ADHERENCE TO NEWBORN RESUSCITATION GUIDELINES IN GARISSA PROVINCIAL GENERAL HOSPITAL

A DISSERTATION SUBMITTED IN PART FULFILLMENT FOR THE DEGREE OF MASTERS IN MEDICINE IN PAEDIATRICS AND CHILDHEALTH AT THE UNIVERSITY OF NAIROBI.

BY:

DR. OTIDO SAMUEL

MB Ch.B (UNIVERSITY OF NAIROBI)

H58/63329/10

DECLARATION

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

Signature: _____   Date: _____

Dr. Otido Samuel, MB Ch.B.

H58/63329/10

This dissertation has been submitted for consideration with our approval as supervisors.

Prof. Francis E. Onyango
Associate Professor,
Department of Paediatrics and Child Health,
University of Nairobi

Signed...Date..

Dr Murila Florence

Senior lecturer, Neonatologist,
Department of Paediatrics and Child Health,
University of Nairobi

Signed... Date..

Dr Kumar Rashmi
Lecturer, Paediatric Intensivist,
Department of Paediatrics and Child Health
University of Nairobi.

Signed...Date..

DEDICATION

To the Almighty Father before whom i lay all my gratitude.

To my dear wife Kate Mackenzie who has stood by me during the course in person and in prayers.

To my son Wayne Ngalu Otido whom God made in a special way.

To my parents John Ngalu Otido and Hellen Lichuma for all the sacrifices they made to get me where I am today.

To all my teachers for sharing their knowledge with me.

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ABBREVIATIONS

ETAT – Emergency Triage and Treatment

KDHS – Kenya Demographic Health Survey

KNH/UON ERC – Kenyatta National Hospital/ University of Nairobi

     Ethics and Research committee.

KPA – Kenya Paediatric Association

KRC – Kenya Resuscitation Council

NRP – Neonatal Resuscitation Program

PALS – Paediatric Advance Life Support

PGH – Provincial General Hospital

TBA – Traditional Birth Attendant

WHO – World Health Organization

DEFINITIONS

Basic newborn resuscitation: defined as Provision of warmth, airway clearing (suctioning), head positioning and positive pressure ventilation via bag-and-mask

Birth asphyxia: The W.H.O definition -the failure to initiate and sustain breathing at birth

**Immediate newborn assessment and stimulation*:* warming, drying and rubbing the back or flicking soles of the feet.

Neonate: an individual of age between birth and 1 month.

Newborn: a baby who has just been delivered.

Resuscitation: Neonatal resuscitation is defined as the set of interventions at the time of birth to support the establishment of breathing and circulation

Vigorous baby: baby with good heart rate >100bpm, good muscle tone and breathing.

ABSTRACT

Background:

Appropriate resuscitation techniques are crucial to the survival of the newborn. It is estimated that approximately 10% of newborns require assistance with breathing at birth. The W.H.O guidelines for neonatal resuscitation have been adopted by the Ministry of Health and it is recommended that all delivery room personnel complete the Newborn Resuscitation Program (NRP) training in order to improve the outcome of the resuscitation.

Justification:

Newborn resuscitation skills are mandatory to the all health workers who attend to mothers in labour. These skills are acquired through training and frequent practicing. No study has been conducted to assess the utilization of newborn resuscitation guidelines in Garissa P.G.H.

Objective:

The aim of the study was to establish the level of adherence to the Newborn Resuscitation guidelines by health workers in Garissa P.G.H.

Methods:

It was a descriptive hospital based cross- sectional study conducted in the labour ward and the theatre departments of Garissa PGH. Thirty nine (39) health workers were observed during resuscitation for a period of two months. Eleven resuscitation steps were observed. To measure the level of adherence to the guidelines, four initial basic steps were used to judge **appropriate practice**. The health worker had to **fully** achieve them as follows; receive the baby in warm towels, used a warm resuscitaire, positioned the baby in a neutral position and assessed breathing in the newborn. A questionnaire was also administered to establish barriers to effective resuscitation. Simple frequency tables were generated for analysis of appropriate resuscitation practice and compared with the health worker demographics. Multivariate logistic regression was used to determine independent correlates of appropriate resuscitation practice.

Results:

From the 136 resuscitations observed, 26.5% (n=36) were performed appropriately. The doctors were found to performed resuscitation more

appropriately than the nurses (OR 6.45, p=<0.001). The most commonly missed steps were provision of warmth by use of warm towels (39%) and failure to assess the newborn's adequacy of breathing (39%).Of the 30 health workers who responded to the questionnaire, 15 (50%) cited that lack of equipment needed for resuscitation was the main barrier to effective newborn resuscitation. Twelve workers (40%), reported lack of training in newborn resuscitation as the main barrier.

Conclusion:

The basic newborn resuscitation practice according to the guidelines was poorly adhered to at 26.5% of the cases observed.

Recommendations:

It is a possibility that emphasis on newborn resuscitation training and refreshers courses for the health workers may be addressed to increase the adherence level to the guidelines.

BACKGROUND

Introduction

Quality Newborn resuscitation based on standard guidelines is a key component of efforts to reduce neonatal morbidity and mortality. It is a fact that most babies born with asphyxia benefit from early intervention with proper resuscitation methods [1].

According to the WHO estimates, around 3% of the 120 million babies born each year in developing countries develop birth asphyxia and require resuscitation. It is estimated that some 900,000 of these newborns die as the result of the asphyxia. Effective resuscitation could prevent some of these deaths as well as improve the outcomes of surviving asphyxiated babies. [1-3]

Birth asphyxia in rural Kenya remains a major cause of neonatal morbidity and mortality resulting in approximately 25% of all newborn deaths that occur in the first 28 days of life[4]. Basic newborn resuscitation techniques can help babies to breathe after birth and reduce mortality by 99 %[4].

Neonatal resuscitation Guidelines were inaugurated in 1987 and were written on the basis of experience and little evidence for recommendations [5]. Twenty years later tremendous changes have occurred. The International Liaison Committee On Resuscitation (ILCOR) sponsored by the American Heart Association (AHA) meets every 5 years to revise recommendations for both adult and paediatric resuscitation. Various National groups around the world revise the guidelines and countries have adapted them to practically fit in their own setting.

