neonate from health facilities without specialist, intensive care facilities to hospitals with neonatal intensive care and other specialist services [Cornette. L et.al, 2004].

2.2 Backgrounds

Organized neonatal transport was initiated in the early 1960's so that intensive care could be accessible to the neonate who requires specialized care .The safest form of neonatal transport is in utero but one cannot always anticipate preterm delivery or neonatal illness, hence the continued need for transport of neonates after delivery [Cornette. L et.al, 2004][Kempley.ST, 2004].

In developing countries most neonatal referrals are self-referrals or are carried out with poorly organized transport which has been associated with inadequate pre-transport stabilization and incomplete advice concerning care during transport [Buch Pankaj et.al, 2012]. As a result, many neonates transported this way are hypothermic, cyanosed and hypoglycemic resulting in serious clinical implications [Agostino. R et.al, 1999] [Britto.J et.al, 1995][Leslie.AJet.al, 1997].Suboptimal conditions of neonatal resuscitation, thermoregulation and transfer have been associated with poor immediate outcome [Njonkanma et.al, 1995].It has been noted that application of the principles of neonatal transport from where they are born or referred from aids in the management of neonatal surgical emergencies in addition to good nursing care, adequate resuscitation and prompt diagnosis [Tenge K et.al ,2007].

2.3 Kenya's referral system

The referral system is a vital part of the Kenya health care system which is currently a four tiered health system [Ministry of Health, 2013][Kenya Health Policy 2012]. The lowest tier is the community health services usually at the household or village level. It is usually managed by community health workers and supervised by community health extension workers. They initiate referrals to primary health facilities [Ministry of Health, 2013].

The second tier includes primary health facilities which include the health centers, maternity homes and dispensaries of both public health and private health care providers. Dispensaries provide general outpatient services and perform minor surgical procedures while health centers provide basic inpatient care and maternity services [Ministry of Health, 2013].

The third tier are the county referral hospitals which are managed by a particular county .It includes the former level 4 and district hospitals .They provide inpatient and outpatient care and are run by consultants, medical officers, clinical officers and nurses .They are also used as training facilities for medical and nursing students and as internship centers [Ministry of Health, 2013].

The fourth tier is the national referral hospitals which are two in Kenya. This are the Kenyatta National Hospital and the Moi Teaching and Referral Hospital. The staff includes specialized consultants, medical officers, clinical officers and nurses [Ministry of Health, 2013].These health facilities are also used as training facilities for undergraduate and postgraduate medical students and as internship centers.

The Kenyan government has referral guidelines that were formulated to act as a guide to the referral of patients between the various levels of care. The health referral system in Kenya has been noted to lack proper organization and transport systems. This has resulted in the utilization of higher tier health facilities such as referral hospitals as a primary health facility where conditions that could have been handled at the lower tier facility are handled at a higher tier facility [Ministry of Health, 2013].

The referral system in Kenya experiences challenges which include: the lack of a well-organized transport system, high number of self-referrals and the lack of adequate resources at the referral hospital [Ministry of Health, 2013] [Kenya Health Policy 2012].

2.4 Components of neonatal transport

The vital components of a neonatal transport are: human resource, vehicle and equipment, communication, family support, documentation and feedback to the referring unit [Ministry of Health, 2013] [WHO, 2003].

2.4.1 Human resource

Human resource essential in neonatal transport includes doctors, nurses or paramedics who are trained in essential newborn care and in the identification and management of emergency signs in the neonate [NNF, 2011]. In western countries, the neonatal transport team includes a trained neonatal nurse in combination with other disciplines such as an anaesthetist, paramedic or a pediatrician. The choice of the neonatal transport team is dependent on the needs of the patient and competency of the staff [Kempley ST et.al,2004]. In developing countries, training of health care personnel can be done so as to achieve the ideal standards of having personnel who are trained in neonatal transport

medicine .There is no observed difference in outcomes when neonates are transported by trained paramedics, registered nurses or physicians [Lee SK et.al,2002].Neonatal transport should be organized so that it provides the same level of monitoring and quality of care that is available at the advanced care facility [NNF, 2011][WHO,2003]. Transport by skilled organized personnel has been shown to decrease neonatal morbidity and mortality and therefore neonates transported by skilled health personnel had a higher survival than those who came by themselves [Kumar P et.al, 2008][WHO, 2003]. A study [Buch Pankaj et.al, 2012] found that only 11.4% of the referred neonates were accompanied by skilled attendants, 23% by unskilled attendants and 73.2% were accompanied by relatives. A study [Singh et.al, 1996], none of the referred neonates were accompanied by a medical health professional. A study on the patient transfer practices in Kenya found that only 60% of referred patients had an appropriate escort [Kuremu et.al, 2008]

2.4.2 Transport vehicle

The vehicle or ambulance used to transport neonates should be able to provide the basic life support requirements. In developed countries ,neonates are transported in modified vehicles and aircraft that are designed to facilitate the safe transfer of neonates [Cornette L et.al,2004].Modification that can be done in developing countries is equipping or fitting the available ambulances with the necessary equipment to facilitate monitoring during transport. Neonates transported by service or private ambulances have been shown to have better outcomes compared to neonates transported by other means [Deepack Rathod et.al, 2014]].Equipment necessary in the transport vehicle include: oxygen cylinders, incubator, infusion pumps and monitors among others [NNF, 2011][WHO, 2003] . The vehicles should have adequate lighting and insulation to keep the baby warm. A study [Buch Pankaj

et.al, 2012] demonstrated that 26.8% of the studied referred neonates came by ambulance while 22.1% came by public transport while a study [Dalal Ekta et.al, 2013] found that 47.3% of the referred neonates came by ambulance, 33.3% by auto rickshaw and 18.3% by open vehicles.

2.4.3 Communication

Communication between the referring facility and the hospital to which the neonate is being transported to plays a vital role as necessary arrangements can be made to receive the baby [WHO,2003]. The receiving facility should be contacted in advance and confirmation done so as to enable the facility prepare to admit the baby. The estimated time of arrival to the receiving facility should also be given [NNF, 2011].

2.4.4 Family support

Family support should be offered before, during and after the transport. The family should be informed about the condition of the baby , indication for the transfer and be offered some insight into what management may be offered to the neonate at the facility to which they have been referred [NNF, 2011][WHO,2003]. In ideal situations, the parents should sign a consent form agreeing that their baby can be transported to another facility for further management.

2.4.5 Documentation

Documentation is essential and should include recording the assessment of the neonate before and during transport [Ministry of Health, 2013][WHO, 2003]. The referral note which is an essential document during transfer of the neonate should be comprehensive and should include the demographic data of the patient such as the name, age and sex of the

neonate. Furthermore, it should entail the name of the referring institution and contact details, date and time of referral, duration of stay at referring institution and management that was given prior to referral. In addition, the indication for the referral should be indicated, laboratory investigations that had been carried out and the results, name and signature of the referring clinician and a detailed perinatal history should be indicated [Ministry of Health, 2013].

2.4.6 Feedback to the referring institution

Feedback to the referring institution is an important component of neonatal transport process and the team at referral center should call or send a written communication to the members of referring facility regarding the condition of the baby with details of medical illness, likely diagnosis, prognosis and likely duration of stay [NNF, 2011].

2.5 Categories of neonatal transfers

The categories of neonatal transfers are: from home to hospital, intra-hospital transport, to facilitate specialist management of the neonate, retrieval from a peripheral hospital for ongoing intensive care and reverse transport [NNF, 2011][Boxwell G et.al,2000].

2.6 Indications for neonatal transport

Neonatal transport is usually indicated when the neonate requires more specialist management and care that is not available at the facility the neonate is being referred from. The common indications for neonatal transport that have been identified from prior studies include: prematurity, birth asphyxia, respiratory distress or apnea, indication for intubation and assisted ventilation, sepsis, surgical conditions, congenital heart disease, heart failure or arrhythmia, infants requiring specialist diagnostic or therapeutic services among others [Dalal Ekta et.al,2013][www.rch.org.au]. A study [Buch Pankaj et.al, 2012] found

that common indications for referral were prematurity (51.5%), respiratory distress syndrome (43.3%), sepsis (25.2%) and birth asphyxia (16.1%). An Indian study [Ekta Dalal et.al, 2013] also found the common indications to be prematurity (21.4%), birth asphyxia (16.4%), sepsis (13.7%), and ventilator support (9.6%).

2.7 Standards of care during transport

The principles of neonatal transport include; assessments, stabilization during transport and care during transport. In developed countries the neonatal transport and emergency systems is well organized, and the transport of critically ill neonates can only be carried out by licensed medical personnel who have undergone training in emergency neonatal care [Maryland Medical Service, 2014].

2.7.1 Assessment

Assessment of the neonate before and during transport include: assessment of the airway, breathing and circulation.

2.7.2 Stabilization before transport

The principles of stabilization include the identification of neonates' immediate needs, initiation of therapeutic interventions, initiation of diagnostic investigations, prevention of deterioration and the establishment and maintenance of ongoing communication with parents.

Stabilization before transfer occurs in two phases. The first phase is from the time a decision of transfer is made to transfer until the transfer team arrives during which care is delivered by the local staff and the second phase is after the transport team arrives. The aim of both phases is to resuscitate and stabilize the infant prior to the transfer. In addition, it helps to minimize the need for interventions during transport. Procedures such as

nasogastric tube insertion or urethral catheters where indicated should be carried out prior to transportation and necessary treatment given prior to transport [Fenton AC et.al, 2004].

