MMED DISSERTATION

TITLE

NEWBORN RESUSCITATION: KNOWLEDGE AND PRACTICE AMONG MIDWIVES IN KENYATTA NATIONAL HOSPITAL LABOUR WARD AND MATERNITY THEATRE.

A DISSERTATION SUBMITTED IN PART FULFILLMENT FOR THE DEGREE OF MASTERS IN MEDICINE IN PAEDIATRICS AND CHILD HEALTH; UNIVERSITY OF NAIROBI.

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DECLARATION

This dissertation is my original work and has not been presented in any other university.

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DEDICATION

To the Almighty without whom I would never have come this far.

To my mother Doreen Alwar, my father John Alwar, and brother Isaac Alwar and my whole extended family who have sacrificed so much to see me through this program and supported me in everything I do.

To my precious jewel Jordan Alwar who is a great inspiration and kept me going.

And

To all the little babies out there waiting to breath.

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ACRONYMS AND ABBREVIATIONS

CO_2	Carbon dioxide
EPLS	European Paediatric Life Support
ETAT+	Emergency triage assessment and treatment of seriously ill children (plus)
IPPV	Intermittent Positive Pressure Ventilation
KNH	Kenyatta National Hospital
NBU	Newborn Unit
NICU	Neonatal Intensive Care Unit
NLS	Neonatal Life Support
NRP	Neonatal Resuscitation Programme
O_2	Oxygen
PALS	Paediatric Advanced Life Support
PI	Principal Investigator
PVR	Pulmonary Vascular Resistance
SVR	Systemic Vascular Resistance

DEFINITIONS

Newborn Resuscitation: refers to the assistance a newborn receives upon delivery. It entails early resuscitation aims at in intervening at primary apnoea. Primary apnoea (initial) responds to simple measures including general measures performed for all infants, these are: warming, necessary suctioning, drying and stimulation. Advanced resuscitation aims at intervening at secondary apnoea. Secondary apnea requires positive pressure ventilation and other advanced life support interventions.

Measures used in early resuscitation will be the study definition of newborn resuscitation.

APGAR Score: systematic tool to document clinical status of the newborn at 1 minute and 5 minutes of life. It is not a prerequisite to resuscitation.

Expected Outcome of the Study: Appropriate practice was considered when all of the following were performed – preparation and provision of warmth, gentle stimulation, correct assessment and positioning of the airway and assessment of breathing.

ABSTRACT

Background: Perinatal asphyxia is one of the most common diagnoses made in our Newborn unit. Morbidity and mortality from perinatal asphyxia can greatly be reduced by effective newborn resuscitation. Opiyo et al in 2007 conducted a study at Pumwani Maternity Hospital, Nairobi, which demonstrated that newborn resuscitation practice improved following a one day training of health workers at the facility. The study we undertook was a descriptive cross-sectional study, which was conducted on midwives practising in the Kenyatta National Hospital maternity theatre and labour wards. The aim of the study was to determine the knowledge and practices in newborn resuscitation by this group of nurses, and to determine whether there were any knowledge and/or practice gaps in the resuscitation of the newborn as compared to the set international guidelines.

Methods and Principal Findings: The study subjects (midwives in maternity theatre and labour ward) were assessed on knowledge through a standardized questionnaire and on practice using a guiding checklist. Resuscitation practice was assessed three times on each midwife. Simple frequencies were used to estimate the proportion of midwives performing newborn resuscitation. The adjusted chi-square test for binary variables, was used to compare demographic and other factors between the midwives who performing newborn resuscitation correctly versus those who did not. Multivariate logistic regression was used to determine independent correlates of correct newborn resuscitative practices.

Utility: This study helped us highlight some of the knowledge and practice gaps amongst the midwives practicing in our maternity units and therefore, based on the results, recommendations on how to address the findings have been proposed.

INTRODUCTION

Passage through the birth canal is a hypoxic experience for the fetus, since significant respiratory exchange at the placenta is prevented for the 50-75 second duration of an average contraction. Most mature infants complete this physiologic transition smoothly, tolerating this well, and will have regular breathing or cry within 90 seconds of birth. About 5-10% of newborns require active intervention to establish normal cardio-respiratory function.[1]

The goals of neonatal resuscitation are to prevent the morbidity and mortality associated with hypoxic-ischaemic tissue injury; commonly diagnosed as perinatal asphyxia; and to re-establish adequate spontaneous respiration and cardiac output. [2]

High-risk situations should be anticipated by the history of pregnancy, labour, delivery and antenatal identification of signs of fetal distress.

Although the Apgar score is helpful in evaluating newborn babies in need of attention, infants who are born limp, cyanotic, apnoeic, or pulseless require immediate resuscitation before the score in the first minute is assigned.

Since 1999, courses in Paediatric Advanced Life Support (PALS) and Newborn Life Support (NLS) have been increasing in Kenya. These courses, however, have been inaccessible to many health workers in the public sector due to cost and lack of awareness. Many midwives, therefore, depend on their basic training to carry out resuscitation of babies born under difficult circumstances. Most newborns do not at present receive adequate care because most birth attendants do not have the necessary knowledge, skills and equipment to help them. Some traditional practices are not only ineffective in reviving depressed newborns but are also harmful to them.[3]The extent to which these are

appropriately practiced in the KNH labour ward and maternity theatre is not known.

LITERATURE REVIEW

Neonatal resuscitation involves complex responses to the needs of a distressed newborn. Effective resuscitation is achieved by using a combination of knowledge, psychomotor skills and other factors such as self efficacy, effective teamwork and leadership. It is important to build mechanisms into the system to evaluate clinical practice and facilitate best practice and optimize outcomes.[4]

PHYSIOLOGICAL CHANGES IN THE NEONATE AT BIRTH AND THE PLACE FOR RESUSCITATION.

In order to understand the value of newborn resuscitation, one must understand that in the physiology of the newborn various spontaneous changes occur in order for the neonate to adapt from intra-uterine to extra-uterine life; cardio-pulmonary adaption being the most important.

Respiratory Adaptation

Alveoli develop functionally by the 25th week of gestation. Type 2 pneumocytes, which produce surfactant, mature by the 35th week of gestation. This is particularly important because prematurity contributes greatly to the ability of a newborn to adapt physiologically to extra-uterine life.

During vaginal delivery, the thoracic cage is compressed and fluid is ejected through the airways. The first opening of alveolar is easier if there is some retention of lung fluid before the first active breaths are taken. Once the umbilical cord has been cut, placental circulation is cut off and the infant becomes increasingly asphyxiated. Finally, the infant gasps several times and

the lungs expand. Air entry into the lungs establishes the lung's interactive forces of surface tension with consequent development of negative pressures. The markedly negative intrapleural pressure (-30 to -50 mmHg) during gasps contributes to the expansion of the lungs. Prolonged labour, especially second stage, therefore, increases the risk of the need to resuscitate as air entry into the lungs may be sub optimal.

The neonate's ribcage is compliant when the lungs are collapsed at rest, hence the end expiratory lung volume is maintained at a higher level with increased respiratory rate, intercostal muscle activity and expiratory laryngeal adduction (appreciated clinically as grunting). Stimuli for breathing at birth include change of temperature, touch, light and sound.

The first principles of newborn resuscitation include drying and stimulation of the neonate.

Circulatory Adaptation

In utero, the pulmonary vascular resistance (PVR) is more than the systemic vascular resistance (SVR) and reversal of these parameters is necessary for successful cardiopulmonary adaptation.

Once the umbilical cord is clamped at birth, SVR increases and vascular resistance to the right atrium is decreased. Left atrial pressure increases relatively and due to improved venous return, the foramen ovale closes. Improved oxygenation of blood following aeration of the lungs with reduction in PVR and increased pulmonary blood flow initiates closure of the ductus arteriosus. In hypoxic states PVR remains high, therefore shunting of blood continues through a patent ductus arteriosus and foramen ovale.

When resuscitating the newborn baby it is therefore, important to position the airway and ensure breathing by administering inflation breaths using positive pressure ventilation. Usually once breathing is established, the heart rate improves.

If the heart rate does not improve with these initial measures cardiopulmonary resuscitation should begin.

Gas Transport

The tissues of foetal and newborn mammals have a remarkable but poorly understood resistance to hypoxia. However, the O_2 saturation of the maternal blood in the placenta is so low that the fetus may suffer hypoxic damage if fetal red cells did not have a greater O_2 affinity than adult red cells. The fetal red cells contain fetal haemoglobin (Hb F), whereas adult red cells contain adult haemoglobin (Hb A). Hb F has a greater affinity for O_2 compared to Hb A and this facilitates movement of O_2 from the mother to the fetus[5]. Mass oxygen loading and reduced unloading at lower partial pressures of oxygen (PaO_2) levels with increased blood flow ensures adequate tissue oxygenation.