The Kenya Resuscitation Council (KRC) under the umbrella of the Kenya Paediatric Association (KPA) is responsible for training health workers in newborn resuscitation in the country. Garissa hospital has no in house training programme for resuscitation. It relies on outside training programmes for its staff.

LITERATURE REVIEW

The WHO recommends that a baby, who does not cry at birth, does not breathe or is gasping 30 seconds after birth must be resuscitated [6]. These are the babies who are at great risk of developing birth asphyxia.

The incidence of birth asphyxia is higher in developing countries than in the developed countries [7-8]. This is because of a higher prevalence of risk factors. Contributing factors include poor health of pregnant women, high incidence of complications during pregnancy and delivery, mothers delivering at home in the hands of unskilled health personnel (TBA) and a high incidence of preterm deliveries. Therefore timely and quality resuscitation of newborns is more critical in developing countries. However, most newborns do not receive adequate care because most birth attendants do not have the necessary knowledge and skills for resuscitation and have inadequate supplies and equipment necessary for newborn resuscitation [6].

The need for resuscitation should always be anticipated. Every birth attendant should be skilled in newborn resuscitation which includes anticipation of a possible resuscitation, early preparation and timely recognition of babies in need of resuscitation. To aid in resuscitation, the hospital should have the necessary equipment and supplies which are clean and in good function [9].

The minimum equipment and supplies for newborn resuscitation include a heat source (preferably a radiant heater) to prevent heat loss or if this is not available, pre-warmed towels and an extra blanket can be used to cover the newborn. Others include a mucus extractor for suctioning, a self-inflating bag of newborn size, two masks for ventilation, and a clock to assess time correctly [9].

Adequate ventilation is more important than additional oxygen; quick action with the bag and mask is more important than intubation. Therefore resuscitation can and should be initiated virtually anywhere, including those places where oxygen is not readily available. The choice of device for ventilation is not as important as how effectively it is used. The most common causes of failed resuscitation are failure to recognize the problem promptly, not reacting quickly enough and not ventilating effectively. Correct technique and assessment of the effectiveness of ventilation are critical [9].

Advanced procedures like chest compression, intubation, administration of oxygen and use of drugs are needed in only 1% of the cases. These procedures

have strict indications and are beneficial only in specific circumstances and if carried out by an experienced person [9].

In reality, even the simplest equipment is frequently not available and hospitals in developing countries lack skilled health workers. In many places, only one birth attendant is present when a mother is delivering. The health worker has to divide her attention between the mother and the newborn. In such situations newborn resuscitation can be compromised [9]. Basic resuscitation will not help all newborns but if done correctly, it will help most, even where only few resources and simple training are available.

To provide basic newborn resuscitation for all newborns who need it, each health institution needs to introduce it as a practice, to maintain the skills of the staff and to ensure that functioning equipment and supplies are always available. At National level, legislation, standards, training courses and training material will help health workers to carry out the task.

The Millennium Development Goal 4 (MDG4) requires reduction of Under 5 mortality by two thirds, by the year 2015. Since 1990, Under 5 Mortality Rate has dropped by 35% but it is still behind the target for 2015[10]. The evidence available shows that Neonatal Mortality Rate is progressively becoming a more prominent component of the under 5 mortality rate because the proportion of the under 5 year old deaths that occur during neonatal period is increasing as the under 5 mortality rate is reducing [10].

Globally the Neonatal Mortality Rate was 23/1000 live births as of 2010, a reduction from 32/1000 live births in 1990. Neonatal mortality rate (NMR) in Sub-Saharan Africa was 35/1000 live births in 2010 compared to 43 in 1990[10]. The Sub-Saharan Africa has the highest risk of death in the first year and in the first month of life [10]. The region has also shown the least improvement in the situation at large.

The Kenya Demographic Health Survey 2008/09 showed that Under 5 Mortality Rate was 74/1000 live births, Infant Mortality Rate (IMR) was 52/1000 live births while NMR was 31/10000. Death during the neonatal period contributed to 60% of infant deaths and 37% of deaths in the under fives [11].

In order to reduce neonatal mortality rate health facilities must be equipped with resuscitation supplies and the health workers must adhere to newborn resuscitation guidelines [11]. Keenan et al on an evaluation of a neonatal resuscitation programme in China found a 53% decline in neonatal mortality

from birth asphyxia following the implementation of the Chinese Neonatal Resuscitation Programme [12].

Study justification
The WHO has established that asphyxia is the main cause of neonatal mortality worldwide. Studies have shown that good resuscitation practice improve outcome of these babies. However these skills are hard to practice in resource limited areas.

The Neonatal Mortality Rate is at 33/1000 live births in North Eastern Province compared to the National rate which is at 31/1000 live births. Though it is not known, asphyxia may contribute to majority of the deaths of these neonates amongst other causes. The 4th Millennium Development Goal requires the reduction of child mortality rate for under five years children. Infant mortality can be reduced by the reduction of neonatal deaths with appropriate resuscitation practice.

Since Garissa P.G.H is the main referral hospital in the North Eastern Province, quality of health care in terms of newborn resuscitation practice is expected to be of better quality compared to other health facilities in the province. Neonatal resuscitation guidelines must be adhered to by all health workers for better outcome of the newborns who need resuscitation.
Newborn resuscitation skills are mandatory to all health care workers who attend to mothers in labour. These skills are attained through training and repeated practice.
This study aims to compare the practice of newborn resuscitation compared to standards which have been set. No study has been done at Garissa PGH to check the level of adherence to newborn resuscitation guidelines.

RESEARCH QUESTIONS

1. What is the level of adherence to the newborn resuscitation guidelines in Garissa Provincial Hospital?

2. What are the factors that are associated with failure to adhere to newborn resuscitation guidelines in Garissa Provincial Hospital?

STUDY OBJECTIVES:

Primary objective:

1. To establish the level of adherence to the Newborn resuscitation guidelines in Garissa P.G.H.

Secondary Objective:

1. To determine factors that are associated with failure to adhere to the newborn resuscitation guidelines at Garissa Provincial General Hospital.

STUDY MATERIALS AND METHODS

Study design
This was a hospital based descriptive cross sectional study.

Study period
The study was between October and November 2012.

Study area
Garissa Provincial General Hospital labour ward and theatre. Garissa Hospital is the main referral hospital in Garissa County, North Eastern Province. It serves a population of 2,345,000 people.