There are three methods of pre departure stabilization. In the first method the transport team loads the neonate into the transport vehicle and assumes care for the patient. This method helps to reduce the out of hospital time and is mainly used for neonates with rapidly progressive disease and is often used with air transport in developed countries .The second method involves the maximal stabilization of the neonate before departure from the referring hospital to minimize the procedures or interventions that are carried out during transport. It is often used with transport teams incorporating physicians and with longer ground or fixed wing transport. The third method is the combination method in which each patient undergoes careful assessment prior to transport. In event is not stable or deteriorating, they are stabilized then transferred [Ohning B et.al, 2004].

Several models for pre -transport stabilization and care have been developed to improve the quality of care before and during transport as well as to decrease the neonatal complications due to inadequate transport .This includes:

1. The **STABLE** model, the pneumatic stands for Sugar, Temperature, Artificial breathing, Blood pressure, Lab work, Emotional support. It has been demonstrated that application of the STABLE model resulted in significant improvement in the morbidity rates [Ricardo Martinez et.al, 2011][Karlsen K et.al ,2001].

2. The **SAFER** model, the pneumonic stands for Sugar, Arterial circulatory support, Family Support, Environment, Respiratory support [NNF, 2011].
3. The **TOPS** model, the pneumonic stands for Temperature, Oxygenation (airway and breathing), Perfusion and Sugar. The TOPS model has been demonstrated to be a useful tool for predicting mortality among transported neonates [Mathur NB et.al, 2007].

The above models emphasize the need to monitor for hypothermia, hypoglycemia and assessment of the airway, breathing and circulation during transport. Furthermore, offering family support and ensuring adequate and safe environment is essential.

Hypoglycemia, hypothermia, poor perfusion and oxygenation have been associated with higher mortality and morbidity in transported neonates [Cornette. L et.al,2004, Narang M et.al,2013,][Kumar PP et.al,2011][Diani Murni et.al,2009]Pre-stabilization and proper standardized care during transport results in decreased incidence of hypoglycemia, acidosis and mortality[Sunil Kumar et.al,2015][Lee SK et.al,2001].

2.7.3 Care during transport

Monitoring during transportation is vital, but mechanical and environmental factors such as shock, vibration and noise can affect the ability of the neonatal transport team to adequately monitor the neonate [Kempley ST et.al,2009][Jackson L et.al,2009][Mebey .A et.al,2011]. Care during transport entails the regular assessment of the airway, breathing and circulation. Measures should also be undertaken to prevent extremes of temperature and hypoglycemia.

2.7.3.1 Monitoring during neonatal transport

This entails assessment of the airway, breathing and circulation.

(a) Airway assessment:

Airway assessment includes assessing for the presence of secretions, suctioning and positioning to ensure airway patency. The neonatal transport team should be capable of recognizing impending respiratory failure, performing effective bag-valve-mask ventilation, performing a traumatic intubation with appropriate endotracheal tubes, instillation of artificial surfactant, and management of ventilator settings [Ohning B et.al, 2004].

(b) Assessment of breathing

This entails monitoring the respiratory rate and the adequacy of breathing. Regular assessment of respiration during transport will help to identify when the neonate requires assisted ventilation or intubation. Assessment of chest movements to monitor ventilation during transport is usually limited and respiratory function monitor can therefore be used to monitor respiratory function continuously during transport [Lilley CD et.al,2005][Klimek J et.al,2006]. Pulse oximetry can be used as a non-invasive method of monitoring oxygen saturation. Carbon dioxide monitoring using either end tidal carbon dioxide (ETCO₂), transcutaneous carbon dioxide (TCO₂) and arterial carbon dioxide measurements have been used in advanced setups to monitor respiratory function[Tingay.DG et.al,2005][Tobias JD et.al,2009].

(c)Assessment of circulation

Circulation should be monitored during transportation using the heart rate, capillary refill time, temperature gradient, blood pressure and monitoring the urine input and output.

2.7.3.2 Temperature control

Temperature control during transport is essential so as to prevent extremes of temperature in the neonate in that hypothermia or hyperthermia. Neonates have a high body surface area and low body fat stores that renders them prone to increased insensible water losses and hypothermia. Premature neonates also have immature skin which further increases heat loss and insensible water losses. The survival rate of low birth weight and sick infants is higher when they are cared for at or near their neutral thermal environment [Kliegman M et.al,2011].

The environment is influenced by factors such as air flow, radiating surface temperatures and humidity. Babies born before arrival to MTRH were noted to have hypothermia at admission especially those who were transported by private means [Makokha et.al,2014]

The neonate's temperature should be maintained through the use of warm clothing, thermal mattresses, incubators or Kangaroo Mother Care. The ideal in transportation is the use of incubators which is used extensively in developed countries [Maryland Medical services,2014].The use of polythene wrap, thermocol boxes and warm bottles can be used in resource limited settings to maintain the neonate's temperature. Warm bottles should be used with caution and be well covered to decrease the risk of burns [L'Herault et.al,2001].

The use of thermal mattresses has been found to be effective in maintaining the neonate's temperature and can be used as an adjunct to the transport incubator [L'Herault et.al,2001].The studies demonstrated that the thermal mattresses extended the ability of the transport incubator to keep the neonate eutermic by decreasing the time required to warm the incubator and enabling warming of incubator in a cooler environment.

A study [Singh et.al,1996] found that in 46.4% of the neonates referred, nothing specific was used for warming, 25.4% used blankets, 24.5% cotton and hot water bottles were used to maintain warmth in 8.1% of the neonates.

Kangaroo mother care (KMC) is an easy to use method that can be used to maintain warmth during transport [Christenson K et.al, 1998]. It was first presented by Rey and Martinez in Bogota, Colombia as an alternative to inadequate and insufficient incubator care for preterm neonates [Conde.Agudelo et.al,2003].It has been found to be effective in thermal control, breastfeeding and bonding between the mother and child irrespective of the setting, weight and gestational age [WH0,1993][Shiau SH et.al,1997] .KMC through prolonged skin to skin contact has also been shown to provide effective thermal control and be associated with a decreased risk of hypothermia [Cattaneo A et.al,1998][Lawn JE et.al,2005]. It can therefore be applied in resource limited settings to ensure warmth of the neonates as it has been shown to be effective [Lawn JE et.al,2005].

2.7.3.3 Glycemic control and fluid requirements

Neonate's are at a high risk of hypoglycemia due to: inadequate stores of liver glycogen and muscle protein, inadequate body fat to meet the metabolic energy needs and the enzyme systems for gluconeogenesis may not be fully developed. Furthermore, the plasma

concentrations of acetoacetate and hydroxybutyrate during the initial 24 hours of life are lower in small for gestational age newborns than in full term infants implying diminished lipid stores, decreased fatty acid mobilization, impaired ketogenesis or combination of the above factors [Kliegman M et.al,2011].

Neonates' should be initiated on breastfeeding as soon as possible within the first hour after delivery unless there are contraindications to enteral feeding. Enteral feeding can also be done via a nasogastric tube or cup feeding using formula milk or expressed breast milk if child is unable to breastfeed. The contraindications to enteral feeding include: severe respiratory distress, congenital anomalies such as tracheoesophageal fistula and intestinal obstruction. In case of contraindications to enteral feeding intravenous fluids should be given during referral [WHO,2003].

The neonate's fluid requirements vary depending on the gestational age, disease states and environmental conditions. The insensible water losses are indirectly proportional to the gestational age meaning that preterm babies lose more water in comparison to term babies. This is due to the fact that premature babies have immature skin, lack of subcutaneous tissue and a large body surface area and hence require higher fluid intake so as to also enable them to excrete solutes as they are unable to concentrate urine [Kliegman M et.al,2011].The transport team therefore needs to ensure fluid or milk intake during transportation of the neonate so as to decrease the risk of dehydration and hypoglycemia. Hypoglycemia has been associated with a higher morbidity and mortality among transported neonates [Cornette. L et.al,2004][Narang M et.al,2013].Monitoring of the neonate is therefore an important component of neonatal transport [O'Reilley M et.al,2012].

CHAPTER THREE: METHODOLOGY

3.1 Study design

The study design is a cross sectional study. It is descriptive as it described the care offered to referred neonates during transport to the newborn unit, MTRH.

3.2 Study site

The study was conducted at the newborn unit at MTRH which is located in Eldoret town, Uasin Gishu County. The hospital has an 800 bed capacity and serves as a referral hospital for Western Kenya which has a catchment area of about 13 million people which is about 33% of Kenya's population.

The hospital's newborn unit is located in the Riley Mother and Baby Hospital wing which was opened in 2009. It is a 70 bed capacity unit, which includes 56 baby cots and 14 incubators. It has staff of various cadres including pediatricians, residents, medical and clinical officer interns, nurses and nutritionists. The deliveries at the hospital are about 10,000 annually which are about 30 babies born daily. The newborn unit located at RMBH currently admits approximately 150 babies per month [MTRH records, 2014].

Neonates managed at the unit are either born at the hospital or referred from other facilities in the region and are managed using the basic pediatrics protocol in Kenya which has been adopted from the WHO guidelines. They are admitted due to various indications such as prematurity, respiratory distress, birth asphyxia, neonatal sepsis, neonatal jaundice and surgical conditions e.g. intestinal obstruction, gastroschisis among others.

3.3 Target population

Neonates admitted to the newborn unit at the Moi Teaching and Referral Hospital.

3.4 Study population

Neonates referred from peripheral health facilities to the newborn unit at Moi Teaching and Referral Hospital during the study period.

3.5 Eligibility criteria

3.5.1 Inclusion criteria:

1. Neonates who had been referred from a peripheral health facility to the newborn unit, MTRH.

3.5.2 Exclusion criteria:

1. Self-referrals.

3.6 Study period

The study was undertaken over a period of 6 months starting from February 2016 to July 2016.

