RELATIONSHIP BETWEEN UMBILICAL CORD CARE FACTORS AND OUTCOMES AMONG NEONATES ATTENDING MERU TEACHING AND REFERRAL HOSPITAL, MERU COUNTY, KENYA

BY

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

I dedicate this work to my mother and my sisters Lucy and Ann Hiuhu for educating me and encouraging me to aim higher and higher in my academics.

ACKNOWLEDGEMENT

I thank the almighty God for taking me this far in my life and for his wonderful blessings especially in my education. I acknowledge my supervisors Dr. George Ochieng Otieno and Dr. Florence Nafula Okwara for their wise guidance and input in this thesis. I also acknowledge my family for their unfailing support and encouragement throughout my studies. In a special way I thank my sister Ann Hiuhu for her financial support to undertake the research and for her constant encouragement. I also wish to acknowledge Lucy, MCH in Charge Meru Teaching and referral hospital for her support during the data collection period. Finally, I acknowledge Kenyatta University School of Public Health and Kenyatta University for giving me the opportunity to study and undertake the research. May God bless you all.

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ABBREVIATIONS

CI	Confidence interval
FGD	Focused Group Discussion
GBS	Group B Streptococcus
HCW	Health care worker
HOD	Head of department
IMCI	Integrated Management of Childhood Illnesses
IREC-KU	Institutional Research and Ethics Committee, Kenyatta University
KDHS	Kenya demographic and health Survey
KNBS	Kenya National Bureau of Statistics
KAP	Knowledge, Attitude and Practices
KI	Key informant
KII	Key Informant Interview
MTRH	Meru Teaching and Referral Hospital
MOH	Ministry of Health
MNT	Maternal and Neonatal Tetanus
NACOST	National Council for Science and Technology
NCK	Nursing Council of Kenya
NGO	Non-governmental Organisation
NMR	Neonatal Mortality Rate
NNT	Neonatal Tetanus
OPD	Outpatient Department
OR	Odds ratio
SBA	Skilled birth attendance
SCMOH	Sub-County Medical Officer of Health
SCPHN	Sub-County Public Health Nurse
TBA	Traditional Birth Attendant
UBA	Unskilled birth attendance
WHO	Worth Health Organisation

DEFINITION OF TERMS

Birth attendance: Refers to the assistance accorded to a mother during delivery and it is classified as either skilled or unskilled birth attendance. Skilled birth attendance refers to a delivery that is assisted by either a doctor, nurse or clinical officer while unskilled birth attendance refers to a delivery that is not assisted by either a doctor, nurse or a clinical officer.

Cord care factors: Encompasses all contributors to cord care outcome

Cord care practices: Encompasses all actions taken towards cord care.

Cord outcome: Refers to either a good or a poor cord outcome whereby a poor cord outcome refers to presence of neonatal omphalitis, prolonged cord separation, umbilical granuloma or neonatal tetanus while a good cord outcome refers to absence of these conditions.

Delayed cord separation: An umbilical cord that remains attached at the umbilicus beyond ten days.

Dry cord care: Refers to care of the cord whereby no chemical substance is applied to the cord until it falls off. Only cleaning with plain water is allowed.

Neonatal tetanus: A clinical presentation with the following signs and Symptoms occurring in sequence; history of normal suck and cry for the first two days of life; history of onset of illness

	after 3 days of age; history of inability to suck; stiffness and/or convulsions.
Omphalitis:	Infection of the umbilical cord characterized by one or more of the following signs: red or swollen umbilicus, swelling of skin around the umbilicus or pus discharge at umbilicus.
Umbilical granuloma:	Refers to friable wet pink tissue enlarged into a "mushroom-like" cherry-red mass measuring 3-10mm in diameter.