The hospital has 131 number of health workers, **37** of whom are stationed in labour ward and maternity theatre. In the year 2011, the facility had 3176 deliveries from January to December. In the same year there were 47 newborn deaths during delivery.

A description of the Garissa PGH delivery area.
The hospital has two delivery areas, the labour ward and the main theatre. Most of the labour ward deliveries are conducted by nurses and in case the newborn requires resuscitation, the same health worker is required to resuscitate. The deliveries conducted in the theatre are conducted by doctors working in Obstetrics and Gynaecology. The doctors working in the paediatrics department receive the newborns and conduct resuscitation if need be.

Labour ward has 3 beds for delivery and 2 nurses at any one point are on a shift. This can create divided attention as the health worker has to take care of the mother and at the same time the baby. In the event of multiple deliveries, the student nurses assist the midwives in both delivery and resuscitation.

Study population
It involved fully qualified doctors and nurses working in the labour ward and theatre departments at the time of data collection.

Inclusion criteria
1. All health workers working in labour ward and maternity.
2. Health workers who had given a written informed consent.

Exclusion criteria

Health workers who had declined to give consent for participation in the study.

Sample size calculation

An assumption made was that the level of appropriate resuscitation practices would be 50%. There was a finite population number of 37 health workers and we aimed to observe each health worker resuscitate, the following calculation was used:

Formula for Sample size calculation for a finite population:

$n^1 = Nz^2 p (1-p) / d^2 (N-1) + z^2 p (1-p)$

$n = 37 \times 1.96^2 \times 0.5(1-0.5) / 0.05^2 (37-1) + 1.96^2 \times 0.5(1-0.5) = 34$ observations

Where:

n^1 – sample size with finite population correction

N – Population Size (37 health care workers)

z – Statistical level of confidence (95%)

p – Expected proportion (50%)

d – Precision (0.05)

The 34 resuscitations to be observed was not going to create enough numbers for analysis therefore to increase the statistical power, the study aimed to increase the number of observations by a multiple of 3 to 4 per health worker bringing the observations to approximately 136. This criterion was also used by Alwar et al 2010[15].

Study procedure

The principle investigator introduced the study to the hospital administrator for approval. With his permission, the investigator also introduced the study to the health workers in labour ward and theatre departments and requested them for their participation. A consent form was provided for further information.

a) Delivery area inspection

The labour ward and theatre were then inspected for availability of supplies and equipment needed for resuscitation. This was cross checked against a standardized check list form (Appendix III) containing equipment and supplies needed for resuscitation.

b) Questionnaire to health workers

Questionnaires (Appendix V) were then issued to the health workers who had given consent. This provided information on characteristics of the health workers, training history and challenges experienced in the resuscitation process. This was only filled once.

c) Observation of resuscitations

The research assistants observed resuscitations as conducted by the health workers and recorded the information in a health worker observation form (Appendix VI). This form provided information on newborn characteristics before resuscitation and the steps that the health worker had followed during resuscitation.

A total of 11 basic steps were observed by the investigators. The health worker was observed -

1. Receiving baby in warm towels
2. Noting time of delivery
3. Using a warm resuscitaire
4. Positioning baby's airway in a neutral position
5. If meconium was present, suctioning done before stimulating the newborn (non-vigorous newborns)
6. Suctioning secretions
7. Assessing adequacy of breathing
8. Identifying need for ventilation (apnea, gasping or respiratory rate < 20 breaths per minute)
9. Using the Bag Valve and Mask device appropriately
10. Providing assisted ventilation (30 -40 breaths per minute)
11. Assessing good chest rise during ventilation.

Primary outcome

Out of these steps, **four** essential steps required to be conducted during any resuscitation were used to define **appropriate** newborn resuscitation practice in this study. For an observation to be classified as appropriate a health worker had to fully achieve each step. Failure to achieve any step deemed inappropriate. The specific steps were as follows: receiving the baby in warm towels, use of a warm resuscitaire, positioning the baby in a neutral position and assessment of breathing in the newborn. The provision of warmth and airway management is crucial in the initial stages of resuscitation. The research assistants did not know which steps were used to determine the appropriate practice to try and minimise the observation bias.

The observations were done in a 24 hour period. Since the observations were made more than once, the health workers were identified by their initials for repeated observations. It was anticipated that not all resuscitation practices would be similar based on the various clinical presentation of the newborns to be resuscitated. The forms were stored by the principal investigator for data analysis.

Observation bias could not be ruled out completely as the health workers knew of the contents of the study before the observations were done. The principle investigator used student nurses to try and minimise the bias.

DATA MANAGEMENT

The data forms were kept by the principal investigator who cleaned the entries as well. The information was later entered in Microsoft Office Access software for storage.

Data analysis

The data was analysed using STATA version 11. Simple frequencies were generated for analysis of appropriate resuscitation steps as done by the health workers.

Odds ratio was used for binary variables to compare demographic factors and expected outcome of appropriate resuscitation. Multi variate logistic regression was used to determine independent correlates of appropriate resuscitation practices.

Ethical considerations

The study was granted approval by the department of Paediatrics and Child Health University of Nairobi, Kenyatta National Hospital/ University of Nairobi Ethics and Research Committee and The Garissa Provincial Hospital Administration. The health workers signed an informed written consent form clearly stating the objectives of the study.

No personal information of the health worker was revealed to a third party. If the health worker needed assistance in resuscitation, the research assistants were advised to assist as a matter of priority.

RESULTS

Hospital preparedness in resuscitation

The labour ward and theatre departments were inspected for drugs and supplies needed for resuscitation and compared to the standardized check list in appendix III. It was established that most supplies were present in both departments except for warm towels which were missing in the labour ward. Others were resuscitation job aides and a clock which were missing in theatre.

Health worker characteristics:

During the two month study period (October to November 2012), a total of 136 resuscitations were observed at Garissa PGH and these resuscitations were conducted by 39 health workers. The median number of resuscitation conducted per health care worker was 6 (IQR 3 to 8). The characteristics of these 39 health workers are summarised in Table 1.

The participants included doctors (35.9%) and nurses (64.9%). One of the doctors was an anaesthetist. Out of the 39 health workers, 69.2% were females. Twenty-one (53.9%) health workers conducting resuscitations reported that they had been trained in Newborn resuscitation.