3.7 Sample size

The sample size (N) was calculated using the Fisher's formula based on the **proportion of neonatal referrals with appropriate transport from a peripheral health facility admitted to the newborn unit, MTRH.**

There were no other similar studies on the proportion of neonatal referrals with appropriate care during transport that could be used to calculate the sample size. Therefore, a proportion (p) of 50% will be used, within 0.05 level of significance and 95% confidence interval.

$$N = Z^2 P (1-P) / W^2$$

Where:

Z_{α} is the standard normal deviate and =1.96 for a 95% confidence level

$P = 50\%$ (p=proportion of neonates with appropriate care during transport)

W is the desired width of the confidence interval and = 0.05^2

Thus: Replacing these values in the above formulae:

$$= 384$$

Adjusting for finite population for newborns referred to MTRH new born unit based on the 2014 hospital medical records where an average of 30 referred neonates were admitted per month, for 6 months: **180**

Thus: ${}^n f = no$; N=120 (N= the population size while ${}^n f$ is the finite sample size)

$$1 + no/N$$

$${}^n f = 384$$

$$1 + 384/180$$

$$= 122$$

To calculate the kth participant = $180/122$

$$= 1.47$$

Consecutive sampling was done until the minimum sample size was achieved.

3.8 Sampling technique

Consecutive sampling was used to recruit neonates admitted during the study period who had been referred from peripheral health facilities to the newborn unit, MTRH.

3.9 Data collection

3.9.1 Data sources

A structured questionnaire was administered and used to provide the demographic details, the mother's antenatal history, care of the neonate during transport and the transport characteristics of the referred neonate. A data checklist (appendix 4) was also used to collect data on the transport. It entailed information on whether oxygen or intravenous fluids were administered in indicated patients and if a referral note and documentation from the referring hospital were present among others. The patients' files were used to obtain the diagnosis at admission, presence of a referral note and the condition of the neonate on admission (temperature, pulse rate, respiratory rate, and random blood sugar). The referral note was also used to provide additional information such as the referral diagnosis and the indication for referral.

3.9.2 Data collection technique

The principal investigator sensitized medical personnel in the new born unit and sick child outpatient clinic (MTRH pediatric outpatient) about the study. This entailed sensitizing them about the main aim of the study, how the babies were to be recruited and how the study would be of benefit to the unit. Informed consent was obtained from the parent/guardian of the neonate. Consent was obtained from health care workers who had accompanied the neonate and were interviewed about the transport. The study included referred neonates admitted during the day and night.

A structured questionnaire was used to document relevant biographic data, reason for referral and the transport characteristics of the referred neonate. The transport characteristics of interest included: mode of transport, duration of transport, condition of the neonate on admission and whether they were accompanied by a trained medical personnel.

The questionnaire also sought to provide information about how care of the neonate during transport was done with emphasis on the mode of feeding during transport and how warmth was maintained. In addition, the antenatal and natal history was included. Relevant antenatal history included the number of antenatal visits and complications that may have arisen during the pregnancy. Natal history included the place of birth, mode of delivery and complications that may have arisen at birth.

Escorting health professional were interviewed to obtain more information about the transport and the challenges they faced. In the event the neonate had been escorted by more than one health care professional the investigator randomly picked the health care professional to be interviewed. An assessment of the ambulances used to transport the neonates was done using an ambulance checklist.

The principal investigator used a checklist to obtain additional information on the neonates transport such as whether supplemental oxygen or intravenous fluids were administered in neonates who had indications. The patients' files were used to obtain additional information such as the diagnosis at admission, the presence of the referral note and the condition of the neonate on admission which included the temperature, pulse rate, respiratory rate and the random blood sugar.

3.9.3 Data analysis and presentation

Data collected were entered into a MS Access database with observation of strict confidentiality. Data were cleaned and coding done. Data were analyzed using SPSS® version 20 at 95% confidence interval. A p-value of less than 0.05 was considered statistically significant. Bivariate analysis was done using Chi square to test for associations and variables that had a p-value of <0.2 were subjected to logistic regression to test for independent associations.

Independent variables included the maternal, neonatal and transport characteristics. Descriptive statistics were used for continuous variables and frequency listings for discrete/categorical data where suitable. Means and medians were calculated and used to describe these variables.

Data were presented in both linear and non-linear forms through the use of graphs and frequency tables.

3.9.4 Data handling and storage

Data was checked for completeness and accuracy by the principal investigator on a daily basis. Data was handled by authorized personnel only. Confidentiality was maintained at all stages of data handling. Data was stored electronically and protected with the use of a password and questionnaires were stored under lock and key and were accessible to the principal investigator. Data cleaning was then carried out.

3.10 Study execution

At the start of the study period, staff at the NBU, MTRH and the sick child outpatient clinic were sensitized about the study. This included informing them about the purpose of the study and how the neonates were to be recruited.

The study was conducted by the principal investigator aided by 2 research assistants who were hired for six months based on their knowledge and availability. The research assistants were clinical officers and were trained by the principal investigator on the background of neonatal transport and the principles that needed to be followed when transporting a sick neonate. In addition, the principal investigator sensitized the research assistants on the eligibility criteria, how to obtain consent for study participation from the parents and health care worker escorting the neonate and the ethical issues surrounding the study. The training also incorporated role playing on how to conduct interviews using the data collection tools. The process was under the guidance of two supervisors who are faculty in the department of Child Health and Pediatrics, Moi University.

The receiving nurse in the sick child outpatient clinic and the newborn unit notified the principal investigator when a referred neonate arrived at the hospital. Neonates who met the inclusion criteria were recruited and data collected using a standard data collection tool which included a questionnaire and data checklists (Appendix 6 and 7). Relevant maternal and neonatal data including the neonatal transport characteristics were entered.

3.12 Ethical considerations

Approval to carry out the study was sought from the Institutional Research and Ethics Committee (IREC) and the MTRH administration before commencement of the study. Informed consent was sought from the parent/guardian to participate in the study. Consent was also obtained from health care personnel who had escorted the neonate.

Participation was voluntary and no form of coercion was offered. The participants received the same level of care accorded to other patients and those who refused to participate were reassured that it would not affect the care they received.

Information obtained was kept confidential and was stored safely during and after the study. Data were stored in a computer with a password known only by the principal investigator. Patients' names or any identifiers were not used in the data collection and entry forms.

3.13 Dissemination of results

The results of the study will be disseminated through a written thesis and an oral defense in a forum that shall be convened by the School of Medicine, Moi University. The results will also be presented in national or international research meetings and published in peer reviewed journals.

CHAPTER FOUR: RESULTS

A total of 122 referred neonates were studied, of whom 71 were male and 51 female giving a ratio of 1.39:1.

4.1 Neonatal characteristics

The mean birth weight was 2.361kilograms with 45% weighing between 2.5 to 4 kilograms. Most of the neonates were delivered SVD at 91% and were born term at 59%.The Apgar score was available in 91 of the referrals with majority at 70% scoring between 8 and 10 at five minutes (Table 1).

Table 1: Neonatal characteristics

Characteristic	Frequency	Percentage (%)
Gestation at birth(n=122)		
Term	72	59
Pre term	50	41
Sex (n=122)		
Male	71	58
Female	51	42
Birth Weight(n=122)		
Less than 1000g	1	0.8
1000-1499g	18	14.8
1500-2499g	47	38.5
2500-4000g	55	45.1
More than 4000g	1	0.8
Mode of delivery(n=122)		
SVD	111	91.0
SBD	2	1.6
CS	9	7.4
Place of delivery(n=122)		
Home	8	6.6
Hospital	114	93.4
Apgar Score at 5mins(n=91)		
0-3	4	4.4
4-5	8	8.8
6-7	15	16.5
8-10	64	70.3

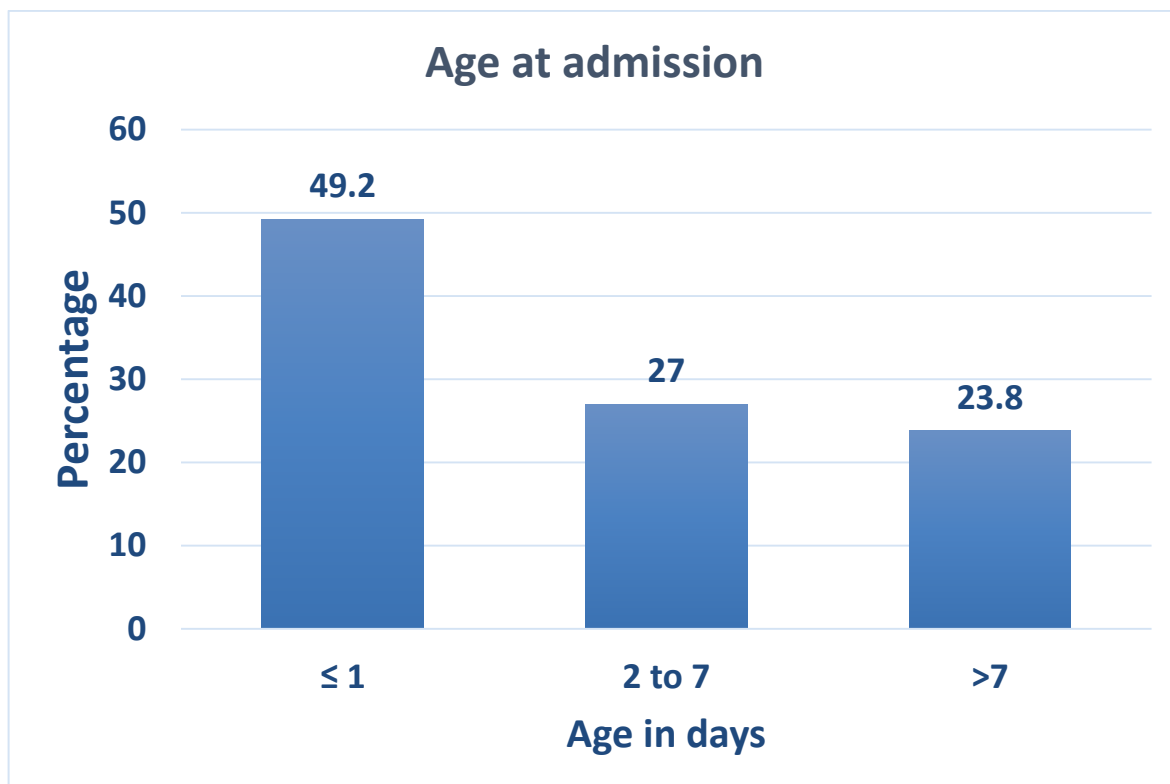


Figure 1: Age of the neonate on admission in days

Majority of the neonates were referred and admitted on the day of birth at 49.2%.