Blood also has increased carbon dioxide transport capacity because of increased haemoglobin levels with greater binding capacity of CO_2.

Concerns have been raised about the potential adverse effects of 100% oxygen used during resuscitation.[6] Hyperoxia slows cerebral blood flow in term and preterm infants,[7] and exposure to even brief periods of 100% oxygen at delivery causes long term reductions in cerebral blood flow in newborn preterm infants.[8] In addition, high concentrations of oxygen lead to generation of oxygen free radicals, which have a role in reperfusion injury after asphyxia.[9] Thus, air (at an

oxygen concentration of 21%) might be a more appropriate gas than 100% oxygen for resuscitating newborns.[10]

Davis et al. In 2004 conducted a meta-analysis and systematic review on newborn resuscitation with room air or 100% oxygen. Their results revealed that term and near-term newborns can reasonably be resuscitated using room air initially, then with oxygen if initial resuscitation fails. The effect of intermediate concentrations of oxygen at resuscitation needs to be investigated.[11]

Acid-Base Balance

At birth there is combined respiratory and metabolic acidosis with low PaO_2 that corrects itself with ventilation as CO_2 is excreted from the lungs leading to increase in pH and buffering of metabolic acids. Hence routine need of bicarbonate during resuscitation is rarely necessary.

PREPARING FOR RESUSCITATION

Adequate preparedness for the arrival of a newborn is important. Ideally babies should be born in a place that has been specially prepared, whether a hospital delivery room or at home, and should be attended by persons with experience in newborn resuscitation. [12]

Guidelines of newborn resuscitation are focused more on common interventions like drying and stimulating and in a step-wise manner managing the airway, breathing and circulation, before going to the less common interventions like use of drugs. This form of management can be illustrated by the use of the inverted pyramid of approach to newborn resuscitation as shown in appendix I

THE GENERAL STEPS IN PERFORMING NEWBORN RESUSCITATION

Prepare a warm place and necessary drugs and equipment.

When preparing to resuscitate the newborn, initial questions to consider include:

1. Is the newborn clear of meconium?
2. Is the newborn breathing or crying?
3. Does the newborn have good muscle tone?
4. Is the skin pink centrally?
5. Is this baby consistent with term gestation?

With these in mind, one can anticipate possible complications that are likely to arise during resuscitation, and have appropriate equipment and possibly drugs ready to manage these complications.

Step by step assessment while considering possible causes of neonatal distress

Warmth and stimulation

Includes general measures performed for all infants which are warming, drying, appropriate stimulation.

Neonatal Airway Assessment

Includes clearing of the airway of secretions with suctioning, if necessary, and positioning of the head to ensure maximal patency of the airway, especially for those who are at risk of obstruction.

Neonatal Breathing Assessment

Assessment of whether the newborn is breathing adequately must be done. Recognition of inadequate breathing allows for one to provide intermittent positive pressure ventilation (IPPV) for apnea/ bradypnea.

Neonatal Circulation Assessment

Assessment of the circulation also must be done. If inadequate measure to improve it can be done by providing IPPV for a heart Rate <100 beats/minute or external chest compressions (ECC) for a heart rate < 60 beats/minute, or giving parenteral epinephrine for persistent heart rate <60 beats/minute along with the above measures.

The steps for newborn resuscitation are shown in an algorithm in Appendix II.

OUTCOME OF INEFFECTIVE NEWBORN RESUSCITATION

The aim of resuscitation is to prevent adverse long-term neurodevelopmental sequelae and death.[14] Rapid and appropriate resuscitative efforts improve the likelihood of preventing brain damage and achieving a successful outcome. Resuscitation of the newborn differs from resuscitation at any other time of life in various aspects. Basic resuscitation will not help all newborns but, done correctly, it will help *most*, even where only few resources and simple training are available.

The probability of adverse sequelae is low if a newborn infant is resuscitated promptly and correctly and starts breathing spontaneously within 20 minutes. Anticipation, adequate preparation, timely recognition and quick and correct

action are critical for the success of resuscitation[15]. Delayed or ineffective action makes resuscitation more difficult and increases the risk of brain damage.

O'Hare et al carried out a study to determine if a team dedicated to basic neonatal resuscitation in the delivery ward of a teaching hospital would impact the outcome of neonates delivered in Kampala, Uganda. They demonstrated that basic neonatal resuscitation in this setting decreased the incidence of asphyxia (defined as failure to initiate and sustain breathing or an APGAR score of <7 at 5 min), improved APGAR scores and a decrease in the mortality of babies weighing more than 2 kg.

The resuscitation team reduced the incidence of and mortality from asphyxia and improved the outcome of babies greater than 2 kg.[16]

Effects of hypoxic-ischaemic injury which occurs following ineffective resuscitation are highlighted in the table below.

Effects of Hypoxic Ischaemic Injury

Central Nervous System	Hypoxic-ischaemic encephalopathy, infarction, intracranial haemorrhage, seizures, cerebral oedema, hypertonia, hypotonia.
Cardiovascular system	Myocardial ischaemia, poor contractility, tricuspid insufficiency, hypotension, cardiac stun.
Respiratory System	Pulmonary hypertension, pulmonary haemorrhage, respiratory distress syndrome.
Urinary System	Acute tubular necrosis, acute cortical necrosis.
Gastrointestinal System	Perforation, ulceration with haemorrhage
Haematological System	Disseminated intravascular coagulation.
Integument	Subcutaneous fat necrosis.
Metabolic	Hyponatremia, hypoglycemia, hypocalcaemia, myoglobinuria.

Globally birth asphyxia is estimated to cause 0.6 – 1.7 million deaths per annum with 99% of these occurring in the developing countries. Effective resuscitation could prevent some of these deaths as well as improve outcomes of asphyxiated babies.[11]

Perinatal asphyxia is one of the most common admission diagnoses at the Kenyatta National Hospital Newborn Unit and a review of NBU mortality report reveals that about 21% of deaths occurring per month are due to perinatal asphyxia.[17]

Kamenir 1997 looked at newborn resuscitation and neonatal outcomes in a hospital in Western Kenya. Out of 878neonates, 4% suffered unfavourable outcomes (implying death immediately after or a few days following resuscitation). He also noted that neonatal resuscitation practices were inconsistent with standard American protocols of newborn resuscitation.[18]Knowledge is the key to success. Several studies have shown that effective transfer of knowledge from one party to another improves outcome considerably.

Waisman et al conducted a study to determine whether the pediatric advanced life support (PALS) course contributes to the knowledge required by health care providers for pediatric resuscitation and whether differences in achievement exist between professional groups.[19] This study demonstrated that PALS is an effective tool for teaching medical professionals pediatric resuscitation and immediate short term knowledge is clearly improved upon completion of the course.

Shapira, in Israel, acknowledged the usefulness of advanced life support courses in improving knowledge and outcomes, and recommended that the guidelines should serve as the gold standard of care for life-threatening situations and resuscitation in adults and children in Israel.[20]

Carbine et al in 2000 used video recordings as a means of determining neonatal resuscitation performance in accordance with Neonatal Resuscitation Programme (NRP) guidelines amongst a mixed group of practitioners. The study revealed that out of 100 resuscitations 54% of the practice deviated from the NRP guidelines.[21]

Chan and Hey in 2003 conducted a study in Ashington Hospital, UK to determine whether nurse practitioners are competent in resuscitating and they confirmed that nurse practitioners working in an obstetric unit where there are no resident paediatric staff can become and remain proficient in neonatal resuscitation.[22]

Kaburu 1992 assessed the accuracy of APGAR scores assigned by health workers at KNH and Pumwani Maternity Hospital, Nairobi, Kenya. He observed that in general practice APGAR scores were more accurately assigned to those babies who required active resuscitation compared to those who did not. [23]

Opiyo et al in 2007 conducted a study at Pumwani Maternity Hospital, Nairobi, which demonstrated that newborn resuscitation practice improved following a one day training of health workers at the facility.[24]

KNH DELIVERY AREA

Setting

The KNH labour ward and maternity theatre are located on the ground floor of the hospital. The labour ward has a twenty-three bed capacity, two delivery rooms and an acute room for the critically ill mothers and one functional resuscitaire. The maternity theatre lies adjacent to the labour ward and there are two theatres in operation with one functional resuscitaire.

The Kenyatta National Hospital Newborn Unit (NBU) and Neonatal Intensive Care Unit (NICU) are situated on the first floor of the hospital. Therefore, babies have to be reasonably stable before they are transferred from either labour ward or maternity theatre to post-natal wards.

Midwives

All nurses in the labour ward and maternity theatre have basic knowledge in midwifery. In labour ward there are 40 midwives in total of whom 14 cover each shift, while in maternity theatre there are 20 in total, 5 of whom cover each shift.