Table 1: Characteristics of health workers involved in resuscitating newborns at Garissa PGH

	Frequency (n=39)	Percent (%)
Gender		
Male	12	30.8
Female	27	69.2
Health worker cadre		
Doctor	14	35.9
Nurse	25	64.1
Resuscitation training		
Yes	21	53.8
No	18	46.2

Newborn characteristics:

Out of the 136 resuscitations, 115 (84.6%) were term babies and 64 (47.1%) were born with meconium stained liquor. The preterm babies were 21 (15.4%). Of note is that of the deliveries observed, (120) 88.2% of the newborns did not have an immediate cry which placed them at risk of developing birth asphyxia. Most deliveries were through spontaneous vertex delivery (SVD) 58.8%. The median Apgar score at 1 and 5 minutes was 6 (IQR 5 to 7) and 7 (IQR 6 to 8) respectively. Table 2 below summarises the newborn characteristics.

Table 2. Characteristics of Newborns resuscitated.

State of newborn at birth	Frequency(n=136)	Percentage (%)
Term		
Yes	115	84.6
No	21	15.4
Immediate cry		
Yes	16	11.8
No	120	88.2
Good muscle tone		
Yes	35	25.7
No	101	74.3
Meconium stained liquor		
Yes	64	47.1
No	72	52.9
Mode of delivery		
SVD	80	58.8
C/S	46	33.8
Breech	10	7.4

Newborn resuscitation practices

Table 3 below shows the results of the resuscitation practices.
The best performed procedure by the health workers provision of warmth by use of a warm resuscitaire at 97.1%.

From the 136 babies observed, 112 (82.3%) proceeded to get assisted ventilation via bag and mask. Bag and mask were appropriately used in 79.5% of the 112 neonates who needed assisted ventilation. Correct ventilation was performed in 56.3% of the resuscitation and in 86(76.8%) cases the health worker was able to check for the chest rise during inflation.

Of note is that of the neonates born with meconium stained liquor and were non-vigorous (newborns with a heart rate less than 100 beats per minute, poor muscle tone and without an immediate cry), **none** was suctioned before stimulation as indicated in the guidelines (appendix I).

Table 3. Newborn resuscitation practices

Variable	n=136 Achieved (%)	Not achieved (%)
Receiving baby in warm towels	83(61%)	53(39%)
Time of delivery noted	87(64%)	49(36%)
Used warm resuscitaire	132(97.1%)	4(2.9%)
Airway positioning	87(64%)	49(36%)
Meconium present (non-vigorous newborn) – suction done before stimulation	0 (0%)	59 (100%)
Suctions secretions appropriately	90(66.2%)	46(33.8%)
Assesses breathing	83(61%)	53(39%)
Identifies need for ventilation	61(54.5%)	51(45.5%)
Appropriate use of BVM device	89(79.5%)	23(20.5%)
Correct ventilation	63(56.3%)	49(43.7%)
Appropriate chest rise	86(76.8%)	26(23.2%)

Outcome measures

The four immediate basic steps were used to judge the appropriate resuscitation practices. The health worker had to receive the baby in warm towels, used a warm resuscitaire, placed the newborn's airway in a neutral position and assessed for breathing. These four are very basic and can be performed at any level of a hospital. The KNH study used similar parameters for analysis [13]. **All** four had to be fully achieved. Based on the above criteria 36 resuscitations (26.5%) out of the 136 observed were judged to have been done appropriately.

Failure to achieve at least one of the steps constituted inappropriate practices and 73.5% (n = 100) of resuscitations were inappropriate. The most commonly missed steps were provision of warmth by use of warm towels (39%) and newborn's assessment of breathing (39%).

Some of the harmful practices in newborn resuscitation as witnessed by the investigators include, giving of 50% dextrose solution per rectum or

intravenously in 4 cases. Inversion of the newborn upside down to drain secretions was done in 3 cases.

Health worker factors effect on appropriate resuscitation practice

Bivariate analysis presented in this section was used to compare health worker independent variables with appropriate resuscitation practice.

Effect of cadre on appropriate resuscitation practice

The doctors were more likely to perform resuscitation more appropriately compared to nurses. The doctors were 11.45 times more likely to perform resuscitation appropriately compared to nurses (p-value <0.001) as shown in table 4.

Effect of health worker training on appropriate resuscitation practice

The health care workers who had been trained in resuscitation of the newborn were more likely to perform resuscitation appropriately compared to untrained health workers. The odds of an untrained health worker performing resuscitation appropriately were 0.46 times that of trained health workers (p-value 0.229). This is however statistically insignificant as shown in table 4.

Effect of health worker gender on appropriate resuscitation practice

The males were more likely to perform resuscitation appropriately than the females. The odds of a female performing resuscitation appropriately were 0.16 times that of males (p-value <0.001). The majority of the nurses were females.

Table 4 below summarises the association between the health worker characteristics and appropriate resuscitation practices.

Variable	Number of health workers n=39	Number of resuscitation Performed n=136	n=36 Appropriate Practice (%)	n=100 Inappropriate practice (%)	Odds ratio	95% CI	p-value
Cadre							
Doctors	14	47	27 (75%)	20 (20%)	11.45	5.03-26.09	<0.001
Nurses	25	89	9 (25%)	80 (80%)	1.00		
Trained							
Yes	21	84	26 (72.2%)	58 (58%)	1.00		
No	18	52	10 (27.8%)	42 (42%)	0.46	0.15-1.57	0.229
Gender							
Males	12	44	23 (63.9%)	21 (21%)	1.00		
Females	27	92	13 (36.1%)	79 (79%)	0.16	0.06-0.45	<0.001

Newborn characteristics effect on appropriate resuscitation practice

Effect of mode of delivery on appropriate resuscitation practice

The resuscitations conducted after caesarean sections were more likely to be performed appropriately than resuscitations after a vaginal delivery. The odds of a resuscitation after a caesarean section were 3.21 times more likely to be appropriate than a resuscitation that followed a vaginal delivery (p-value 0.021) as shown in table 5.

Effect of meconium stained liquor on appropriate resuscitation practice

A delivery with meconium stained liquor made the health worker to perform resuscitation more appropriately than a delivery with no meconium. The odds of a resuscitation of a newborn delivered without meconium stained liquor were 0.88 times that of resuscitation with meconium. However, this association was not statistically significant as shown in table 5.