4.2 Maternal characteristics

The median maternal age was 23 years ,with majority aged between 20 and 35years.Majority had secondary level of education at 42% and attended at least one antenatal clinic at 89%.Antenatal complications were reported in 16(13%) of the mothers and included preeclampsia,malaria,urinary tract infections, antepartum hemorrhage, anemia and premature rupture of membranes(Table 2).

Table 2: Maternal characteristics

	Frequency(n=122)	Percentage (%)
Age of the mother		
<20 year	34	27.9
20-35 years	81	66.4
>35 years	7	5.7
Level of education		
None	4	3.3
Primary	49	40.2
Secondary	51	41.7
College/University	18	14.8
Parity		
Primigravida	65	53.3
Multigravida	57	46.7
Marital Status		
Married	90	73.8
Single	32	26.2
Antenatal attendance		
Yes	109	89.3
No	13	10.7
Antenatal Complication		
Yes	16	13.1
No	106	86.9

N/B: The term primigravida was used to refer to mothers who had their first child.

4.3 Pre-transport care

An intravenous line was inserted in 67(54%) of the referrals. Nasogastric tube was indicated in 18 of the neonates and was inserted in 6(33%) of those with indication (Table 3)

Table 3:Pre-transport care

	Frequency	Percentage (%)
Intravenous line inserted(n=122)		
Yes	67	54.9
No	55	45.1
Nasogastric tube indicated(n=122)		
Yes	18	14.8
No	104	85.2
Nasogastric tube inserted(n=18)		
Yes	6	33.3
No	12	66.7

4.4 Referral Diagnosis

Non-surgical conditions accounted for 65% of the referrals and 35% were surgical conditions. The common non-surgical conditions referred were prematurity, birth asphyxia and neonatal sepsis (Table 4). Majority of the surgical conditions referred were gastroschisis (23%) and anorectal malformation (14%) as shown in table 5.

Table 4:Non-surgical Referral Diagnosis

Diagnosis	Frequency (n=79)	Percentage (%)
Prematurity	39	49.4
Birth asphyxia	18	22.8
Neonatal sepsis	13	16.5
Neonatal jaundice	8	10.1
Congenital heart disease	1	1.3

Table 5: Surgical referral diagnosis

Diagnosis	Frequency(n=43)	Percentage (%)
Gastroschisis	10	23.2
Anorectal malformation	6	14.0
Spina bifida	8	19.0
Omphalocele	4	9.3
Intestinal obstruction	4	9.3
Bladder extrophy	2	4.5
Hypospadias	1	2.3
Hydrocephalus	1	2.3
Lingual cyst	1	2.3
Prune belly syndrome	1	2.3
Cleft palate	1	2.3
Gluteal mass	1	2.3
Sacrococcygeal teratoma	1	2.3
Anterior chest wall abscess	1	2.3
Hypertrophic pyloric stenosis	1	2.3

4.5 Reason for Referral of the Neonate to MTRH.

Majority of the neonates were referred due to lack of newborn unit at the referring facility (45.9%) and for surgery/surgical review (38%).Eleven (9.02%) were referred for other reasons which included health care worker industrial strike, lack of finances to cater for private hospital care and fumigation of the newborn unit at the referring hospital.

Table 6: Reason for referral to MTRH

Reason for referral	Frequency	Percentage (%)
Lack of new born unit	56	45.9
Lack of equipment	11	9.0
For investigation	20	16.4
Lack of personnel	3	2.5
For surgery/surgical review	46	37.7
Others	11	9.0

4.6 Referral characteristics

Majority of the neonates were escorted by a health care worker at 77.9% and had stayed at the referring hospital for less than 12 hours prior to referral (Table 7).

Table 7: Referral characteristics

Characteristic	Frequency(n=122)	Percentage (%)
Escorted by a Health Care Professional		
Yes	95	77.9
Notification given to MTRH before referral		
Yes	78	63.9
Mother informed of indication for referral		
Yes	122	100
Duration of stay at referring hospital		
<12hrs	50	41.0
12 -24hrs	31	25.4
> 1 day to 2 days	14	11.5
>2 to 7 days	18	14.8
> 7days	9	7.4
Referral note present		
Yes	122	100
Referral note complete		
Yes	95	77.9

4.7 Transport Characteristics

The choice of transport used was influenced mainly by the availability of transport and distance at 68.2% and 67.2% respectively (Table 8). Majority (78.7%) of the neonates were transported by ambulance and were escorted by a health care worker at 78% (Table 9).

Table 8: Factors that influenced the choice of mode of transport

Consideration	Frequency	Percentage (%)
Cost	9	
Distance	83	68.0
Availability of Transport	82	67.2
Others	3	2.5

Table 9: Transport characteristics

	Frequency(n=122)	Percentage (%)
Mode of transport		
Ambulance	96	79
Motorbike	1	0.8
Personal car/taxi	6	4.9
Public service vehicle	17	14
Walked	1	0.8
Air and taxi	1	0.8
Who escorted the neonate		
Nurse	73	59.8
No escort	27	22.1
Clinical officer	6	4.9
Paramedic/EMT	16	13.1
Duration of transport		
<1hour	68	54.8
1 to 3 hours	42	34.1
>3 hours	12	9.9

4.8 Care of the neonate during transport

Majority (90.2 %) of the neonates were kept warm using clothing while 9.8% used KMC. Most of the neonates did not receive either enteral feeds or intravenous fluids were not infused during transport. One of the neonates was fed on water mixed with glucose powder. Five of the neonates who required intravenous fluids did not come by ambulance. The appropriateness of the intravenous fluid was assessed in terms of the type and amount

given. Monitoring was done in 60(63%) of the neonates who were escorted by a health care worker during transport.

Table 10: Care during transport

	Frequency	Percentage (%)
How the neonate was kept warm(n=122)		
Clothing	110	90.2
KMC	12	9.8
Feeding during transport (n=122)		
Breastfeeding	41	33.6
EBM via NGT	4	3.3
IVF	34	27.9
Not fed	42	34.4
Others	1	0.8
Monitoring done(n=95)		
Yes	60	63.2
No	35	36.8
What was monitored (n=60)		
Temperature	55/60	91.7
Circulation	38/60	63.3
Blood glucose	8/60	13.3
Respiration	38/60	63.3
Airway	26/60	43.3
Intravenous fluids indicated(n=122)		
Yes	60	49.2
No	62	50.8
Intravenous fluids given(n=60)		
Yes	34	56.7
No	26	43.3
Intravenous fluids appropriate(n=34)		
Yes	23	67.6
No	11	32.4

4.9 Condition of the neonate on admission

On admission, 54(44%) of the neonates had hypothermia and 25(20%) had hypoglycemia (Table 11).None of the neonates transported using Kangaroo Mother care had hypothermia.

Table 11: Condition of the neonate on admission

	Frequency(n=122)	Percent (%)
Temperature(degrees celsius)		
< 36.5	54	44.3
36.5-37.5	48	39.3
>37.5	20	16.4
Respiratory Rate(breaths/min)		
< 40	6	4.9
40-60	64	52.5
> 60	52	42.6
Random blood sugar(mmol/l)		
<2.5	25	20.5
2.5-6.9	78	63.9
>7	19	15.6

4.10 Factors associated with hypothermia

On bivariate analysis, low birth weight (p-value 0.034), prematurity (p-value 0.029), hypoglycemia (p-value 0.007), and long distance (p-value <0.001), were significantly associated with hypothermia (Table 12).

Table 12: Factors associated with hypothermia

HYPOTHERMIA			
FACTOR	YES(n=54)	NO (n=68)	p-value
MODE OF TRANSPORT			
Ambulance(n=96)	39(40.6%)	57(59.4%)	0.120
Self-arranged(n=26)	15(57.7%)	11 (42.3%)	
ESCORT			
Yes(n=95)	39(41.5%)	56 (58.9%)	0.181
No (n=27)	15 (55.6%)	12 (44.4%)	
BIRTH WEIGHT			
<2.5kg (n=66)	35(53%)	31(47%)	0.034
≥2.5 kg (n=56)	19(33.9%)	37(66.1%)	
GESTATION AT BIRTH			
Preterm(n=50)	28(56%)	22(44%)	0.029
Term (n=72)	26(36.1%)	46(63.9%)	
DURATION OF TRANSPORT			
< 1 hour(n=68)	29(42.6%)	39(57.4%)	0.687
≥ 1hour (n=54)	25(46.3%)	29(53.7%)	
DISTANCE			
≥50km (n=52)	34(65.4%)	18(34.6%)	<0.001
<50km (n=70)	20 (28.6%)	50(71.4%)	
HYPOGLYCEMIA			
Yes(n=25)	17(68%)	8(32%)	0.007
No (n=97)	37(38.1%)	60(61.9%)	

The significant variables were subjected to logistic regression to seek independent association with hypothermia. Prematurity (OR 2.251; 95% CI 1.078-4.705; p=0.046) and hypoglycemia (OR 3.445; 95% CI 1.353-8.776; p=0.014) and long distance (OR 4.722; 95% CI 2.183-10.21; p=<0.001) were significantly associated with hypothermia (Table 13).