ABSTRACT

Global neonatal mortality stands at 22 per 1000 live births and about 41% of deaths in children under 5 years old occur in the neonatal period. In Kenya, neonatal mortality was 22 deaths per 1000 live births between the years 2004 and 2008 and 60 % of infant deaths in Kenya occur during the first month of life. Neonatal sepsis is the leading cause (15%) of all neonatal deaths worldwide. Umbilical infections are an important cause of neonatal morbidity and mortality in developing countries with incidence rates as high as 55-197 per 1000 live births in community-based studies. Poor cord care practices may predispose to poor cord outcomes. The findings of this study will be used to make relevant recommendations on cord care and will probably trigger other researchers to study the subject of cord care and eventually influence cord care policies, guidelines and practices targeting reduction in morbidity and mortality related to umbilical cord infections and other umbilical cord conditions (prolonged cord separation and umbilical granulomas). The broad objective of the study was to determine the relationship between cord care practices and cord outcomes among neonates attending Meru Teaching and Referral Hospital, Meru County, Kenya. The study population was 132 mothers/caregivers and baby pairs of neonates. A case control design was used to compare cord care factors (sterility of cord cutting tools, application of substances on the umbilicus, hand washing before substance application, method of bathing, skilled birth attendance and source of advice on cord care) and cord outcomes. A focused group discussion and three key informant interviews provided secondary data. Cases were neonates presenting with omphalitis, tetanus, prolonged cord separation and umbilical granuloma while controls were neonates without the aforementioned conditions. A sample of 132 neonates (66 cases and 66 controls) was recruited. Data was collected using interviewer administered questionnaires, Key Informant Interview guides and a Focus Group Discussion guide. Data was analyzed using SPSS 20.0. Logistic regression was used to predict the probability of the outcomes of interest relative to the independent variables. P values and confidence intervals were used as inferential statistics. Thematic content analysis was used in analysis of qualitative data. P value of <0.05 was considered significant. Dry cord care was associated with omphalitis ($p=0.000$, OR 15) but was protective for prolonged cord separation ($p=0.015$, OR 0.18). Home delivery, unskilled birth attendance and receiving advice on cord care from a non-health care worker were associated with neonatal omphalitis ($p=0.001$ for the three variables, OR 8.1 for home delivery and unskilled birth attendance and OR 7 for advice from a non-health care worker) and prolonged cord separation ($p=0.000$ for both variables, OR 13.6 and 10.8 respectively). Immersion bathing was associated with omphalitis ($p=0.001$, OR 5.7). From the FGD, it was reported that following most home deliveries, non-sterile cord cutting tools were often used and hand washing was not practiced before substance application to the umbilical cord. In conclusion, findings of the study indicate that dry cord care was significantly associated with neonatal omphalitis and use of antiseptics was significantly associated with delayed cord separation. Recommendations made include promotion of use of antiseptics for cord care and nationwide dissemination of current Ministry of Health Kenya guidelines on cord care to health care workers in order to harmonize cord care practice.

CHAPTER ONE INTRODUCTION

1.1 Background to the study

Global neonatal mortality stands at 22 per 1000 live births and about 41% of deaths in children under 5 years old occur in the neonatal period (WHO, 2013a). Neonatal mortality in Kenya stood at 22 deaths per 1000 live births by 2013 (KNBS, 2014) and sixty % of infant deaths in Kenya occur during the first month of life (KNBS, 2010). In a study carried out Kilifi District Hospital, Kenya, neonatal deaths comprised close to 60% of all inpatient deaths in children aged ≤ 5 years **(**Mwaniki *et al*, 2010). Among leading neonatal causes of death are pre-term birth, birth asphyxia, pneumonia, sepsis, neonatal tetanus and diarrhea.

Approximately 460 000 infants die annually in the developing world because of bacterial infections, of which umbilical cord infections are an important precursor (Ahmadpour-Kacho *et al*, 2006). Umbilical cord infections have much higher incidence rates 55-197 per 1000 live births in community-based studies (Ganatra & Zaidi, 2010) compared to developed countries (0.7%) (Pallazi & Brandt, 2008). In 2012, neonatal sepsis was estimated to cause 15% of all neonatal deaths worldwide (UNICEF, 2013). Neonatal tetanus causes more than a half million deaths worldwide (Rokotomalala *et al*, 2010).