Effect of immediate cry at birth on appropriate resuscitation practice

A delivery where the newborn did not make an immediate cry made the health worker to perform resuscitation more appropriately than a delivery where the newborn cried immediately after birth. The odds of resuscitations of a newborn without an immediate cry were 2.38 times more likely to be done appropriately than resuscitations whereby the newborn cried immediately but this association was not statistically significant as shown table 5.

Table 5 Effect of newborn characteristics on appropriate resuscitation practice

Mode of delivery	Odds ratio	95%CI	P-value
SVD	1.00		
C/S	3.21	1.19 – 8.66	0.021
Breech	2.17	0.49 - 9.69	0.309
Meconium stained Amniotic fluid			
Yes	1.00		
No	0.88	0.38 – 2.02	0.757
Baby cried immediately			
Yes	1.00		
No	2.38	0.57 – 9.96	0.236

Result of logistic regression analysis of health worker characteristics with appropriate resuscitation

The findings of the logistic regression analysis are presented in Table 6. Health worker cadre was statistically significantly associated with appropriate resuscitation practice ($p = <0.001$) after adjusting for the confounding effects of resuscitation training and health worker gender. The odds of appropriate resuscitation practice was approximately six-fold higher among doctors (Odds ratio = 6.45, 95% CI 2.44 to 17.06) compared to nurses.

Unlike in the unadjusted analysis health worker gender ($p = 0.073$) and attendance of resuscitation training ($p = 0.42$) did not show statistically significant associations with appropriate resuscitation practice after controlling for the effect of health worker cadre.

Table 6: Health worker predictors of appropriate resuscitation

	Adjusted Odds ratio	95% CI		P value
Health worker cadre	6.45	2.44	17.06	<0.001
Health worker Gender	0.45	0.18	1.08	0.073
Resuscitation training	0.67	0.26	1.76	0.42

Factors reported to affect health workers use of the neonatal resuscitation guidelines

Thirty (n=30) health care workers were interviewed using a questionnaire in this section. The participants included nurses, doctors and clinical officers who participate in the delivery process. Female health workers were the majority respondents at 53.3%. The maternity unit had 70% of the health workers who took part in this study. Doctors accounted for 53.3% of the workers. Only one clinical officer participated in the study. The majority (70%) of the health workers had worked for less than 2 years in their respective units. Eighteen health workers (60%) had been trained in newborn resuscitation. Most participants (60%) had not seen the guidelines in the hospital. From the 30 health workers, 21 (70%) reported they had used the guidelines during resuscitation.

The rest of the variables are summarised in table 7.

Table 7: Characteristics of the health workers

Variable	Number (n=30)	Percentage %
Sex		
Female	16	53.3
Male	14	46.7
Age		
<25 years	2	6.7
25- 35 years	21	70.0
>35 years	7	23.3
Unit		
Maternity	18	60.0
Theatre	5	16.7
Paediatrics	7	23.3
Designation		
Nurse	13	43.3
Doctor	16	53.3
Clinical officer	1	3.3
Years of service		
<2 years	21	70.0
2-5 years	5	16.7
> 5 years	5	13.3
Neonatal resuscitation course Awareness		
No	9	30.0%
Yes	21	70.0%
Neonatal resuscitation course Attended		
No	12	40.0%
Yes	18	60.0%
Reason for Non attendance		
Never heard of any course	7	63.6
No time off work	4	36.4
Seen the guidelines in the facility		
No	12	40.0
Yes	18	60.0
Have a copy of guidelines		
No	17	56.7
Yes	13	43.3
Ever used guidelines		
No	9	30.0
Yes	21	70.0

Barriers to utilisation of the neonatal guidelines.

Most health workers reported that lack of training in newborn resuscitation was the main barrier for them in providing appropriate resuscitation. Others mentioned that lack of essential resuscitation equipment like suction machine, oxygen and face masks were the main issue hindering their effort in resuscitating babies. A few of them mentioned that lack of adequate staff in the labour ward contributed to poor support during resuscitation.

One health worker reported that some care givers decline resuscitation to be performed to their newborns due to cultural practices. Table 9 gives a summary of the findings.

Table 9. Health worker view on their barriers to effective newborn resuscitation.

Comment	Frequency n=30 (%)
Lack of training	12 (40%)
Lack of equipment	15(50%)
Lack of adequate staff	3 (10%)
Lack of job aides	3(10%)

DISCUSSION

Newborn resuscitation is an essential skill that all health workers who deal in the delivery process must have. To prevent birth asphyxia and its sequelae, timely and quality resuscitation is essential. The resuscitation skills are taught in various programmes around Kenya mostly by the KEMRI based ETAT (Emergency triage and treatment programme).

In this study, most (61%) of the trained health workers had attended ETAT programme which offers a section on newborn resuscitation. No follow up has been done in Garissa PGH to establish if the guidelines are being adhered to. Studies have demonstrated that training in newborn resuscitation improves the health worker's practice and hence newborn survival.

The Chinese neonatal resuscitation program has been a success since its inauguration in 2004. Keenan et al in 2010 did an evaluation of a neonatal resuscitation programme in China and found a 53% decline in neonatal mortality from birth asphyxia following the implementation of the Chinese Neonatal Resuscitation Programme [12]. Here in Kenya, Opiyo et al in 2007 demonstrated that newborn resuscitation practices improved after a one day training programme in Pumwani Maternity hospital [13]. Opiyo was able to demonstrate that the training improved performance of initial resuscitation by 66% and that there was a reduction of harmful practices that health workers used to perform prior to the training.

 Before the commencement of the study, the delivery areas were inspected for the preparedness of basic newborn resuscitation. It was established that majority of the necessary equipment and supplies were available in both the theatre and labour ward. Stephen N Wall et al stated that the most important device for resuscitation in a low resource setting is the self inflating Bag and mask device [14]. Same study mentioned that supplementing oxygen during resuscitation does not provide additional benefit compared to babies who are resuscitated without oxygen. Therefore, basic resuscitation was seen as to be practicable in Garissa PGH.

In this study, four basic steps in newborn resuscitation were identified in which the health worker must have achieved all to qualify as having done an appropriate practice. The four steps were used because they are basic and are crucial to newborn survival [14, 15, 19]. They can also be performed by any health worker in any level of a hospital.