Table 13: Logistic regression for factors associated with hypothermia

Variables:	Odds Ratio	95% Confidence Interval	P-value
Escort vs No escort	0.557	0.235, 1.319	0.263
Distance from referral facility (>50km vs<50km)	4.722	2.183, 10.210	<0.001
Birth weight <2.5kgs vs \geq 2.5kgs	2.199	1.055, 4.583	0.053
Preterm vs Term	2.251	1.078, 4.705	0.046
Hypoglycemia vs No hypoglycemia	3.445	1.353, 8.776	0.014

4.11 Factors associated with hypoglycemia

On bivariate analysis, prematurity(p-value 0.002), hypothermia(p-value 0.007), and the lack of either enteral feeding or intravenous fluids during transport(p-value <0.001), were significantly associated with hypoglycemia(Table 14)

Table 14: Factors associated with hypoglycemia

FACTOR	HYPOGLYCEMIA		p-value
	YES(n=25)	NO (n=97)	
MODE OF TRANSPORT			
Ambulance(n=96)	16(16.7%)	80(83.3%)	0.057
Self-arranged(n=26)	9(34.6%)	17 (65.4%)	
ESCORT			
Yes(n=95)	16(16.8%)	79(83.2%)	0.061
No (n=27)	9 (55.6%)	18 (66.7%)	
BIRTH WEIGHT			
<2.5kgs (n=66)	17(25.8%)	49(74.2%)	0.118
≥2.5kgs (n=56)	8(14.3%)	48(85.7%)	
GESTATION AT BIRTH			
Preterm(n=50)	17(34%)	33(66%)	0.002
Term (n=72)	8(11.1%)	64(88.9%)	
NUTRITION DURING TRANSPORT (IVF/Enteral)			
Yes(n=80)	7(8.8%)	73(91.2%)	<0.001
No (n=42)	18(42.9%)	24(57.1%)	
HYPOTHERMIA			
Yes(n=54)	17(31.5%)	37(68.5%)	0.007
No (n=68)	8(11.8%)	60(88.2%)	

The significant variables on bivariate analysis were subjected to logistic regression to determine independent association with hypoglycemia. Lack of enteral feeding or intravenous fluids during transport (OR 7.82; 95% CI 2.9-20.9; $p < 0.001$), and prematurity (OR 4.121; 95% CI 1.61-10.54; $p = 0.004$) and hypothermia (OR 3.446, 95% CI 1.353-8.776; $p = 0.014$) were significantly associated with hypoglycemia (Table 15).

Table 15: Logistic regression for factors associated with hypoglycemia

Variables:	Odds Ratio	95% Confidence Interval	P-value
Escort vs No escort	0.405	0.155, 1.062	0.108
Duration of transport (<1hr vs >1hr)	0.551	0.227, 1.339	0.273
No feeding vs feeding	7.821	2.913, 20.994	<0.001
Birth weight <2.5kgs vs \geq 2.5kgs	2.082	0.821, 5.275	0.181
Preterm vs Term	4.121	1.610, 10.544	0.004
Hypothermia	3.445	1.353, 8.776	0.014

4.12 Health Care Worker Characteristics

Majority of the newborns escorted by health care workers were escorted by nurses at 76.8% and paramedics at 16.8%. Training in neonatal transport was reported in 54(56%) of the health care workers. Notification by the referring hospital to the newborn unit, MTRH was done in 89% of the referrals. The reasons provided for lack of notification included lack of knowledge, hospital phone in the referring hospital not working and the call not being received at MTRH (Table 16).

Table 16: Health care worker characteristics

	Frequency	Percentage (%)
Professional qualification(n=95)		
Paramedic/EMT	16	16.8
Clinical officer	6	6.4
Nurse	73	76.8
Trained on transport(n=95)		
Yes	54	56.8
No	41	43.2
Where trained (n=54)		
College/University	46	85.2
Seminar/Training Program	1	1.9
Hospital CME	5	9.3
Others	2	3.7
Aspects trained on		
	Yes	
Stabilization of the neonate prior to transport	52/54	96.3
Monitoring/Care of neonate during transport	53/54	98.2
Documentation	39/54	72.2
Family support	22/54	40.7

4.13 Challenges faced by the Health Care Workers during Transport

Forty eight (50.5%) of the health care workers reported that they faced challenges during the transfer of the neonate .Challenges in keeping the newborn warm was reported in 7(7.4%) of the health care workers which included lack of adequate or enough clothing and the lack of incubators.

Challenges in feeding the newborn during transport was reported in 13(13.7%) of the health care workers which included lack of alternative feed, transport environment not conducive and lack of intravenous fluids. The other reasons provided were the lack of an intravenous access, poor breastfeeding technique and the inability of the neonate to breastfeed well.

Monitoring challenges was experienced in 36(37.8%) with the majority of health workers at 86% reporting the lack of monitoring equipment as the challenge (Table 17).

Table 17: Challenges faced by health care workers during transport

	YES	NO	
Faced challenges during transfer			
Frequency	48	47	95
Percentage (%)	50.53	49.47	100
Challenges in keeping warm			
Frequency	7	88	95
Percentage (%)	7.37	92.63	100
Faced challenge during feeding			
Frequency	13	82	95
Percentage (%)	13.68	86.32	100
Faced challenges in monitoring			
Frequency	36	59	95
Percentage (%)	37.89	62.11	100
Other challenges			
Frequency	10	85	95
Percentage (%)	10.53	89.47	100
Challenges faced			
	Frequency	Percentage (%)	
Challenges faced in keeping warm (n=7)			
Lack of incubators	2	28.6	
Lack of adequate clothing	5	71.4	
Challenges faced with feeding(n=13)			
Lack of intravenous fluid	1	7.7	
Lack of alternative feed	3	23.1	
Transport environment not conducive	4	30.8	
Others	5	38.5	
Challenge faced in monitoring(n=36)			
Lack of equipment	31	86.1	
Inadequate personnel	1	2.8	
Environmental noise	3	8.3	
Lack of training	1	2.78	

4.14 Ambulance characteristics

None of the 95 ambulances were equipped with neonatal transport incubators and 48(67%) had monitoring equipment which was mainly thermometers

Table 18: Ambulance characteristics

EQUIPMENT	FREQUENCY	PERCENTAGE (%)
OXYGEN CYLINDER	75	78.9
RESUSITATION EQUIPMENT	46	48.4
MONITORING EQUIPMENT	64	67.3
INTRAVENOUS FLUIDS	71	74.7
SUCTIONING APPARATUS	42	44.2

CHAPTER FIVE: DISCUSSION

Neonatal transport is an integral aspect of health care and though it is ideal to be carried out in utero it is not always possible to predict possible neonatal morbidity hence the need for post-delivery transfer [Ricardo Martinez et.al,2011].

5.1 Demographics

This study found that majority of the neonates in the study were referred on the day of birth at 49.2%. The finding in this study may be due to the early recognition of the need to refer this neonates after birth by the health professionals in the referring facility and the fact that the reason for majority of the referrals were due to a lack of a newborn unit in the referring health facility at 45.9%.

This is similar to study in Ibadan that had more neonates referred on the day of birth at 46.2% [Muhydeen A et.al, 2016]. In a study in South Africa, most of the referrals were aged 7 days and below at 56 %, this study however included return referrals from the hospital [Ashokcoomar P et.al.2016]. In contrast, in a study in India had 71.6% of the referred neonates aged less than 24 hours on admission, with 4.2% admitted aged more than 72 hours[Seghal et.al ,2001].

In this study, majority of the neonates recruited weighed between 2.5 to 4 kilograms at 45%. This is similar to a study in India in which most of the neonates recruited were equal to and more than 2.5 kilograms at 36.5% [Kumar PP et.al,2011].

5.2 Indications for neonatal transport.

This study demonstrated that the common indications for referral were mainly non-surgical conditions at 65%, with prematurity, birth asphyxia, neonatal sepsis and neonatal jaundice being the most common .The surgical conditions included gastroschisis omphalocele,

intestinal obstruction, anorectal malformations and spina bifida among others. Prematurity was the most common diagnosis in the study.

A study in Senegal also found that the common referral diagnosis were prematurity(29%),birth asphyxia(24%) and respiratory distress(13.9%)[Dicko et.al,2010]. A study in India found prematurity to be the major referral diagnosis at 21.4%,birth asphyxia 16.4%,neonatal sepsis 13.7%,respiratory distress syndrome at 9.3% [Ekta Dalal et.al ,2013]. A study in South Africa also found that prematurity was the most common indication for referral at 75% [Ashokcoomar P et.al.2016].

This is in contrast study in Ibadan [Muhydeen A et.al ,2016], in which the most common diagnosis for referral was severe birth asphyxia at 47.9%, neonatal sepsis 38%, prematurity 31.4%, neonatal jaundice 26.2%, while surgical conditions accounted for 7.2%.The difference may be attributed to the fact that the study included self-referrals who had delivered at home which may account for the high number of neonates with birth asphyxia.