These midwives are required to undergo a one month orientation in the units under the supervision of a senior member of staff within the unit before they are permitted to handle deliveries of the newborns on their own.

There are four main cadres of nurses in the 2 units. The junior most are the Enrolled Community Nurses (ECN I), these are nurses who have attained a certificate in enrolled community nursing and have been working as nurses for less than 3 years in KNH. The second cadre of nurses is the Nursing officer III (NOIII), these are nurses/midwives who have attained a diploma in nursing and

have been working as nurses in KNH for a period of less than 3 years. The third cadre of nurses is the Nursing Officer II (NO II), these are nurses who have either attained a degree in Bachelor of Science in Nursing (BScN) and have been working in KNH for less than 3 years or have been promoted from NOIII status. Promotions generally occur after 3 years of service. The final cadre of nurses is the Nursing Officer I (NO I) who are mainly degree holders in BScN with some level of experience or have been promoted from the status of NO II.

The deliveries in KNH labour ward are performed mainly by the midwives, occasionally by student nurses under supervision and rarely by residents in Obstetrics and Gynaecology. The nurse to patient ratio is approximately 1:10. Resuscitation is mainly performed by the midwives and residents in Paediatrics. Deliveries in the KNH Maternity theatre are usually performed by residents in Obstetrics and Gynaecology, the baby is received by a theatre nurse (midwife) and resuscitation is performed by residents in Paediatrics assisted by the midwife.

LIFE SUPPORT COURSES

Advanced resuscitation courses teach both cognitive knowledge and psychomotor skills. In Kenya, European Paediatric Life Support (EPLS) courses have been available since 1999. The course is offered at Gertrude's Garden Children's Hospital and since 2006 The Aga Khan University hospital.

Emergency Triage Assessment And Treatment of Critically Ill Children (ETAT Plus) was introduced in Kenya in 2006 and has been offered in Kenyatta National Hospital and several other hospitals around Kenya in conjunction with the Ministry of Health.

These two courses lay emphasis on neonatal resuscitation. However the midwives practicing in the labour ward and maternity theatres have not been availed for these courses.

JUSTIFICATION

Kenyatta National Hospital is the larger of the only two public tertiary health facilities in the country. As a referral centre, KNH receives patients with complications from various hospitals and around the country.

The hospital serves as a teaching hospital for the University of Nairobi as well; hence; to the general public medical staff practicing in this hospital should be credible and show no less than excellence in their practice.

It is expected from anyone seeking services at the Kenyatta National Hospital that medical staff members are up to date with currents trends of managing various conditions, and especially so, emergency and/or critical care.

Goal 4 of the Millenium Development Goals, aims at reducing child mortality rates for children under the age of 5 years. Infant mortality can be reduced, by reducing the number of mortalities that occur following perinatal asphyxia, through effective newborn resuscitation.

According to the Kenyatta Medical Records statistics, in the year 2008, the two units (labor ward and maternity theatre) handled approximately 8912 deliveries throughout the year. The newborn unit admitted 2114 neonates. It is however not clear how many of these required active resuscitation.

Newborn resuscitation is an important aspect of emergency care and poses a challenge to many, including experienced clinicians and midwives. The

principles of newborn resuscitation have changed over the years from focusing on drug therapy and unsafe practices; to simple maneuvers that assist the newborn in physiological adaptation to extra-uterine life.

It is known that staff takes time to become skilled in neonatal resuscitation. There is a widespread perception that this skill wanes off when not put to regular use.

This study aims at determining some of the practices in newborn resuscitation and comparing them to international standards of newborn resuscitation. No such study has been done at the KNH to assess knowledge, and practice of midwives towards newborn resuscitation.

UTILITY

This study essence described some of the practices of newborn resuscitation in the maternity theatre and labor wards and gauged them in comparison to standard teachings of newborn resuscitation.

The study also identified gaps in knowledge and practice among the midwives and with this information clear recommendations on what needs to be done to improve our health care delivery services, with regard to newborn resuscitation can be formulated.

The study also highlighted the challenges that midwives came across when resuscitating the newborn, and hence, recommendations have been made, and these are aimed at improving the delivery of this service.

RESEARCH QUESTION

What is the practice of newborn resuscitation amongst midwives in Kenyatta National Hospital labor ward and maternity theatre?

OBJECTIVES

Primary Objectives

1. To describe the practices of midwives in the KNH labour ward a maternity theatres with regard to newborn resuscitation.

Secondary Objectives

1. To determine the midwives' knowledge of newborn resuscitation in t KNH labour ward and maternity theatre.
2. To compare the knowledge and practice found among midwives in labo ward and maternity theatre to those laid down in the standard practice.

METHODOLOGY

STUDY DESIGN

This was a descriptive cross sectional study.

STUDY AREA

Kenyatta National Hospital Labour ward and Maternity Theatre.

STUDY POPULATION

Fully qualified midwives who had been working in the labour ward and maternity theatre for a period of least 4 weeks from the initial date of data collection.

SAMPLE SIZE CALCULATION

General aim

This was a cross-sectional descriptive study to assess knowledge and practices of midwives in newborn resuscitation. We estimated the proportion of midwives performing newborn resuscitation according to the set standard guidelines.

The sample size calculation for the primary objective was based on an average number of deliveries conducted by each midwife and not the number of midwives currently rotating in the 2 units, given that the study aimed to estimate a quantity of interest with a specified precision in this case, the average proportion of appropriate resuscitation practices.

The actual numbers of study subjects who took part in this study were used to analyze one of the secondary objectives which, is to determine the knowledge of newborn resuscitation among midwives in KNH labour ward and maternity theatre.

STATISTICAL METHODS

Sample size

Due to the paucity of prior data to inform sample size calculations of this sort, it was assumed that 50% of the midwives would perform newborn resuscitation correctly. Since each midwife was assessed more than once, it was also assumed that Intraclass correlation coefficient = 0.15 (the assumption was practices performed by each health worker were similar 85% of the time i.e. repeatability coefficient of each midwife was 0.85)

Sample size calculation based on single proportion:

$\pi(1 - \pi)/e^2$

π = Proportion

e = Required size of standard error

The outcome will be the average proportion of appropriate resuscitation practices estimated at 50% (p=0.5).

Estimate within ±7.5% (standard deviation = 0.075)

95% confidence interval to be between ±7.5

Width of interval is approximately ±2.0 se, meaning we want to study enough resuscitation practices to give a standard error as small as 0.045.

Design effect = $1 + (n^1 - 1) \times ICC$

Where n^1 = average cluster size (in this case number of health workers)

No. Of clusters = $n/n^1 [1+ (n-1) \times ICC]$

The aim was to improve power by observing each midwife more than once.

Uncorrected sample size $0.5(1-0.5)/0.045^2 = 0.25/0.002 = 125$

$N = 125$

Design Effect median = 1.4^{25}

$125 \times 1.4 = 175$

Using the formula for sample size calculation above, we required 125 observations of newborn resuscitation practices. Incorporating the design effect, we required a corrected sample size of 175 observations of newborn resuscitation practices. This size is also considered achievable within the time limits given for the study. Given that the total number of midwives that this study aimed to capture was 60, hence each midwife was observed two to four times. It was however anticipated that not all 60 midwives would have taken part in this study.

A range of sample sizes has also been calculated based on different standard errors to give us a minimum and maximum sample size that can suitably be used for this study as shown in bold print in the table below.

Range of Sample Size Calculations

Standard Error	Uncorrected Sample size	Corrected Sample Size
0.01	2500	3500
0.0125	1602	2244
0.015	1111	1555
0.0175	806	1128
0.02	625	875
0.0225	490	686
0.025	403	564
0.0275	328	459
0.03	277	388
0.0325	238	333
0.035	208	291
0.0375	178	249
0.04	156	217
0.0425	**138**	**193**
0.045	**125**	**175**
0.0475	**109**	**153**
0.05	**100**	**140**
0.0525	89	125
0.055	83	116
0.0575	76	106
0.06	69	97

SAMPLING PROCEDURE

The principal investigator introduced the study to the matrons in charge of the two units through meetings. With their permission, the principal investigator met with the midwives working in labour ward and maternity theatres, introduced them to the study and requested for their participation. A consent information sheet for these health workers was provided for further information.