They are as follows: receiving the baby in warm towels, use of a warm resuscitaire, positioning the baby in a neutral position, assessing breathing in the neonate and correctly identifying the need for assisted ventilation in the neonate. Of the 136 resuscitations observed, only 36 (26.5%) were performed appropriately. This is lower than the KNH study by Alwar et al in 2010, which demonstrated 47.19% of resuscitations were done appropriately [15]. It is expected that the KNH study would have a higher percentage of appropriate resuscitation because it has an in house newborn training programme while Garissa doesn't have. The KNH study also used nurses who usually conduct more deliveries and resuscitation than doctors.

The most commonly missed step was the use of warm towels when receiving the newborn (39%) followed by inappropriate assessment of breathing (39%). During the inspection of Garissa PGH, it was noted that the pre-warmed towels are generally provided for in theatre as opposed to the labour ward. This created the discrepancy in the provision of warmth between the two delivery areas. Babies who are cold have increased oxygen consumption and develop hypoglycaemia and acidosis easily compared to warm babies [20]. The newborns have a large surface area to weight ratio therefore heat is lost easily from their bodies. The Kenyan Guidelines recommends that all babies should be received in warm towels and only stimulated if they do not have meconium stained liquor [21]. This is contrast to the KNH study where the use of warm towels was achieved in 82% of the resuscitations observed.

Still in the provision of warmth, it was also noted that four babies were not placed in a warm resuscitaire. In this group of newborns, the health worker forgot to switch on the resuscitaire. The research assistants for ethical reasons assisted in this situation but recorded the event as not achieved by the health worker.

The health workers did not assess breathing in the newborn adequately in 39 % of the cases. Inappropriate assessment of breathing is of concern as the baby's respiratory rate and adequacy of breathing is crucial in the initial evaluation for need of resuscitation. This is a concern because knowing the adequacy of breathing necessitates the next step in resuscitation. This group of newborns were at a great risk of developing asphyxia. Appendix I shows the flow chart in resuscitation. The health workers are given a period of 30 seconds to check the heart rate and respiratory rate before moving on to the next step.

The newborn requires proper positioning of the airway to facilitate breathing. The anatomic structure of their neck necessitates neutral positioning during resuscitation. In this study, the health workers were able to achieve this in 64% of the 136 episodes leaving the rest at risk of poor breathing positions. In the KNH study neutral airway position was achieved in 76% of the 178 of the resuscitations conducted.

The doctors were found to be practicing appropriate resuscitation more often than the nurses by up to 11 times (p-value <0.001). Even after adjusting for the confounding effect of resuscitation training and health worker gender factors, health worker cadre (doctors) was still statistically significantly associated with appropriate practice (OR 6.45, p = <0.001). Although no studies have been done to compare practice in newborn resuscitation between doctors and nurses, in this study it is hypothesised that the doctors performed better because they conducted less resuscitations n=47 (34%) compared to the nurses who conducted 89 (66%) of the 136 resuscitations.

In this study, it was surprising that the health workers who had been trained in newborn resuscitation did not have an impact on appropriate resuscitation (p=0.229). Similarly to the KNH study, the health workers who were trained in newborn resuscitation did not give a significant difference compared to the health workers who were not trained (OR 1.13, CI 0.68-1.88, p=0.64). However, indeed the American Heart Association (AHA) Neonatal resuscitation program (NRP) states that completion of the training does not necessarily imply an individual is competent to perform neonatal resuscitation [16]. On the contrary some studies in East Africa have demonstrated a positive impact on newborn outcome after training health workers. In 2006, O'Hare et al in Kampala Uganda demonstrated a reduction in the incidence of birth asphyxia after nurses were trained in basic newborn resuscitation [17]. In Kenya the Pumwani study also showed the same [13] as stated above.

In the bivariable analysis, the health worker gender was also shown to have a strong association with appropriate outcome. The males performed better than the females (p= <0.001). The males were mostly doctors who had been trained in newborn resuscitation. Upon further analysis using the logistic regression model, gender was found to be insignificant (p=0.073).

It was also noted that after a caesarean delivery, the newborns were resuscitated appropriately (OR 3.21, p-value 0.021) as shown in table 6. These resuscitations

were carried out by doctors who have been shown to conduct resuscitation more appropriately. This may also be attributed to the fact that most are trained in resuscitation and probably to the fact that they conduct less resuscitation as compared to the nurses. Similarly the KNH study by Alwar also demonstrated that resuscitations which were done in theatre were more likely to be appropriate than those conducted in the labour ward (OR 2.07, p=0.04).

On assessment of factors affecting the health workers utilization of the guidelines, most health workers reported that lack of equipment and training is the main reason why they do not practice resuscitation appropriately. Some cited lack of resuscitation protocols and inadequate staff support as hindrance to effective resuscitation. Similar issues were raised by Bream et al in the Malawi study in 2005[18]. From the hospital survey Garissa PGH was found to have a good environment for resuscitation.

It is however commendable that the health workers knew how to use the Bag and mask device appropriately (87.5%) though 55.9% of the resuscitations were correctly ventilated. Studies in low resource settings support the use of BVM as the most crucial equipment in resuscitation [14]. This is important as ventilation alone is the key to reviving a newborn as opposed to older child and adults who need chest compressions.

CONCLUSION

1. The basic newborn resuscitation practices according to the guidelines were poorly adhered to at 26.5% of the cases observed.
2. The health workers practice in assessment of adequacy of breathing by basically counting the respiratory rate was notably low at 39%. This step is crucial to the survival of a newborn at risk of asphyxia as it necessitates the next step in resuscitation.