In developed countries, cardiac and surgical conditions account for majority of the referrals. A study in Portugal found that surgical and cardiac conditions accounted for 50% of the referrals while 26% were due to prematurity and other medical conditions[Guimarães H et.al 2016]. In Argentina ,surgical cases accounted for 34%,while cardiovascular disorders accounted for 29%[Goldsmid G et.al ,2012].This can be attributed to the fact that in developed countries mothers with high risk pregnancies and anticipated preterm delivery are made to deliver in centres that can manage prematurity and also due to a regionalised neonatal transport system.

The reasons for transfer to the newborn unit in this study were mainly due to a lack of newborn unit at the referring facility at 45.9% and for specialized care for example surgery at 37.7%. A study in South Africa found that 57.5% of the referrals were primary transfers for specialized or higher levels of care and 42.5% were return transfers. This study analyzed both neonatal transfers to and from the referral hospital [Ashokcoomar P et.al.2016].

Majority of the studies on neonatal transport did not look into the reasons for transfer to a referring hospital.

5.3 Pre-transport care

In this study, intravenous access was put in 67(54.92%) of the referrals. A limitation in the study was that the patency of the intravenous line was not checked on admission. A study by found that 48% of the neonates had an intravenous access of which 12% were not patent on admission [Goldsmit G et.al ,2012]. Common errors before and during transport have been noted to be the absence of an intravenous line and the inappropriate type and amount of intravenous fluid [Mutlu M et.al,2011]].

In this study, nasogastric tube insertion was indicated in 18(14.8%) of the referrals, of which 6 had the nasogastric tube inserted prior to transport. This included neonates who had intestinal obstruction, anorectal malformation, and gastroschisis among others. Majority of the studies done had not looked at whether a nasogastric tube was inserted in neonates with indications prior to transport.

5.4 Care during transport

Neonates during transport require care irrespective of whether they are critically ill or less critically ill. A study found that 57% of neonates in that study had clinical deterioration independent of the patients' characteristics, type or severity of their condition. The study noted more instability in the thermal and respiratory status. This demonstrated that newborns during transport require care irrespective of whether they are critically ill or less critically ill [Goldsmith G et.al, 2012].

5.5 Thermal regulation practices

In this study, majority (90.2%) of the neonates used clothing to provide warmth while 9.8% were transported using kangaroo mother care. None of the neonates was transported in an incubator which may be attributed to the fact that none of the ambulances were equipped with a transport incubator. A study in Senegal also demonstrated that none of the neonates were transported in an incubator and were held in their caregivers' arms during transport [Dicko TF et.al, 2010].

In Nigeria, a study [Muhydeen et.al, 2016] found that majority were also transported using clothing at 100%, 0.7% of whom were placed in an incubator and 0.2% were transported using well wrapped hot water bottles. None of the referred neonates was transported using KMC. An Indian study found that 25.4% of the neonates were transported using blankets, 24.5% used cotton wool while 8.1% were transported using hot water bottles and none was transported using KMC [Singh.H et.al, 1996].

In contrast, a study in Mexico found that majority of the neonates at 97% were transported in incubators [Ricardo Martinez et.al,2011]. This can be attributed to a more organized neonatal transport system and availability of transport incubators.

5.6 Feeding practices during transport

In this study, majority (34%) did not receive either enteral feeds or intravenous fluids during transport. This may have been attributed to the fact that the duration of transport from the referring hospital in majority of the neonates was less than an hour. The reasons given by the health care workers escorting the neonates included; feeding of the neonate prior to transportation, lack of alternative feed, lack of intravenous line and lack of a prescription of fluids or enteral feeds by the referring medic.

Majority of the studies on neonatal transport did not look into the modes of feeding intra transport. A study in India found that none of the neonates was fed during transport [5]. This included both those who came by ambulance and by other modes of transport. A study [Muhydeen et.al,2016] found that 2.43% of the referred neonates received intravenous fluids and 16.1% were breastfed.

5.7 Monitoring during neonatal transport

In this study, 95 neonates were escorted by a health care worker, of whom 60% were monitored. Of this temperature was monitored in majority of the neonates at 91.6%. The low percentage (13%) in the measurement of the blood glucose was attributed to the lack of glucometers during transport. According to the health care workers interviewed during the study, 36(37.8%) reported challenges in monitoring the neonate during transport. Majority of whom (86%) attributed this to the lack of equipment such as thermometers and

glucometers. The other challenges included lack of training, lack of personnel and environmental noise.

In contrast ,a low level of monitoring of temperature was reported in 7(1.7%) and random blood sugar in 1(0.24%) of the participants in a study done in Ibadan [Muhydeen et.al,2016].

Majority of the studies on neonatal transport did not look into monitoring of neonates during transport and the challenges faced by the health care worker escorting the neonate. There is therefore a need for more studies to be carried out in developing countries to assess the levels of monitoring during neonatal transport and the challenges faced by the health care workers.

5.8 Condition of the neonate on arrival

This study found that on arrival 54(44%) of the referred neonates had hypothermia on admission. None of the neonates that were transported using kangaroo mother care had hypothermia. This is similar to a study in which found that 46% of the study participants had hypothermia on arrival despite majority of the neonates being transported by an ambulance [Ekta Dalal et.al ,2013]. A study [Ayesha B et.al ,2016] found that 39% of the neonates had hypothermia on arrival.

More than a fifth of the neonates had hypoglycemia on arrival. This is similar to studies done by [Ekta Dalal et.al ,2013] and [Goldsmith G et.al ,2012] in which 20.6% and 20% of the neonates had hypoglycemia respectively.

Majority of the studies did not make associations between the neonatal and transport factors with either hypoglycemia or hypothermia in the neonate.

A study done in MTRH showed that babies born before arrival to the newborn unit were noted to be hypothermic[Makokha F et.al,2014]. Hypothermia has been associated with an increased risk of mortality among referred newborns [Buch Pankaj et.al,2012].

5.9Transport characteristics

5.9.1Mode of transport.

In this study, majority of the referred neonates were transported by ambulance which may be attributed to the devolution of the health services and the acquisition of ambulances by the various counties within the country.

This is similar to a study in which ambulances were the major mode of neonatal transport at 75%[Punitha P et.al ,2016]. In a South African study , all the referrals were transported by ambulance, 62.2% by frontline ambulance, 29.2% by obstetric unit ambulance and 1.7% by planned patient transport vehicles[Ashokcoomar P et.al,2016] . This difference can be attributed to the study design in which data collection was limited to the emergency medical services in the study area which is the local public ambulance provider

A study,[Deepak Rathod et.al ,2014] also found ambulances to be the major mode of transport at 36% followed by taxi at 29% and bus at 15%. In India , [Ekta Dalal et.al ,2013]also had similar findings where ambulance transport accounted for 47.3% ,rickshaws for 33.3%,and open vehicles at 8.3%.

In contrast, a study done in Nigeria found that only 4% came by ambulance,43.9% by private vehicle ,28.9% taxis ,10% by commercial buses and 10% walked to

hospital[Muhydeen et.al,2016].The low ambulance usage was despite the fact that 60% of the neonates in the study came from centers with ambulance services

The choice of the mode of transport in this study was mainly influenced by distance and the availability of transport .Majority of the studies didn't describe the factors that influence the choice of the mode of transport.

5.9.2 Escort during transport

This study found out that majority of the neonates were transported by a health care professional who were mainly nurses at 76.8% which can be attributed to the fact that most of the neonates came by ambulance.

In a study,[Singh H et.al ,1996], none of the referrals were accompanied by a health care worker. A study on patient transfer practices in Western Kenya found that 60% of the patients had appropriate escort [Kuremu R et.al ,2008]. A study,[Buch Pankaj et.al ,2012], found 11.4% of the neonates were accompanied by skilled attendants, 23% by unskilled attendants and 73.2% by relatives. A study in Nigeria found that 7% of the neonates were accompanied by medical personnel [Muhydeen et.al,2016].

Neonatal transport carried out by a skilled personnel has been found to decrease neonatal morbidity and mortality [Agostino R et.al,1999].A study found that there is no difference in outcomes when newborns are transported by trained paramedics, registered nurses or physicians by [Lee SK et.al,2002].

Significant improvements in the rates of hypoglycemia, hypothermia, hypoxia and hypotension have been noted after the newborns are stabilized and transported by a

specialist transport team [Kumar P et.al,2008]. A study by in an analysis of pre and post training of health personnel noted increased effectiveness in neonatal transport which resulted in improved neonatal morbidity rates with subsequent decrease in mortality. Proper training of the transport team can help decrease transport related morbidity[Martinez et.al,2011] .

The incidence of hypoxia, abnormal temperature, hypoglycemia or hyperglycemia has been noted to be higher in neonates transported on their own compared to those that came accompanied by a specialized neonatal transport team [Kumar P et.al.2008].

5.10 Study limitation

1. Estimation of the gestational age was done using the last menstrual period only. To improve accuracy it is ideal to combine two methods which can be either a first trimester ultrasound or the New Ballard score.
2. The intravenous lines of the neonates at admission were not accessed for patency.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

1. Prematurity was the main referral diagnosis
2. Majority of the neonates had hypothermia on admission which was significantly associated with prematurity, birth weight of less than 2.5kg and hypoglycemia.
3. Despite ambulances being used as the key mode of transport, the monitoring, warmth provision of enteral feeds or intravenous fluids received by the neonates during transport is inadequate.