In Kenya, about 38% of births occur outside health facilities and only 39% are conducted by skilled health professionals (KNBS, 2014). Traditional Birth Attendants (TBA) continue to play a vital role in delivery, assisting with 28 % of births (the same percentage as are assisted by nurses and midwives). Relatives and friends assist with 21

% of births, and for 7 % of births, the mothers do not receive any form of assistance (KNBS, 2010). With more than a third of deliveries in Kenya conducted by unskilled birth attendants (TBAs), it implies that a large percentage of neonates are exposed to unclean cord care at birth and during the neonatal period. Various cultural practices and beliefs are associated with care of the umbilical cord. Substances applied to the cord stump in various cultures include ash, oil, butter, spice pastes, herbs, and/or mud. These substances are often contaminated with bacteria and thus increase the risk of infection (Herlihy *et al*, 2013).

Good umbilical cord care is important in decreasing the incidence of omphalitis as well as neonatal tetanus (Rokotomalala *et al*, 2010). Various public health interventions have proven effective in decreasing the incidence and death from these infections (Rokotomalala *et al*, 2010). In Nepal, for example, the use of chlorhexidine decreased the incidence of omphalitis by 75% and neonatal mortality by 24% compared to dry cord care (Mullany *et al*, 2006a). Current clinical procedures for aseptic cord care are based on research from developed countries. This research does not provide a clear understanding of optimal cord care practices in resource limited settings (Ahmadpour-Kacho *et al*, 2006). There is not enough evidence to recommend the widespread use of topical antimicrobials on the cord stump (WHO, 2013). In Kenya, MOH gives varying recommendations on routine substance application on the umbilicus; application of 4% hibitane solution (MOH Kenya, 2013), dry cord care (MOH Kenya, 2012) and daily application of methylated spirit (NCK, 2009). Some studies report that various umbilical

cord antiseptics can delay umbilical cord separation (Rokotomalala *et al,* 2010, Pezzati *et al,* 2002) which in turn is a risk factor for omphalitis (Rokotomalala *et al,* 2010).

There is a dearth of information with regard to cord care practices in developing countries. A systematic review of randomized controlled trials and quasi-randomized controlled trials by Zupan and Garner (2004) did not find any studies from developing countries regarding cord care. In Kenya, only one study on cord care (a KAP study on cord care practices) was found during literature search. In a study done to assess the effect of topical applications including human milk, ethyl alcohol (96%), and silver sulfadiazine on umbilical cord separation time in newborn infants, the researchers concluded that further research in developed countries is required before advising on best cord care practices (Ahmadpour-Kacho *et al,* 2006).

1.2 Problem Statement

Two hundred and seventy four neonatal deaths out of twenty five thousand one hundred and eight live births were reported in Meru County in the year 2012. Despite the existence of guidelines on cord care, morbidity and mortality from such conditions as neonatal omphalitis, neonatal tetanus and neonatal sepsis remains high. Poor cord care practices are leading contributors (Rokotomalala *et al,* 2010). According to the Sub-County MOH (SCMOH) Imenti North Sub-county of Meru County, harmful cord care practices are prevalent in Meru County. Various efforts are currently in place to curb poor cord outcomes in Kenya. These include dissemination of guidelines on recommended cord care. However, these guidelines are not standardized. In Kenya, MOH gives varying recommendations on cord care; Application of 4% hibitane solution

(MOH Kenya, 2013) dry cord care (MOH Kenya, 2012) (National guidelines on Essential Newborn Care) and daily application of methylated spirit (NCK, 2009).

1.3 Justification

Best practices regarding cord care remains a controversial subject (Zupan & Garner, 2004) and recommendations on cord care by MOH Kenya remain unstandardized. Furthermore, current clinical procedures for aseptic cord care are based on research from developed countries. This research does not provide a clear understanding of optimal cord care practices especially in low resource settings where availability of water and proper sanitation is a challenge.

Anecdotal evidence as reported by the Nursing Officer in Charge of MNCH Department of MTRH indicated that unhygienic cord care practices were prevalent in Meru County. They further expounded that there were many neonates who presented with omphalitis at the IMCI clinic and of these children, most of them were usually delivered at home. In addition, cord care practice was still not harmonized in MTRH and this resulted in advocating for dry umbilical cord care by some nurses/clinicians and application of spirit on the umbilical cord by other nurses/clinicians. Mothers/care takers of neonates were used as the study population because they are involved in direct care of the newborn either as direct care givers or as supervisors of the care given to neonates including umbilical cord care.