RECOMMENDATIONS

1. It is a possibility that emphasis on training and refresher courses for the health workers may be addressed to increase adherence level to the guidelines.
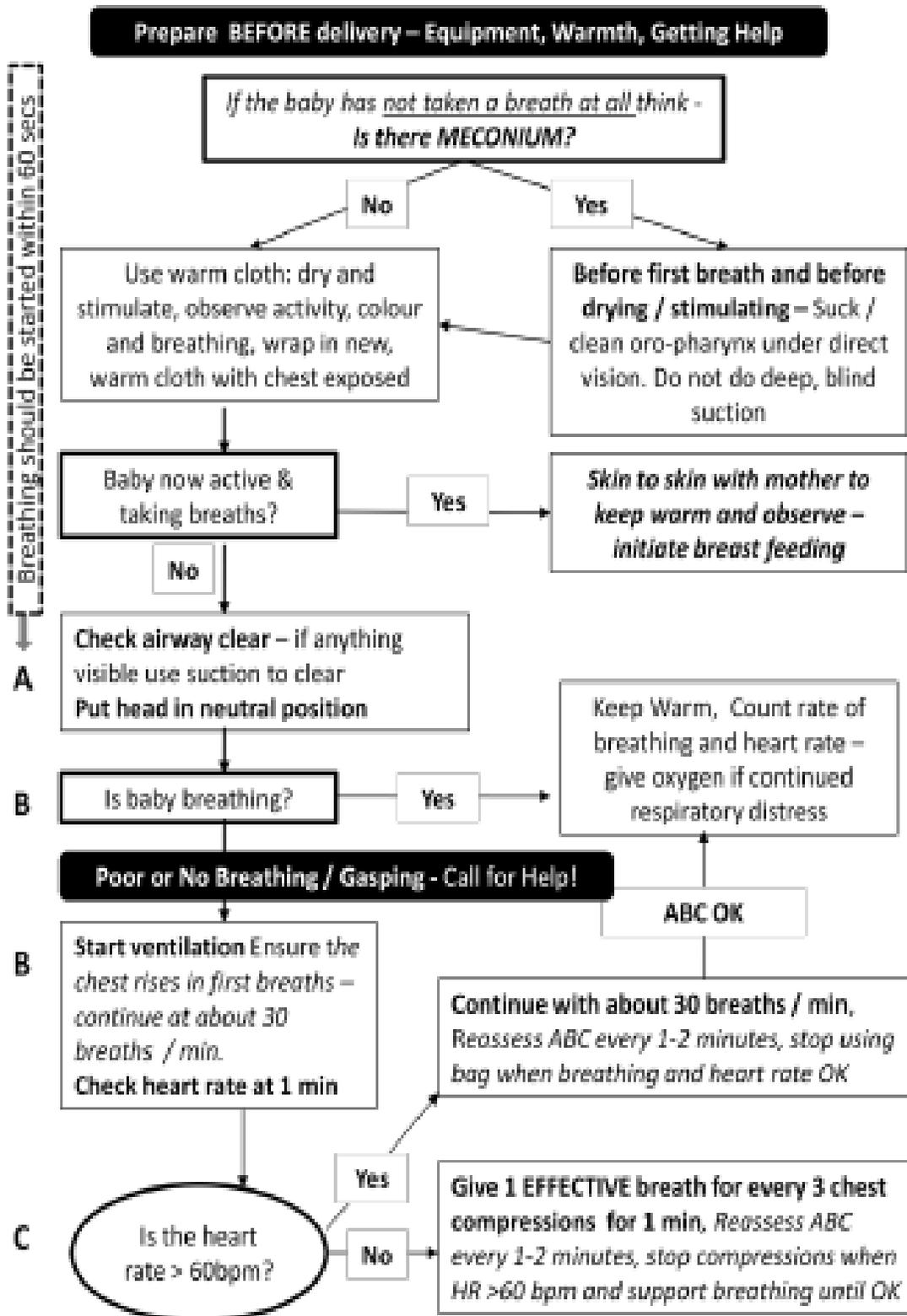
STUDY LIMITATIONS

1. Resuscitations were mainly carried out by nurses and other cadres did not do as much resuscitation as them.
2. The presence of an observer creating a Hawthorne effect (tendency of an individual improving their performance once he/she knows that they are being observed) on the study was anticipated and we used student nurses to try and minimise this effect.

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Appendix I: Newborn resuscitation flow chart

Prepare BEFORE delivery – Equipment, Warmth, Getting Help

If the baby has not taken a breath at all think -
Is there MECONIUM?

No → Use warm cloth: dry and stimulate, observe activity, colour and breathing, wrap in new, warm cloth with chest exposed

Yes → Before first breath and before drying / stimulating – Suck / clean oro-pharynx under direct vision. Do not do deep, blind suction

Breathing should be started within 60 secs

Baby now active & taking breaths?

Yes → *Skin to skin with mother to keep warm and observe – initiate breast feeding*

No

A Check airway clear – if anything visible use suction to clear
Put head in neutral position

B Is baby breathing?

Yes → Keep Warm, Count rate of breathing and heart rate – give oxygen if continued respiratory distress

Poor or No Breathing / Gasping - Call for Help!

ABC OK

B Start ventilation Ensure *the chest rises in first breaths – continue at about 30 breaths / min.*
Check heart rate at 1 min

Continue with about 30 breaths / min, *Reassess ABC every 1-2 minutes, stop using bag when breathing and heart rate OK*

C Is the heart rate > 60bpm?

Yes

No → Give 1 EFFECTIVE breath for every 3 chest compressions for 1 min, *Reassess ABC every 1-2 minutes, stop compressions when HR >60 bpm and support breathing until OK*

Appendix II: Consent form.

This is a study to assess factors influencing health care workers in utilisation of neonatal resuscitation guidelines in Garissa P.G.H. the health care workers involved in the delivery process; maternity, labour ward and theatre department.

Participant Identification number: _____

Date:_____

Investigator: **Dr. Otido Samuel** (MB.Ch.B)

    Postgraduate student, department of Paediatrics,

    University of Nairobi.

Supervisors: **Prof Francis Ephraim Onyango**,

    Associate Professor Paediatrics and Child Health,

    University of Nairobi.

    Dr. Murila Florence,

    Senior lecturer, Paediatric and Child Health,

    University of Nairobi.

    Dr Kumar Rashmi,

    Lecturer, Paediatrics and Child Health,

    University of Nairobi.

Research procedure.

Hereby am requesting your support by participating in this research study. The purpose of this consent form is to provide you with the information you will need to help you decide whether to participate in the study. This process is called 'Informed Consent'. Please read this consent information carefully and ask any questions or seek clarification on any matter concerning the study with which you are uncertain.

The activities to be done.

a) I would like to find out about the neonatal resuscitation practices with regards to the neonatal resuscitation guidelines in your hospital.
b) I would like to observe how the health care workers carry out newborn resuscitation.
c) I would also like to find out the challenges the health workers face in providing effective neonatal resuscitation.

Participants:

They will be the health care workers working in labour ward and maternity theatre departments.

Process:

1. Resuscitation will be observed by the investigator to assess the participants practice and a record of the event will be recorded on an observation form.
2. A questionnaire will be given to you to get more information about yourself and the challenges you face in resuscitation.