6.2 Recommendations

1. There should be improved monitoring, provision of warmth and enteral feeds or intravenous fluids during neonatal transport.
2. There should be enhanced utilisation of Kangaroo Mother Care during neonatal transport.
3. Ambulance should be equipped adequately with transport incubators, monitoring and resuscitation equipment for neonatal transport

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APPENDICES

Appendix 1: English consent form for parent/guardian

SERIAL NUMBER

Study Title:

Care of referred neonates during transport to the newborn unit, Moi Teaching and Referral Hospital

Introduction:

My name is Dr. Anne Sogomo. I am a post-graduate student in the department of Child Health and Paediatrics at Moi University. As part of my post-graduate studies, I am required to carry out a research project. My research study is aimed at describing the care of referred neonates during transport to the newborn unit, MTRH.

Study Procedure:

If you agree to participate in this study, questions will be asked about you and the neonate using an interviewer administered questionnaire. Routine clinical follow up will progress as usual without interference by the study

Benefits of the study:

There is no direct benefit to the participants but the study will contribute to inform policy makers on strengths and weaknesses in transport of newborns. No payments will be made for participating in the study.

Risks of the study:

There are no risks involved in this study. This study will be anonymous. The baby will receive treatment as per the diagnosis made based on the hospital and Ministry of Health neonatal protocols.

Confidentiality:

All information obtained from you will be kept strictly confidential and used only for research purposes. Your name will not appear on the data collection tools. All papers and computer records will be kept under lock and key and security codes respectively

Rights to refuse or withdraw from study:

Participation is entirely voluntary. You are free to withdraw from the study at any point

In case of any question regarding the study, you can contact Dr. Anne .Sogomo on mobile phone 0720-796985

Having read and been explained to the above:

I Mr. / Mrs. / Miss.....

(Participant/ guardian) to (name of dependant)

.....

With knowledge that this study is voluntary, do hereby give my consent to participate in the study.

I understand that I can withdraw from the study without any penalty or harm.

Parent/guardian signature..... Date

Signature of person obtaining consent.....Date.....

Principal investigator's signature Date

Appendix 2: Fomu idhinisho ya mzazi/mlezi

IDHINI YA KUSHIRIKI KATIKA UTAFITI

NAMBARI.....

Kichwa cha Utafiti:

Uhudumu wa watoto waliohamishwa kutoka hospitali nyingine wakiwa safarini hadi hospitali ya rufaa ya Eldoret.

Utangulizi:

Kwa majina ni Daktari Anne Sogomo. Mimi ni mwanafunzi katika chuo kikuu cha Moi. Nasomea taaluma ya udaktari wa watoto. Katika masomo yangu, nahitajika kufanya utafiti. Lengo la utafiti huu ni kuangazia jinsi watoto waliosafirishwa kutoka hospitali nyingine hospitali ya rufaa ya Eldoret wanahudumiwa wakiwa safarini kuja MTRH.

Utaratibu wa utafiti:

Iwapo wewe utakubali kushiriki katika utafiti huu, utaulizwa maswali na mtafiti kuhusu mtoto na huduma alizopokea alipokuwa anasafirishwa.

Faida ya kushiriki:

Hakuna malipo yoyote kwa kushiriki katika utafiti huu. Walakini, matokeo ya utafiti huu yatatumiwa na washika dau kuimarisha huduma ya usafirishaji wa watoto wachanga kutoka hospitali moja hadi nyingine.

Madhara:

Hakuna madhara yoyote yatakayohusishwa katika utafiti huu. Utafiti utakuwa wa kisiri. Mtoto atapata matibabu ya ugonjwa kulingana na matokeo au sera zinazokubaliwa na hospitali hii pamoja na utaratibu wa wizara ya Afya.

Siri:

Mambo ya utafiti huu yatatunzwa kwa siri na kutumika katika utafiti tu. Utambulisho wako hautawekwa bayana katika makaratasi yoyote . Makaratasi yote yatawekwa katika kabati lililofungwa na kifunguu kuwa na mtafiti mkuu. Tarakilishi itatumika kuimarisha siri.

Uhuru:

Kushiriki katika utafiti huu ni kwa hiari. Unaruhusiwa kutoka katika utafiti wakati wowote bila madhara yoyote. Iwapo una swali lolote kuhusu utafiti huu, unaweza kuwasiliana na Daktari Anne. Sogomo kupitia numbari ya simu ya rununu 0720-796985

Baada ya kusoma na kuelezwa kwa kina mambo yanayohusiana na utafiti huu;

Mimi..... mzazi/mlezi

wa.....(jina la mshiriki) natoa idhini yangu kushiriki katika utafiti huu. Nafahamu kuwa naweza kusitisha ushiriki wangu katika utafiti huu wakati wowote bila madhara yoyote.

Sahihi ya mlezi/mzazi Tarehe

Sahihi ya anayechukua idhini..... Tarehe.....

Sahihi ya mtafiti mkuu Tarehe

Appendix 3: English consent form for health care professional

SERIAL NUMBER

Study Title:

Care of referred neonates during transport to the newborn unit, Moi Teaching and Referral Hospital

Introduction:

My name is Dr. Anne Sogomo. I am a post-graduate student in the department of Child Health and Paediatrics at Moi University. As part of my post-graduate studies, I am required to carry out a research project. My research study is aimed at describing the care of referred neonates during transport to the newborn unit, MTRH.

Study Procedure:

If you agree to participate in this study, questions will be asked about the transport of the neonate you escorted using an interviewer administered questionnaire. Routine clinical follow up will progress as usual without interference by the study.

Benefits of the study:

There is no direct benefit to the participants but the study will contribute by informing policy makers on strengths and weaknesses in transport of newborns. No payments will be made for participating in the study.

Risks of the study:

There are no risks involved in this study. This study will be anonymous. The baby will receive treatment as per the diagnosis made based in the hospital and Ministry of Health neonatal protocols

Confidentiality:

All information obtained from you will be kept strictly confidential and used only for research purposes. Your name will not appear on the data collection tools. All papers and computer records will be kept under lock and key and security codes respectively

Rights to refuse or withdraw from study:

Participation is entirely voluntary. You are free to withdraw from the study at any point. In case of any question regarding the study, you can contact Dr. Anne .Sogomo on mobile phone 0720-796985

Having read and been explained to the above:

I Mr. / Mrs. / Miss.....

with knowledge that this study is voluntary, do hereby give my consent to participate in the study.I understand that I can withdraw from the study without any penalty or harm.

Health care professional signature.....Date

Signature of person obtaining consent.....Date.....

Principal investigator's signature Date

Appendix 4 :Fomu idhinisho ya mhudumu wa afya**IDHINI YA KUSHIRIKI KATIKA UTAFITI****NAMBARI.....****Kichwa cha Utafiti:**

Uhudumu wa watoto waliohamishwa kutoka hospitali nyingine wakiwa safarini hadi hospitali ya rufaa ya Eldoret.

Utangulizi:

Kwa majina ni Daktari Anne Sogomo. Mimi ni mwanafunzi katika chuo kikuu cha Moi. Nasomea taaluma ya udaktari wa watoto. Katika masomo yangu, nahitajika kufanya utafiti. Lengo la utafiti huu ni kuangazia jinsi watoto waliosafirishwa kutoka hospitali nyingine hospitali ya rufaa ya Eldoret wanahudumiwa wakiwa safarini kuja MTRH.

Utaratibu wa utafiti:

Iwapo wewe utakubali kushiriki katika utafiti huu, utaulizwa maswali na mtafiti kuhusu mtoto na huduma alizopokea alipokuwa anasafirishwa.

Faida ya kushiriki:

Hakuna malipo yoyote kwa kushiriki katika utafiti huu. Walakini, matokeo ya utafiti huu yatatumwa na washika dau kuimarisha huduma ya usafirishaji wa watoto wachanga kutoka hospitali moja hadi nyingine.

Madhara:

Hakuna madhara yoyote yatakayohusishwa katika utafiti huu. Utafiti utakuwa wa kisiri. Mtoto atapata matibabu ya ugonjwa kulingana na matokeo au sera zinazokubaliwa na hospitali hii pamoja na utaratibu wa wizara ya Afya.

Siri:

Mambo ya utafiti huu yatatunzwa kwa siri na kutumika katika utafiti tu. Utambulisho wako hautawekwa bayana katika makaratasi yoyote . Makaratasi yote yatawekwa katika kabati lililofungwa na kifunguu kuwa na mtafiti mkuu. Tarakilishi itatumika kuimarisha siri.

Uhuru:

Kushiriki katika utafiti huu ni kwa hiari. Unaruhusiwa kutoka katika utafiti wakati wowote bila madhara yoyote. Iwapo una swali lolote kuhusu utafiti huu, unaweza kuwasiliana na Daktari Anne. Sogomo kupitia numbari ya simu ya rununu 0720-796985.

Baada ya kusoma na kuelezwa kwa kina mambo yanayohusiana na utafiti huu;

Mimi..... natoa idhini yangu

kushiriki katika utafiti huu. Nafahamu kuwa naweza kusitisha ushiriki wangu katika utafiti huu wakati wowote bila madhara yoyote.

Sahihi ya mhadumu wa afya Tarehe

Sahihi ya anayechukua idhini.....Tarehe.....

Sahihi ya mtafiti mkuu Tarehe

Appendix 5: Questionnaire to health care professional**Demographic data:**

Serial No..... Date.....Date of birth

...../...../..... Date of referral .../...../ Date of admission.../...../.....

Residence.....

Time of admission.....

Referral information:

Name of referring institution.....

Duration of stay at referring institution.....

Date decision to refer was made.....