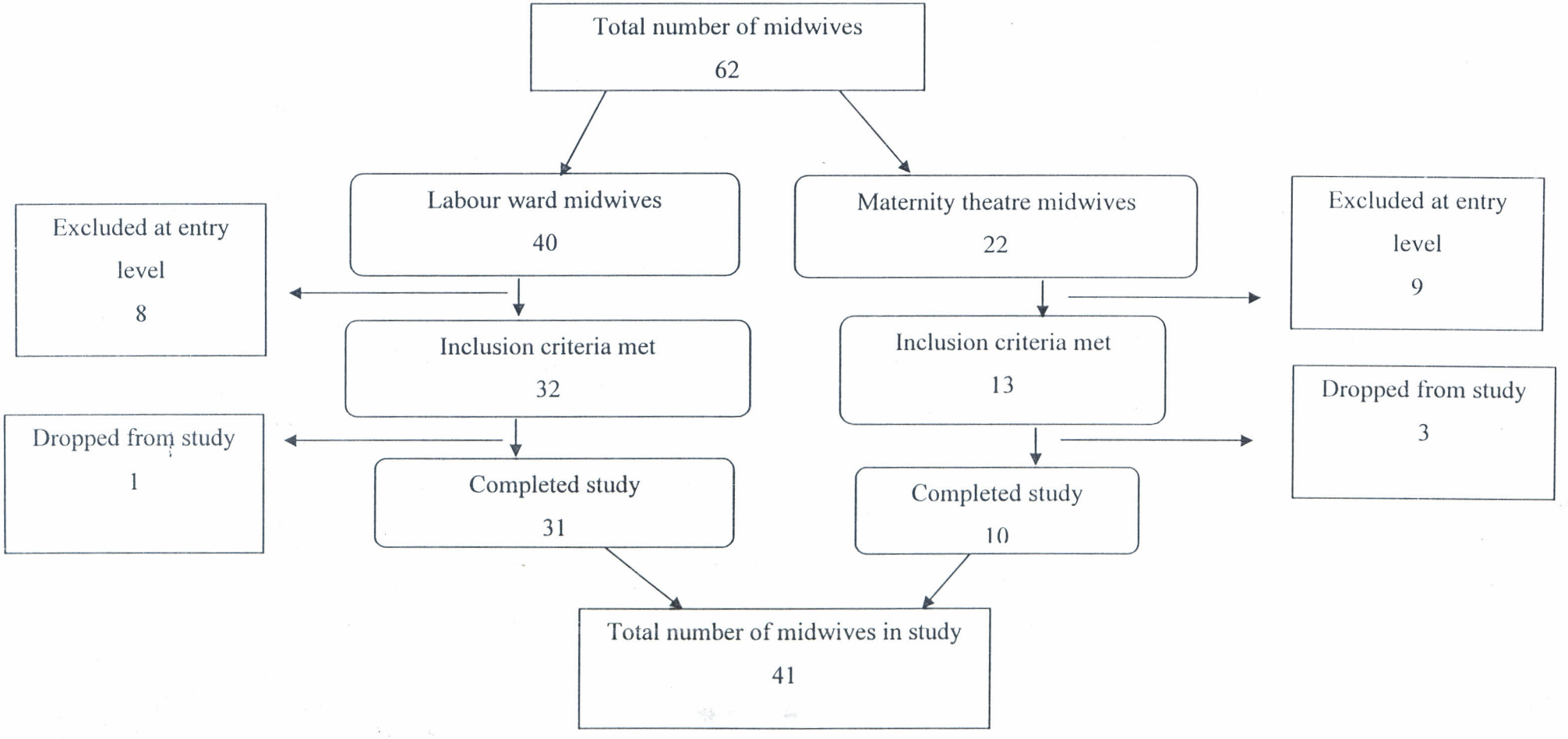
Given the nature of the study, all midwives were invited to participate in the study on a voluntary basis as long as they met the inclusion criteria and signed the informed consent. (Appendix III)

Of those who met the inclusion criteria and consented to participate in the study, the principal investigator kept a record of the midwives eligible to take part in the study. Using the midwives' three initials of their names, each midwife was randomly given a code which was to be used during data entry for both the questionnaire and the observed checklist.

Data was collected in 2 main stages. The initial stage was completion of a questionnaire (Appendix IV), which gave us characteristics of midwives and standardized multiple choice questions on newborn resuscitation were answered using this tool. The study questionnaire was administered to each eligible midwife, which, they filled and returned to the principal investigator by the end of their shift. This questionnaire was only filled once by each eligible midwife during the study period.

The second stage of data collection was observation of newborn resuscitation practice. The principle investigator and research assistants used a standardized checklist to observe the resuscitation practices (appendix V). The completed checklist was then handed back to the principal investigator for further data

Management. The number of times each midwife was observed was also recorded so as to avoid over/under observations. This information was kept strictly confidential.



INCLUSION/EXCLUSION CRITERIA

Inclusion Criteria

i. Midwives who had been working in either unit for at least 4 weeks.

ii. Those who signed an informed consent.

Exclusion Criteria

i. Midwives who had rotated in either units for a period of less than 4 weeks.

ii. Those who declined to consent or failed to complete the questionnaire.

iii. Student midwives and visiting midwives.

STUDY MATERIALS

Tools: A standardized questionnaire and checklist (Appendix IV and V)

Personnel: Alongside the Principal Investigator (PI), there were 3 research assistants to help with the data collection. The research assistants were selected based on their initial training of any paediatric life support course and who had fulfilled the requirements for becoming an instructor candidate. These recommendations are usually made at the end of each ETAT+ course. Once selected, the research assistants were trained by the PI on effective newborn resuscitation and, on effective use of the study questionnaire and checklist to ensure that these tools will be used uniformly. The principal investigator was available in person or on phone to clarify any problems encountered.

Timing: The study period was between October and December 2009. Data was collected on both weekdays and weekends with an aim of observing deliveries carried out on a 24 hour basis.

Variables: Because of the clustered nature of this study, in that each midwife was observed approximately three times, it was anticipated that not all resuscitation practices would be similar based on each neonate's adaptation, however this was compensated for in the sample size calculation.

DATA MANAGEMENT

Data forms (study questionnaire and checklist) were be kept by the Principal Investigator in a lockable unit, and each of the entries on both the checklist and the questionnaire were entered and tallied into a password-protected Microsoft Excel worksheet. The data was thereafter imported into a STATA database. Although the database was programmed to identify missing and inconsistent data, the principal investigator checked the data in the database against the original forms and all errors identified were corrected.

Data analysis

The data was analyzed using STATA v. 11 (Stata Corp., Texas, USA.) and any other approved software to help generate results and graphical plots. We used simple frequencies to estimate the proportion of midwives performing newborn resuscitation correctly, with our expected outcome being appropriate initial steps and airway and breathing assessment.

We used an adjusted chi-square test for binary variables to compare demographic factors and the expected outcome of appropriate resuscitation. Multivariate logistic regression was used to determine independent correlates of correct newborn resuscitative practices.

ETHICAL CONSIDERATIONS

Permission to conduct the study was sought from the Kenyatta National Hospital Ethical Committee and the Department of Paediatrics and Child Health, University of Nairobi. The objectives of the study were clearly outlined to the midwife in attendance and they were requested to sign a consent form. Those midwives who did not consent assured that refusal to take part in the study would not in any way compromise their position in their workstations.

Prior to the delivery the observer got biophysical data from the midwife through a standardized questionnaire. All personal information was kept strictly confidential. The principal investigator and/or research assistants offered help to the midwives when need arose, and kept a check on the safety of the newborn during resuscitation to ensure that unsafe practice was avoided.

RESULTS

A total of 178 resuscitation episodes conducted by 41 nurses were observed during the study. The results of an analysis of the basic demographic characteristics of the nurses enrolled in the study are presented in Table 1. Most of the nurses were female (80.49%) and worked within labour ward (75.61%). Almost half (48.78%) of the nurses in the study population were aged between 25 years and 35 years and almost half (48.78%) all these health workers had practiced as professional nurses for less than 2 years. The participants included various cadres of nursing officers. Nursing officer I (NOI) accounted for 41.46%, two of whom practiced in the maternity theatre while the rest practiced in the labour ward. Nursing officer II (NOII) accounted for 36.59% of the total group, five of whom practiced in the maternity theatre and ten in the labour ward. Only two nursing officer III (NOIII), took part in this study, and accounted for 4.88% of the total study population. Both practice in the labour ward. Of the study population 17.07% of the participants were enrolled community nurses (ECN I), 5 of them practiced in the labour ward while 2 practiced in the maternity theatre. Out of a total of 41 nurses 43.90% were aware about newborn resuscitation courses, and 3 out of the 42 nurses had attended a newborn resuscitation training course.

Table 1 below describes some of the characteristics of the study participants.