Confidentiality:

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

The information obtained will not be used to report an individual worker's performance and the report will be put as a whole not individually.

Benefits:

There is no monetary benefit to participating in this research study.

You will receive education on neonatal resuscitation/ a refresher education based on the current guidelines which can sharpen your skills further. This will be done as a training at the end of the study.

The results obtained from the research study will be used to highlight the barriers you face as a health care worker and this can be used for policy change in your facility in discussion with your administrators.

Risks

There will be no risks involved in you participating in this study.

Refusal to participate will not jeopardise your position as a health care worker.

Voluntariness:

The study is purely on voluntary basis.

One is free to participate or withdraw from the study at any point.

Problems or Questions:

Any queries about the study can be enquired from the principal investigator, **Dr Samuel Otido** by mobile number **0722910156**.

<u>Consent form participants' statement:</u>

I _____ having received adequate information regarding the research study, risks and benefits hereby AGREE/ DISAGREE (cross out as appropriate) to voluntarily participate in the study. I also understand that I am free to withdraw from the study at any time. I have been given adequate opportunity to ask questions and seek clarification on the study and these have been addressed satisfactorily.

_____   Date: _____
Participant's Signature.

I _____ declare that I have adequately explained to the above participant, the study procedure, risks, benefits and given him/ her time to ask questions and clarification regarding the study. I have answered all the questions raised to the best of my ability.

Investigator's Signature _____   Date: _____

APPENDIX III. NEONATAL RESUSCITATION EQUIPMENT CHECK LIST FORM.

Hospital:

Service station: Labour ward [   ]   Theatre [   ]

Mark as appropriate - √ for present and **X** for absent; condition – Good or Bad

Item	Present	Absent	Condition
Resuscitation Guideline aides on the wall			
Resuscitaire			
Warm towels			
Functioning Ambubag (500mls)			
Resuscitation Masks sizes 0			
Resuscitation Mask size 1			
Vacuum Suction machine			
Disposable bulb pipettes			
Radiant heater			
Oxygen Source			
Functioning wall clock			
Adrenaline 1:1000			
Normal saline/ ringer's lactate fluids			
Dextrose fluid			

APPENDIX IV: <u>NEWBORN RESUSCITATION OBSERVATION FORM</u>

Date: _____

Observation Number [   ]   Initials: _____

Gender: M [ ]   F [ ]   Cadre: _____

Trained: Yes [ ]   No [ ]

Condition of the newborn at birth:

Date of birth: _____

Mother's initials: _____

Gestation in weeks: _____

Mode of delivery: _____

Term Baby	Yes [ ]	No	[ ]
Meconium	Yes [ ]	No	[ ]
Good muscle tone	Yes [ ]	No	[ ]
Immediate cry	Yes [ ]	No	[ ]

APGAR SCORE   1 Min: 5 Min: 10Min:

The following are the basic steps in newborn resuscitation to be followed as required by the National Guidelines.

Tick once as appropriate on column 1, 2 or 3 as achieved by the HCW.

KEY:

1. = Did not achieve action
2. = Partially achieved action
3. = Full achieved action

Item	1	2	3
Receives baby with warm towels, dries, stimulates and covers with a dry towel. (if no meconium)			
Notes time of delivery			
Attends to temperature management (uses warm resuscitaire, warm towels)			
Positions airway in neutral position			
If meconium present, identifies indication for endotracheal intubation (if applicable)			
If secretions present, lightly suctions the mouth then nose			
Assesses breathing (looks, listens and feels)			
Correctly identifies need for assisted ventilation - progressively reducing respiratory rate and heart rate			
Uses appropriate bag and mask size			
Provides assisted ventilation correctly (30-50 bpm)			
Checks for chest rise during assisted ventilation			

COMMENTS: other observation made or interventions undertaken by observer during resuscitation.

APPENDIX V: Health Care Worker Questionnaire Form

SECTION A: Encircle one answer and specify where indicated.

1. Serial Number.................. Initials................. Designation......................

2. Age
   a. Under 25 years
   b. 25 – 35 years
   c. Over 35 years
3. Sex
   a. Male
   b. Female

4. Which is your department?
   a. Maternity
   b. Maternity theatre
   c. New born unit
   d. Paediatric

5. Years of service in the unit?
   a. Under 2years   b. 2-5 years   c. Over 5 years

6. What is your formal training level?
   a. Clinical officer
   b. Medical officer (MB.Ch.B)
   c. Enrolled nurse (KEN/KECHN)
   d. Registered nurse (KRN/KRCHN)
   e. Other (specify) _____

7. What are your previous working place(s) before Garissa PGH?
   _____
   _____

8. Have you undergone post basic training?
   a. Advanced diploma
   b. Mmed paediatrics
   c. Mmed (other)
   d. Other (specify) _____

9. Are you aware of any paediatric life support course in Kenya that train newborn resuscitation?
   a. Yes   b. No

10. If yes which one(s)?
    a. European Paediatric Life Support (EPLS)
    b. Paediatric Life Support (American PLS)
    c. Emergency Triage Assessment And Treatment of Critically Ill Children Plus (ETAT+)
    d. Helping Babies Breathe (HBB)
    e. Other (specify)_____

11. Have you ever been trained in any Basic Paediatric Life support Course that train in newborn resuscitation?
    a. Yes   b. No

12. If yes, which one(s)
    a. European paediatric Life Support (EPLS)
    b. Paediatric advance life support (American PLS)
    c. Emergency Triage Assessment And Treatment of Critically Ill Children Plus (ETAT+)
    d. Helping Babies Breathe (HBB)
    e. Other (specify)_____

13. If no why?
    a. Have never heard of any course
    b. Cost of the course is expensive
    c. No time off work to attend the course
    d. Not interested

14. Which year did you attend the course? _____

   (N/A if not attended)

15. Have you ever attended a refresher course for any of the above?
      a. Yes   b. No

16. If yes, when? _____

17. Have you seen the National Neonatal Resuscitation Guidelines in your
   facility?
      a. Yes   b. No

18. If yes, where have you seen them? _____

19. Do you have a copy of the guidelines with you?
      a. Yes   b. No

20. Have you ever used the guidelines during resuscitation?
      a. Yes   b. No

SECTION B:

21. What are the factors that make it easier for you to utilise the neonatal resuscitation guidelines in your practice?

22. What are the factors that restrain you from utilising the neonatal resuscitation guidelines in your practice?