Duration of transport

Reason for referral

- | | | | |
|---------------------------|--------------------------|-------------------------|--------------------------|
| i. Lack of a newborn unit | <input type="checkbox"/> | iv. Lack of personnel | <input type="checkbox"/> |
| ii. Lack of equipment | <input type="checkbox"/> | v. For specialized care | <input type="checkbox"/> |
| iii. For investigation | <input type="checkbox"/> | vi Others; specify..... | |

Notification given to the NBU, MTRH before transfer YES NO

Referral diagnosis

Diagnosis at admission

Neonate escorted by a health care professional YES NO **Health professional escorting neonate**

1. What is your professional qualification?

- | | | | |
|-------------------|--------------------------|-------------------------|--------------------------|
| (a) Doctor | <input type="checkbox"/> | (d) Clinical officer | <input type="checkbox"/> |
| (b) Paramedic/EMT | <input type="checkbox"/> | (e) Nurse | <input type="checkbox"/> |
| (c) Consultant | <input type="checkbox"/> | (f) Other, specify..... | |

2. Was the newborn unit, MTRH notified about the patient before transfer? YES NO

If no reason(s)

.....

3. Have you been trained on principles of neonatal transport? YES NO

a) If yes, where were you trained?

- i. College /university iii. Hospital CME
 ii. Seminar /training program iv. Other, specify.....

b).If yes, what aspects of neonatal transport were you trained on?

- i. Stabilization of neonate prior to transport
 ii. Monitoring/care of neonate during transport
 iii. Documentation
 iv. Family support
 v. Other, specify.....

4. Was monitoring done during transport? YES NO

If yes, specify

- i. Monitoring of temperature iv. Monitoring of respiration
 ii. Monitoring of circulation v. Monitoring of airway
 iii. Monitoring of blood glucose

5. Did you face any challenges during the transfer of the neonate? YES NO

a) Did you face any challenges in keeping the baby warm? YES NO

If yes, specify,

- i. Lack of incubators
 ii. Lack of warm clothing
 iii. Other, specify.....

b) Did you face any challenges in feeding the neonate during transport? YES NO

If yes, specify

- i. Lack of appropriate intravenous fluid
 ii. Lack of alternative feed e.g. formula
 iii. Transport environment not conducive
 iv. Other, specify

b) Did you face any challenges in monitoring the neonate during transport?

YES NO

If yes, specify,

- i. Lack of equipment
- ii. Inadequate personnel
- iii. Environmental noise
- iv. Lack of training
- v. Other ,specify

c) Were there other challenges experienced during the transport of the newborn?

YES NO

If yes, specify

.....

.....

Appendix 6: Questionnaire To Parent/Guardian

(Fill part on demographic data and referral information if had not been filled in questionnaire to health care provider)

Demographic data:

Serial No..... Date.....Date of birth
/...../..... Date of referral .../...../ Date of admission.../...../.....

Residence.....

Time of admission.....

Referral information:

Name of referring institution.....

Duration of stay at referring institution.....

Date decision to refer was made.....

Duration of transport

Reason for referral

- | | | | |
|------|------------------------|--------------------------|-------------------------|
| i. | Lack of a newborn unit | <input type="checkbox"/> | iv. Lack of personnel |
| | | <input type="checkbox"/> | |
| ii. | Lack of equipment | <input type="checkbox"/> | v. For specialized care |
| | | <input type="checkbox"/> | |
| iii. | For investigation | <input type="checkbox"/> | vi Others; |
| | specify..... | | |

Notification given to the NBU, MTRH before transfer YES NO

Referral diagnosis

Diagnosis at admission

Newborn escorted by a health care professional YES NO

Neonate's characteristics

Gestational age: Term Preterm Sex: Male Female

Birth weightkgs

Mode of delivery: SVD SBD AVD CS

Place of delivery: Home Hospital

Age at the time of admission.....

Apgar score at 1min..... 5min.....10 min.....Not available.....

Maternal characteristics

Ageyears

Level of education: None Primary Secondary College/University

Parity: PARA.....+.....

Marital status: Married Single Divorced Separated

Antenatal clinic attendance: Yes No

Total antenatal visits:

Antenatal profile: PMTCT: VDRL: Hb: Blood group: Rhesus:

Antenatal Complication: Yes/No, If Yes specify.....

Transport characteristics

1. Were you informed of the reason for transfer? Yes/No

If yes, specify:

- (a) For surgery (c) For further management
 (b) For investigations (d) Other specify.....

2. What was the mode of transport?

- (a) Ambulance (c) Personal car/taxi
 (b) Motorbike (d) Public service vehicle
 (e) Other, specify.....

3. What influenced the choice of transport?

- (a) Cost (c) Availability of transport
 (b) Distance (d) Other, specify.....

4. Who escorted the neonate?

- (a) Nurse (c) Doctor
 (b) Family members (d) Clinical officer
 (e) Other, specify.....

5. How was the baby kept warm during transport?

- (a) Incubator (c) KMC
 (b) Warm clothing (d) Polythene bags/sheets
 (e) Other, specify.....

6. How was the baby feed during transport?

- a) Breastfeeding (d) EBM
 (b) Formula feeds (e) IVF
 (c) None of the above (f) other, specify.....

CONDITION OF NEONATE ON ARRIVAL

Temperature: _____ degrees Celsius

Pulse rate: _____ beats/min

Respiratory rate: _____ breaths per min

Random blood sugar: _____ mmol/l

Appendix 7: Data checklist

	YES	NO
Referral letter present <ul style="list-style-type: none"> • <i>If yes, is it complete?</i> 		
Did neonate require oxygen? <ul style="list-style-type: none"> • <i>If yes, was oxygen given?</i> 		
Was nasogastric tube indicated? <ul style="list-style-type: none"> • <i>If yes, was nasogastric tube inserted?</i> 		
Intravenous line inserted		
Was monitoring done en route of? <ul style="list-style-type: none"> a) <i>Temperature</i> b) <i>Respiration</i> c) <i>Circulation</i> 		
Presence of monitoring chart <i>If yes, is it complete?</i>		
Was the neonate kept warm?		
Was IVF indicated? <i>If yes, was it given?</i> <i>Was fluid given appropriate?</i>		

Appendix 8: Ambulance checklist

	YES	NO
OXYGEN SUPPLY <ul style="list-style-type: none"> • Was oxygen delivery intact 		
Incubator		
Resuscitation equipment: ambubags		
Essential medicine e.g. resuscitation medications		
Monitoring equipment e.g. thermometers, pulse oximeters		
Intravenous fluids		
Suctioning apparatus		

Appendix 9: Ministry Of Health Official Referral Form

Client Referral Form

Emergency U r g e n t Routine (*Tick as appropriate)

Local Inter - county Overseas (*Tick as appropriate)

Date..... Time..... Facility code.....

Client Details:

Name AgeSex: Male /Female

IP/OP number:..... ID number:

NHIF Number:..... Telephone Number(s).....

Physical Address..... County.....

Sub County..... Sub Location.....

Assistant Chief..... Telephone Number(s).....

Next of Kin Details:

Name Relationship to client

Telephone Number.....

Referring from Facility/Department

Referral to Facility/Department

History/Investigations.....Diagnosis:

Reasons for Referral:.....

Referring Officer Details:

Name..... Telephone Number.....

Designation.....Signature.....

Referral Back Details (Tracking Slip):

Name of the Facility or

Department.....

Date Client Reported..... Referred from Facility/Department

Clinical Details:.....

Clinician Name..... Telephone Number.....

Designation.....

Signature.....Date.....

Appendix 10: Hospital Approval



MOI TEACHING AND REFERRAL HOSPITAL

Telephone: 2033471/2/3/4
 Fax: 61749
 Email: director@mtrh.or.ke
Ref: ELD/MTRH/R.6/VOL.II/2008

P. O. Box 3
 ELDORET

11th September, 2015


Dr. Anne Jepchumba Sogomo,
 Moi University,
 School of Medicine,
 P.O. Box 4606-30100,
ELDORET-KENYA.

RE: APPROVAL TO CONDUCT RESEARCH AT MTRH

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:-

"Care of Referred Newborns during Transport to the Newborn Unit at Moi Teaching and Referral Hospital".

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.


DR. JOHN KIBOSIA
DIRECTOR
MOI TEACHING AND REFERRAL HOSPITAL

CC - Deputy Director (CS)
 - Chief Nurse
 - HOD, HRISM

Appendix 11: IREC Approval



MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 334711/2/3



MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

Reference: IREC/2015/146
Approval Number: 0001496

11th September, 2015

Dr. Anne Jepchumba Sogomo,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.



Dear Dr. Sogomo,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"Care of Referred Newborns During Transport to the Newborn Unit at Moi Teaching and Referral Hospital."

Your proposal has been granted a Formal Approval Number: **FAN: IREC 1496** on 11th September, 2015. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 10th September, 2016. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc	Director - MTRH	Dean - SOP	Dean - SOM
	Principal - CHS	Dean - SON	Dean - SOD



Moi Teaching and Referral Hospital
P.O. BOX 3
ELDORET
Tel: 334711/2/3

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)



Moi University
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET
Tel: 334711/2/3
2nd February, 2016

Reference IREC/2015/146

Approval Number: 0001496

Dr. Ann Jepchumba Sogomo,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.



Dear Dr. Sogomo,

RE: APPROVAL OF AMENDMENT

The Institutional Research and Ethics Committee has reviewed the amendment made to your proposal titled:-

"Care of Referred Newborns during Transport to the Newborn Unit at Moi Teaching and Referral Hospital".

We note that you are seeking to make amendments as follows:-

1. To include sick child outpatient clinic as an additional study site.
2. To recruit one additional research assistant.
3. To restructure the data tool into two parts, one for the health care professional and one for parent/guardian.

The amendments have been approved on 2nd February, 2016 according to SOP's of IREC. You are therefore permitted to continue with your research.

You are required to submit progress(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change(s) or amendment(s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc: Director - MTRH Dean - SPH Dean - SOM
Principal - CHS Dean - SOD Dean - SON