Table 1: Characteristics of Health Workers

Variable	Number (n=41)	Percentage
Sex		
Female	33	80.48
Male	8	19.52
Age		
25-35	20	48.78
>35	21	51.22
Unit		
Labour ward	31	75.61
Maternity theatre	10	24.39
Designation		
ECNI	7	17.07
NOIII	2	4.88
NOII	15	36.59
NOI	17	41.46
Years of Service		
<2yrs	20	48.78
2-5yrs	12	29.27
>5yrs	9	21.95
Paediatric/Neonatal Life Support Course Awareness		
No	23	56.10
Yes	18	43.90
Paediatric/Neonatal Life Support Course Attended		
N/A	38	92.68
PALS	3	7.32
Stated reason for non attendance		
Never heard of any course	19	46.34
Cost of course	7	17.07
No time off work	*10*	24.39
Not interested	2	4.88
N/A (have attended courses)	3	7.32

The detailed description of results of a test administered to all 41 participants to assess health worker knowledge on resuscitation practices are attached in appendix VI. Table 2 below summarizes the performance on the test based on providing answers for objective (multiple choices) questions on newborn resuscitation.

Table 2: Performance of midwives in an assessment of their knowledge regarding resuscitation practices

Results of assessment	Total number of nurses(n=41)
Pass >50%	16(39.02%)
Fail<50%	25(60.97%)

Resuscitation practices

Table 3 presents the details of the 178 births for which resuscitation was observed in the study, 154 (86.52%) were term deliveries. Out of the total, 15.17% of the newborns were born through meconium stained liquor and 72.27% cried immediately at birth. An observation of timing of resuscitation was made and we found that 86.52% of all resuscitations were initiated within the first minute of birth with all resuscitation episodes in the study being initiated within the first 5 minutes of birth. The median (IQR) Apgar score at 1 minute and 5 minutes was 8 and 9, respectively. The most commonly conducted practices during the period around delivery included recording the time of delivery (92.13%), preparation to conduct deliveries and providing warmth for the newborn (82.02%). The frequency with which other recommended tasks including airway positioning and breathing assessment were conducted are

presented in table 3. Stimulation of newborns was common (71.91%), however in some cases the stimulation was too vigorous and was judged inappropriate. A total of 88 (49.44%) newborns required airway suctioning, however, 42.7% of these were judged inappropriate. Intermittent positive pressure ventilation (IPPV) was required in 20.79% of cases and nurses were able to correctly identify half 48.65% of these cases. Correct bag-valve mask devices were used in only 6 out of the 37 episodes (16.2%) in which nurses were observed to have used a BVM device. Lastly, 3 newborns out of 31(90.32%) who required assisted breathing were correctly ventilated.

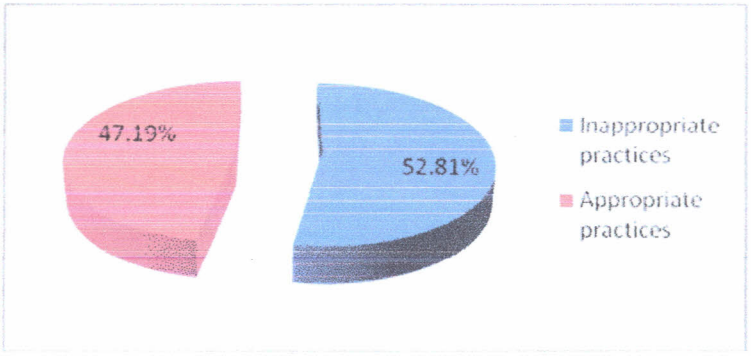
Table 3: Practice of Neonatal Resuscitation

Variable	Frequency (n=178)	Percentage
Term		
No	24	13.48
Yes	154	86.52
Meconium		
No	151	84.83
Yes	27	15.17
Newborn's Immediate Cry		
No	49	27.53
Yes	129	72.47
Initiation of Resuscitation		
<1min	154	86.52
1-4min	24	13.48
Preparation and Warmth		
No	32	17.98
Yes	146	82.02
Appropriate Stimulation		
No	50	28.09
Yes	128	71.91
Time of Delivery Noted		
No	14	7.87
Yes	164	92.13
Airway Positioning		
No	42	23.60
Yes	136	76.40
Suction Need and Technique		
Inappropriate	76	42.70
Appropriate	12	6.74
Not Applicable	90	50.56
Breathing assessment		
No	62	34.83
Yes	116	65.17
Identifies Need for IPPV		(n=37)
No	19	51.4
Yes	18	48.6
Use of Appropriate BVM		(n=37)
No	31	83.8
Yes	6	16.2
Correct Ventilation		(n=31)
No	28	90.32
Yes	3	9.68

Appropriate resuscitation practices

Figure 2 below shows the proportion of resuscitation episodes that were classified as being appropriate or inappropriate in the study, based on the expected outcome. Out of a total of 178 observations made, 84 (47.19%) of the newborns were appropriately resuscitated as evidenced by an observation in which the nurse prepared and used a warm resuscitaire, gently stimulated the newborn to breathe, correctly positioned the airway, and assessed breathing. In 52.81% of the resuscitation episodes which were classified as inappropriate practice the nurse failed to conduct one or more of the 4 steps listed above. The most commonly missed step was assessment of breathing (missed in 34.83% of episodes). Stimulating the newborn to breathe was deemed inappropriate in 28.09% episodes and the airway was incorrectly positioned in 23.60% of all episodes. Further, identification of the need for positive pressure ventilation went unrecognized in almost half of the cases which required IPPV. Correct ventilation in terms of appropriate rate and effectiveness was achieved in 9.68% of the cases observed.

Figure 2: Proportion of appropriate resuscitation practices among 178 episodes conducted by midwives in the study



BIVARIATE ANALYSIS

The bivariate analysis presented in this section compared the proportion of appropriate resuscitation practices for all 178 episodes by different levels of the dependent variables. However, the p-values are based on a chi square test (χ^2) of independence adjusted for clustering of observations by the 41 nurses conducting resuscitations. Further, a logistic regression model using generalized estimated equations (GEE) was used in order to take account of the clustering.

Nurse's gender

Out of the 41 nurses observed, 33 were female and they carried out 148/178 (83.15) of the resuscitation practices 45.94% of which were appropriate compared to 53.33% of appropriate practices amongst the male group of nurses. A p value of 0.46 was obtained which was not statistically significant. Upon further analysis using the logistic regression model explained above, male nurses were 34% more likely to perform appropriate resuscitation practices as shown in Table 4 below.

Table 4: Resuscitation Practice versus Gender

Sex	Number of nurses	Number of episodes	Appropriate practices(%)	Inappropriate practices(%)	Odds Ratio	95% Confidence interval	P
Female	33	148	68(45.95)	80(54.05)	1.00		
Male	8	30	16(53.33)	14(46.67)	1.34	0.69-2.61	0.38

Ward or Unit of Practice

The unit in which a nurse works is significantly related to appropriate practice. The tables below indicate that newborn resuscitation practices were more appropriate amongst the nurses working in maternity theatre compared to those in labour ward. Nurses working in the maternity theatre were two times more likely to attain the expected outcomes compared to those in labour ward. These findings were statistically significant as shown.

Table 5: Resuscitation Practice versus Midwives' Unit of Practice

Unit	Number of nurses	Number of episodes	Appropriate practices(%)	Inappropriate practices	Odds Ratio	95% Confidence interval	P
Labour Ward	31	137	59(43.07)	78(57.78)	1.00		
Maternity Theatre	10	41	25(60.98)	16(39.02)	2.07	1.04-4.09	0.04

Chi-2(1) = 4.0617

Midwives' designation

Out of 178 practice episodes, appropriate practice was best recorded amongst the ECNI and NOI cadres. Although the cadre NOI was 42% more likely to practice newborn resuscitation appropriately, the cadre of nurses with regard to the expected outcome did not show statistical significance as shown below.

Table 6: Resuscitation Practice versus Midwives' Designation

Designation	Number of nurses	Number of episodes	Appropriate practices (%)	Inappropriate practices (%)	Odds Ratio	95% Confidence interval	P
ECN I	7	35	18 (51.43)	17 (48.57)	1.00		
NO III	2	5	2 (40)	3 (60)	0.76	0.33-1.75	0.52
NO II	15	64	30(46.88)	34(53.12)	0.83	0.33-2.08	0.70
NO I	18	74	41(55.4)	33(44.6)	1.42	0.59-3.41	0.44

Chi-2(3) = 0.7841

Years of Service In the Unit

Almost half of the total number of nurses had been working in the 2 units for a period of less than 2 years. Those who had been working for the period between 2-5 years were observed to have appropriate practices (54.39%) compared to the rest of the groups. These findings were however not statistically significant. Upon further analysis, it was interesting to note that those who had been working for a period of 2-5 years were more likely to perform better in resuscitation practices compared to those who had been working for less than 2 years (OR 1.67), this number dropped in the group of nurses who had been working for more than 5 years (OR 1.33). This, however, is still not statistically significant as shown in table 7 below.

Table 7: Resuscitation Practice versus Years of Service in the Unit

Years	Number of nurses	Number of episodes (n=178)	Appropriate practices (%)	Inappropriate practices (%)	Odds Ratio	95% Confidence interval	P
<2 yrs	20	84	35(41.67)	49(58.33)	1.00		
2-5yrs	12	57	31(54.39)	26(45.61)	1.67	0.86-3.25	0.13
>5yrs	9	37	18(48.65)	19(51.35)	1.33	0.65-2.79	0.46

Chi-2(2) = 2.2442

Attendance of newborn resuscitation course

Out of a total of 41 nurses who took part in this study, only 3 (7.32%) had been trained in Paediatric Advanced Life Support (PALS). The three took part in 14/178 of the resuscitation practices, 50% of which were termed appropriate. From this study, bivariate analysis on attendance of newborn resuscitation courses did not have significant statistical inference on expected outcome. On the other hand 39 out of the 41 midwives who took part in the study had not attended any form of newborn life support training. A total of 164 episodes of resuscitation were observed from this group, 53.04% were noted to be inappropriate practices while 46.95% were considered appropriate practice as the expected outcome was achieved. Table 8 shows a summary of these observations.

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Table 8: Resuscitation Practice Vs Attendance of Newborn Resuscitation Course

Trained	Number of nurses	Number of episodes (n=178)	Appropriate practices (%)	Inappropriate practices(%)	Odds Ratio	95% CI	P
No	39	164	77(46.95)	87(53.05)	1.00		
Yes	3	14	7(50)	7(50)	1.13	0.68-1.88	0.64

Chi-2(1) = 0.0481

KNOWLEDGE AND RESUSCITATION PRACTICES

In this study, the nurses' knowledge was assessed based on answers provided for objective questions on newborn resuscitation, in the form of multiple choice questions (MCQ) with one correct answer for each question. Twenty seven out of the forty one nurses did not attain a standard pass mark of 50%, of those who passed the MCQ, 60.32% of their resuscitation practices were noted to be appropriate, though a p value of 0.342 indicates that this is not statistically significant as shown in Table 9 which indicates that only 8% of those who scored well in the MCQ were likely to perform better than those who did not attain the pass mark.

Table 9: Resuscitation Practice versus Assessed Knowledge

Years	Number of nurses	Number of episodes	Appropriate practices(%)	Inappropriate practices(%)	Odds Ratio	95% CI	P
Fail	27	114	53(46.49)	61(53.51)	1.00		
Pass	14	64	31(48.44)	33(51.56)	1.08	0.61-1.93	0.79

Chi-2(1) = 6.7518

MULTIVARIATE ANALYSIS OF HEALTH WORKERS CHARACTERISTICS VERSUS EXPECTED OUTCOME

Further analysis to assess the relationship between expected outcome of newborn resuscitation and the characteristics of health workers was explored in a multivariate analysis model for clustered populations.

From this analysis it came out clearly that those who had attended newborn life support courses or paediatric life support courses were two times more likely to perform appropriate newborn resuscitation compared to those who had not attended life support courses (p=0.06). Of note is that the three who had attended life support courses all practiced in the labour ward. We also can further appreciate that newborn resuscitation was about 2.5 times better performed by those who practiced in the maternity theatre compared to those who practiced in labour ward (p=0.03). It was established that none of the midwives practicing in the maternity theatre had attended any newborn life support courses.

Table 10: Multivariate Analysis Of Health Workers Characteristics versus The Study's Expected Outcome.

Outcome / Characteristics	Odds Ratio	P	95% Confidence Interval
Female	1.61	0.13	0.88-2.98
NO I	0.72	0.45	0.31-1.68
NO II	0.72	0.50	0.28-1.86
NO III	1.6	0.33	0.62-4.09
Attended NLS	2.22	0.06	0.96-5.10
Maternity theatre	2.48	0.03	1.08-5.71

DISCUSSION

Midwives can be considered the first point of contact in paediatrics, their input in the care of the newborn is highly significant and therefore optimal appropriate practice is expected. When patients face a life-threatening event such as cardiopulmonary arrest, they rely on the competence and skills of healthcare professionals. Because nurses are often the healthcare providers closest to the bedside and the first to respond to patients' needs, their knowledge and skills need to be optimal and their performance proficient. [26]

In this study, 75% of the midwives were working in the labour ward while a quarter of the study population practiced in the maternity unit (Table 1). The unit in which the midwives practiced significantly influenced appropriate practice of newborn resuscitation. Those working in the maternity units were two times likely to perform appropriate newborn resuscitation from the statistical inference generated (OR 2.07, p=0.04). This may have been due to the fact that preparedness for resuscitation was more likely in the maternity theatre where emergencies are more likely to be encountered. This difference may also be explained by the fact that the nurse to client ratio in the maternity theatre is 1:1 whereas in the labour ward 1 midwife can have as many as 10 clients to attend to and therefore performance of appropriate resuscitation may be hampered. Adequate preparedness for the arrival of a newborn is important. Ideally babies should be born in a place that has been specially prepared, whether a hospital delivery room or at home, and should be attended by persons with experience in newborn resuscitation. [12]

The cadre of midwives also varied in the two units. Though not statistically significant, a notable finding was that the most midwives of higher cadre (NO I), were more likely to perform appropriate practice compared to their junior counterparts (OR 1.42), which is not surprising and may be explained by their level of experience in handling the newborn. A study by Rutherford et al looked at the various barriers nursing practitioners face when handling emergencies and inexperience was cited as a factor.[26]

The midwives' experienced in terms of years of service in their respective units also did not have significant statistical deduction, those who had worked

between 2-5 years were 67% more likely to perform appropriate practice (OR 1.67). Midwives who had worked in the units for more than 5 years were less likely to perform appropriate resuscitation (OR 1.33). This may be explained by the fact that this group of midwives are, more likely to be involved with administrative duties and therefore less hands-on practice of deliveries and newborn resuscitation.

In terms of knowledge of newborn resuscitation, there was no significant impact of knowledge assessed on practice of newborn resuscitation. Differences in practice of newborn resuscitation, between the groups that had performed well (achieved $\geq$50%) and those who had not, was not statistically significant. However from the multivariate analysis, it came out strongly that those who had attended a paediatric or newborn life support course were two times more likely to perform better in practice. This supports findings from a study conducted at Pumwani Maternity Hospital, Nairobi, by Opiyo et al in 2007, which demonstrated that newborn resuscitation practice improved following a one day training of health workers.[24]

With regard to resuscitation practice in comparison with set international guidelines, the results demonstrate that sadly, there is paucity of current knowledge and practice of newborn resuscitation in a maternity unit that serves a large majority of antenatal clients within Nairobi and neighboring towns. An expected outcome of initial steps of resuscitation was assessed in 178 events. Less than 50% of the expected outcome was deemed appropriate practice in keeping with a study by Carbine et al in 2000 revealed that out of 100 resuscitations 54% of the practice deviated from the NRP guidelines.[21]

A general observation made was that only 13.48% of resuscitation episodes were initiated within 1-4 minutes. This may be attributable to the set-up within the labour ward, given that some deliveries were conducted in observation rooms and not in delivery rooms, therefore movement of a compromised newborn may have delayed the initiation of resuscitation. It was commendable to note that in one case observed, a neonate was delivered outside the labour ward but was attended to in the first minute of life.

Another general observation made was that appropriateness/effectiveness of interventions in newborn resuscitation appeared to diminish as more advanced care was required. Assessment of breathing was missed in 62/178 (34.83%) observations. The recognition of those who required positive pressure ventilation was made in 48.6% of the observations. Effective use of the bag, valve mask device was performed in 9.68% of those who required this intervention, while the use of inappropriate BVM was encountered in 31/37 observations. Statistical tests were not applied to these observations because the numbers did not give us enough power to statistically infer the results to the general situation. These results, however, did raise concern given that one of the most important interventions in effective resuscitation of the newborn is effective ventilation. The use of inappropriate BVM may have been cited as an unavoidable circumstance because of the equipment availed to the midwives. Unavailability of appropriate equipment may have contributed to poor performance of certain resuscitation measures. A suitable study on appropriate and effective use of equipment may be of value.

CONCLUSION

Preparation of delivery as well as provision of warmth was one of the most appropriately performed practice, while the most inappropriately performed practice was ventilation of the newborn using an appropriate bag, mask valve device. Appropriate interventions diminished as more advanced care was required.

Knowledge of newborn resuscitation was notably low. Good knowledge of newborn resuscitation, however, did not have a significant effect on practice. Attendance of newborn resuscitation courses did have a significant influence on practice.

With regard to standard practice less than half (47.19%) of the resuscitation episodes analyzed were regarded as appropriate practice in accordance with set guidelines.

RECOMMENDATIONS

Midwives in maternity theatre and labour ward should be adequately trained in newborn life support (NLS) with emphasis on regular practical drills, in order to aid in improving knowledge and practice of newborn resuscitation.

The gaps found in this study can inform policy makers on involving this group of nurses in paediatric life support causes which lay emphasis on newborn life support.

Appropriate equipment should be availed to the midwives in order to assist them in better performance of resuscitation.

Further studies in issues pertaining to advanced newborn life support and specific outcomes, that were not assessed in this study should be looked into.

STUDY LIMITATIONS

Observer's bias: the principal investigator anticipated some bias when observing these midwives, given the fact that the principal investigator had previously worked with some of the midwives. There was therefore a need for other independent research assistants to assist in the data collection. The use of research assistants to carry out the observations also helped eliminating the Hawthorne effect that was expected due to the nature of the study.

Some observations were discarded or rendered unfit for data analysis because medical personnel other than the midwives in areas such as the maternity theatre, handled some emergencies, however, given that the midwives receive the newborns they still play a role in resuscitation of the newborn before stepping aside to allow the residents to further examine the newborn. We observed each midwife up to the point where other medical personnel took up the resuscitation, or for ethical reasons, the observer/research assistant intervened during the process of resuscitation.

The tools of assessment of knowledge (study questionnaire) in this study were limiting and could only achieve partial and not complete assessment of knowledge.

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Appendix I

Figure 1 The Inverted Pyramid – Approach to Newborn Resuscitation.

KEY:

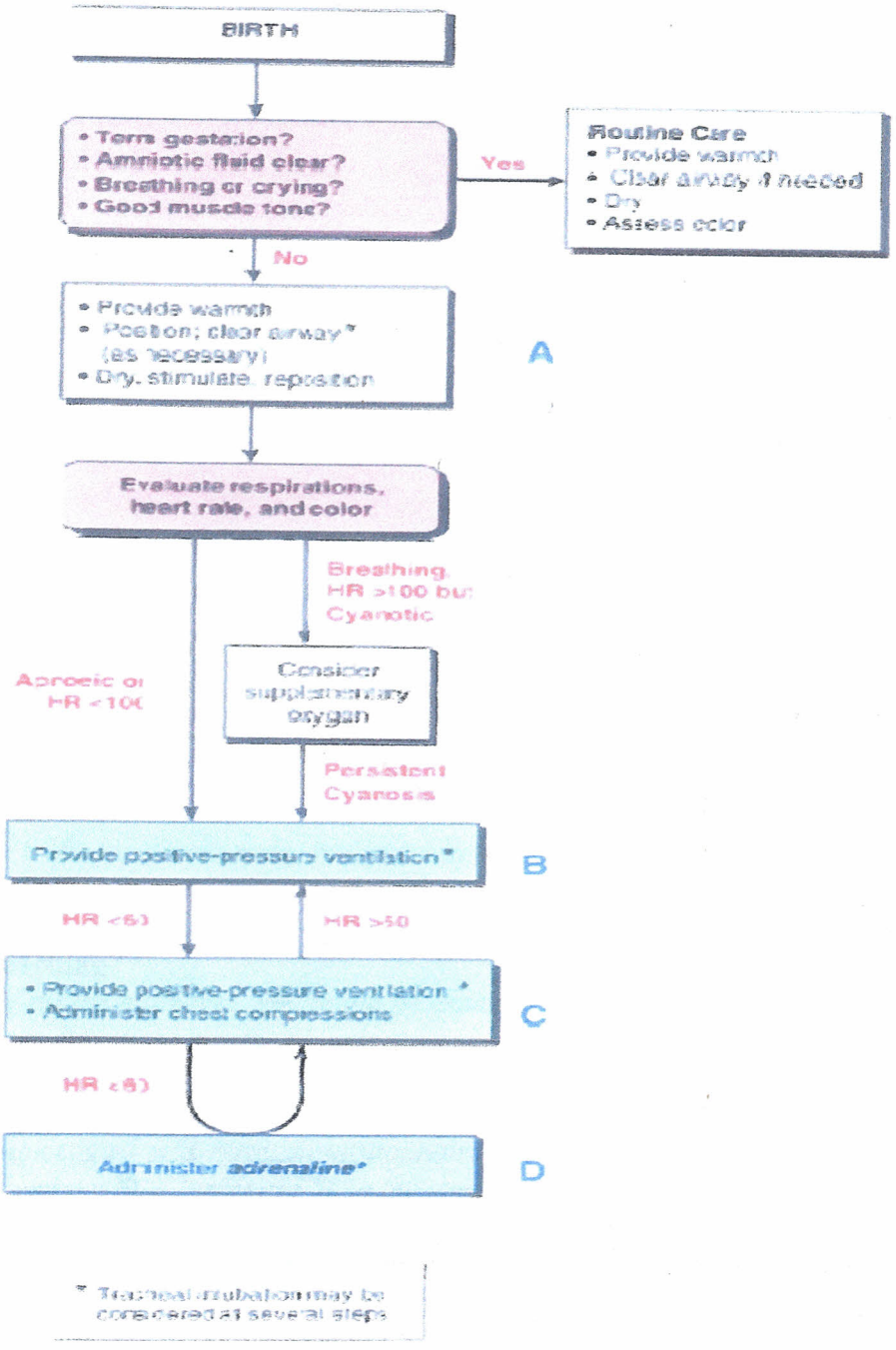
A – Airway

B – Breathing

C – Circulation

D – Drugs

Appendix II



Algorithm neonatal resuscitation, indicating that the decision to perform tracheal suctioning for meconium-stained amniotic fluid is now based on the vigor of the infant rather than the consistency of the meconium.

Appendix III – Consent Information Sheet for health workers.

A study to examine the knowledge and practice of neonatal resuscitation amongst midwives in Kenyatta National Hospital Labour ward and Maternity theatre.

About Dr. Teresa Alwar

I am postgraduate student in the Department of Paediatrics, University of Nairobi. This is a dissertation in part fulfillment for the degree of Masters of Medicine in Paediatrics and child health; University of Nairobi and I would like to undertake this research as an area of interest.

What is this research activity?

I would like to find out the level of knowledge on the modern, recommended approach to resuscitate newborn babies amongst midwives at the Kenyatta National Hospital labour ward and maternity theatre.

At the same time I would like to observe the how midwives carry out resuscitation of the newborn babies.

I would also like to find out how many midwives have been trained on paediatric advanced life support and whether this has any impact on the way the resuscitation is carried out.

Who am I approaching?

I am approaching all the midwives who might be expected, routinely, to provide resuscitation to a newborn infant during the course of their normal work .

What am I asking people to do?

To assess the knowledge I will have a questionnaire that I and my research assistants will give each midwife who will volunteer to be in the study.
To assess the practice we will observe episodes when health workers are actually resuscitating babies and make a record of this. This will mean an observer being present when a health worker is taking care of a baby.
I kindly ask you to agree to being observed in this way.

Confidentiality.

Your name and job title will not be used in any reports of this work. Only a code number will appear on the record made of the observation(s) and only the research team will have access to the link between the code numbers and individuals. No one other than the research team will be allowed to see the record of the observation(s) without your permission.

We will not use any of the records to report on an individual worker's performance. We will only report how groups perform as a whole.

Risks of the research.

I do not believe there are any risks to taking part in this research.

Benefits of the research

I am unable to offer any individual benefits for participating in this research.

However, it is hoped that this research will help to reveal the strengths and weaknesses of newborn resuscitation carried out by, the team of midwives and in accordance make recommendations as per the results with an aim to improve the care given to newborn babies in the hospital.

Voluntary Participation.

There is no obligation at all to help with this study and there will be no penalties of any kind if you decide not to take part. If you do agree to start helping with the study at any time you may change your mind and ask not to be involved any further.

Do you have any questions?

Consent Form

I, _____ have been informed about the study on Knowledge and Practice of newborn resuscitation amongst midwives in Kenyatta National Hospital Maternity Theatre and Labour Ward, under the direction of Dr. Teresa Alwar have been provided with information concerning this study to help me understand it.

The implications, duration, purpose, voluntary nature and inconveniences or risks that may reasonably be expected have been explained to me by:

_____*(name of person taking consent).*

I have been given the opportunity to ask questions concerning the study and these have been answered to my satisfaction. If I have further questions, I may contact:

Dr. T. Alwar

P.O. Box 72187-00200

Nairobi

Tel.0722383914

I understand that I may at any time during the study revoke my consent without any loss or penalty and that the information I have contributed will then be destroyed.

I confirm that I am happy to be involved and have my practice observed by the study team

Signed:_____ Date ____ / ____ / _____

Signature of person taking consent

_____

Appendix IV: Study Questionnaire

PART A: Encircle one answer and specify where indicated.

1. Serial No ----------
2. Age:
    a. Under 25 years
    b. 25 – 35 years
    c. Over 35 years
3. Sex
    a. Male b.Female
4. What is your designation? (specify) ----------
5. In which institute did you attain your basic training qualification?

    ----
6. In which year did you qualify in your basic training? ----------
7. In which unit do you practice?
    a. Labour ward b. Maternity theatre.
8. Years of service in the unit.
    a. Under 2 years b.2-5 years c. Over 5 years
9. Are you aware of any paediatric life support courses available in Kenya?
    a. Yes b. No
10. If yes, which one(s)---------- (specify)

11. Have you ever attended any Paediatric Advanced Life Support Course?

a. Yes b.No

12. If yes, which one(s)

a. European Paediatric Life Support

b. Paediatric Advanced Life Support

c. Emergency Triage Assessment And Treatment Of Critically Ill Children Plus (ETAT+)

d. Other (specify) --------

13. If no, why?

a. Have never heard of any of the courses.

b. Cost of the course.

c. No time off work to attend the course.

d. Not interested.

14. Which year did you attend this course(s)? --------

N. B Indicate N/A if you have not attended any course.

15. Have you attended a refresher course for any of the above?

a. Yes b. No

16. If yes, When? ----------

PART B: ONE Of the Following Is True. (Circle the correct answer)

1) **The best way to determine if a newborn needs resuscitation is to**

   A. Dry the baby and observe the response to this stimulation
   B. Wait until 1 minute after birth and assign the Apgar score
   C. Listen to the baby's heart rate
   D. Perform resuscitation only if central cyanosis is present
   E. Check for meconium staining on the baby's skin

2) **Immediate care for a normal newborn include**

   A. Skin to skin contact followed by placing the baby in a warming incubator
   B. Drying the baby, removing the wet cloth, and covering the baby with a clean, dry cloth
   C. Stimulating the baby by slapping the soles of the baby's back
   D. Deep suctioning of the airway to remove mucus
   E. Squeezing the chest to remove secretions from the airway

3) **When resuscitating term newborn where there is no meconium, but the baby is floppy and not breathing the baby should be dried and the following should be done.**

   A. After opening the airway should receive cycles of 1 rapid breath and 3 chest compressions.

   B. After opening the airway should receive 5 slow inflation breaths before the pulse is checked

   C. After opening the airway the baby should be given oxygen by funnel while the pulse is checked.

   D. After opening the airway the baby should be given oxygen by funnel while an umbilical venous catheter (UVC) is inserted and glucose given.

   E. After opening the airway the baby should be given 2 rapid breaths and 5 chest compressions.

You are resuscitating a newborn and find that the pulse is less than 90 beats/min. What will be your intervention?

A. Start CPR (cardiopulmonary resuscitation) at a ratio of 3:1 and reassess after 30 seconds to 1 minute.

B. Give positive pressure ventilation for 30 seconds to 1 minute and reassess.

C. Start CPR at a ratio of 15:2 and reassess after 30 seconds to 1 minute.

D. Give Oxygen by funnel and reassess after 1 minute.

E. Administer adrenaline 1-2mls stat and reassess.

4) **Which of the following is the most essential equipment for newborn resuscitation?**

A. Oxygen cylinder

B. Laryngoscope

C. Bag-valve-mask device

D. Sodium bicarbonate

E. Adrenaline

5) **Ventilation with bag and mask:**

A. Self-inflating bags (Ambu Bag) can deliver oxygen without squeezing the bag

B. Positive pressure ventilation is indicated only when the heart rates stays below 80 bpm

C. Ventilation should be 40-60 breaths per minute (without chest compressions)

D. The pressure required should be just enough to achieve chest expansion

E. Adding a reservoir on the secondary inlet of a self inflating bag should be routine to ensure resuscitation is with 100% oxygen

6) **When performing newborn resuscitation with a bag and mask, it is important to verify that**

A. The newborn's head is in a neutral position

B. The seal between the newborn's mouth, nose and bag is adequate

C. The baby is not covered.

D. Cardiac massage is being performed if the heart rate is <100

E. a) and b)

7) **If there is no chest movement after five initial inflation breaths**

A. Apply chest compressions at about 80 times a minute

B. Suction the airway

C. Re-check head position and continue with inflation breaths

D. Give supplemental oxygen

E. Administer 1: 10, 000 adrenaline intravenously

8) **With respect to chest compressions:**

A. The sternum should be compressed over its lower third with force applied just below an

imaginary line joining the nipples

B. One should start chest compressions before ventilation if no heart beat is present

C. The correct location for thumb placement is 2.5 cm below an imaginary line drawn between the nipples

D. One should start chest compressions after 15-30 secs of positive pressure ventilation with 100% oxygen, if the heart rate is less than 90 bpm

E. Use just enough pressure to depress the sternum 2.5 cm deep

9) **Newborn resuscitation procedures**

A. Always require the use of oxygen

B. Should be started after assigning the Apgar score

C. Can usually be carried out without oxygen

D. Should only be carried out by a paediatrician

E. Should only be carried out with parental consent

Appendix V: Observer's Checklist

Observation Number ☐☐☐ **Provider Code:** ☐☐☐

Prior Events and Observation At Birth:

Term Baby	**Yes** ☐	**No** ☐
Meconium	**Yes** ☐	**No** ☐
Immediate Cry	**Yes** ☐	**No** ☐
Initiation of Resuscitation		**<1 min** ☐
		1-4min ☐
		>5 min ☐

Item	1	2	3
Attends to temperature management (warm resuscitaire, warm towels)			
Receives baby with a warm towels dries, stimulates and covers with a dry towel.			
Notes time of delivery			
If meconium present, identifies indications for endotracheal suctioning in a depressed baby.			
Positions Airway			
If secretions are present, lightly suctions mouth then nose			
Assesses breathing (Looks, listens and feels)			
Correctly identifies need for assisted ventilation (apnoea, gasping or respiration rate <20 breaths/min			
Uses appropriate bag and mask size.			
Provides assisted ventilation correctly (30-40 breaths/min)			
Checks for chest expansion.			
Apgar Score	1 minute	5 minutes	10 minutes

COMMENTS: (Other observations made or interventions undertaken by observer during resuscitation)

1= did not achieve action 2= partially achieved action 3= fully achieved action

APPENDIX VI

Assessment of Knowledge

Variable	Frequency (n= 41)	Percentage
Q 1 (A)		
A	30	73.17
B	5	12.2
C	3	7.32
D	1	2.44
BLANK	2	4.88
Q2 (B)		
A	3	7.32
B	34	82.93
C	3	7.32
BLANK	1	2.44
Q3 (B)		
A	10	24.39
B	13	31.71
C	4	9.76
E	14	34.15
Q4 (B)		
A	11	26.83
B	12	29.27
C	4	9.76
D	11	26.83
E	1	2.44
BLANK	2	4.88
Q5 (C)		
A	8	19.51
B	5	12.20

C	27	65.85
BLANK	1	2.44
Q6 (D)		
A	6	14.63
B	5	12.20
C	5	12.20
D	9	21.98
E	14	34.15
BLANK	2	4.88
Q7 (E)		
A	8	19.51
B	15	36.59
C	3	7.32
D	3	7.32
E	12	29.27
Q8 (C)		
A	6	14.63
B	13	31.71
C	16	39.02
D	4	9.76
E	2	4.88
Q9 (A)		
A	17	41.46
B	5	12.20
C	8	19.51
D	8	19.51
E	2	4.88
BLANK	1	2.44

Q10(C)		
A	12	29.27
B	20	48.78
C	8	19.51
BLANK	1	2.44
PERCENTAGE SCORE		
20	2	4.68
30	10	24.39
40	15	36.59
50	8	19.51
60	4	9.76
70	1	2.44
90	1	2.44

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Ref: KNH/UON-ERC/ A/251

8th July 2009

Dr. Teresa Alwar
Dept.of Paediatrics & Child Health
School of Medicine
University of Nairobi

Dear Dr. Alwar

RESEARCH PROPOSAL: "NEWBORN RESCITATION: KNOWLEDGE AND PRACTICE AMONG MIDWIVES IN KNH LABOUR WARD AND MATERNITY THEATRE" (P165/5/2009)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and approved your above cited research proposal for the period 8th July 2009 –7th July 2010.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

DR. L. MUCHIRI
AG. SECRETARY, KNH/UON-ERC

c.c. The Chairperson, KNH/UON-ERC
The Deputy Director CS, KNH
The Dean, School of Medicine, UON
The Chairman, Dept.of Paediatrics & Child Health, UON
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