The findings of this study were used to make relevant recommendations on cord care practices. This information will influence cord care policies, guidelines and practices targeting reduction in neonatal morbidity and mortality.

1.4 Research questions

1. What is the relationship between demographic characteristics and cord outcomes among neonates attending MTRH?
2. What is the relationship between umbilical cord care practices and umbilical cord outcomes among neonates attending MTRH?
3. What prevailing socio-cultural, economic and institutional factors influence cord care practices in Meru County?

1.5 Hypotheses

Null Hypothesis:

There is no association between umbilical cord care practices and umbilical cord outcomes among neonates attending Meru Teaching and Referral Hospital

Alternate hypothesis:

There is an association between umbilical cord care practices and umbilical cord outcomes among neonates attending Meru Teaching and Referral Hospital.

1.6 Objectives

1.6.1 Broad objective

The broad objective of the study was to determine the relationship between cord care practices and cord outcomes among neonates attending MTRH.

1.6.2 Specific objectives

The specific objectives of the study were to;

1. Assess the relationship between demographic characteristics and cord outcomes among neonates attending MTRH.
2. Assess the relationship between cord care practices and cord outcomes among neonates attending MTRH.
3. Identify socio-cultural and economic factors affecting cord care practices in Meru County.
4. Identify institutional factors affecting cord care practices in Meru County.

1.7 Limitations

Neonatal sepsis was not studied as a poor cord outcome. Another limitation was that there was only one case of neonatal tetanus during the study period and thus the association between the cord care factors and neonatal tetanus could not be determined.

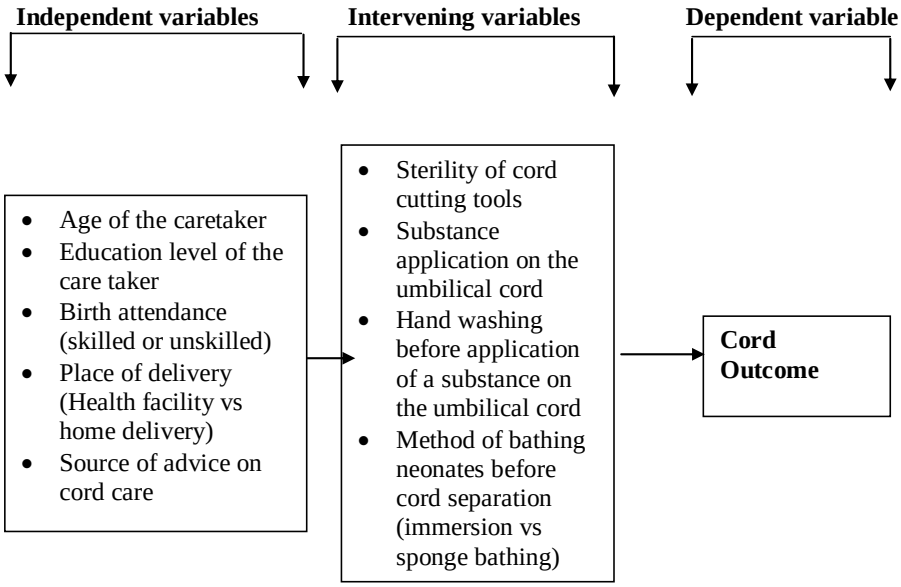
1.8 Conceptual framework

The conceptual framework displays the interaction between independent variables and the intervening variables in relation to the dependent variable (cord outcome). The independent variables included age of mother/caretaker (under 18 years old vs 18 years or older), education level of care taker (No formal education, primary/some primary education, secondary education, college education), place of birth (health facility delivery vs home delivery), attendance at birth (skilled vs unskilled birth attendance) and source of advice on cord care (health care worker vs other source). The intervening variables included sterility of cord cutting tools, application of substances on the umbilical cord, hand washing before application of substances on the umbilical cord and method of bathing neonates before cord separation. All the intervening variables were assumed to

have an influence on the causal relationship between the independent and the dependent variables.

Conceptual Framework

Comment [HE1]: Narration on the conceptual framework is provided above



Source: Solar & Irwin (2010)

Figure 1.1: Conceptual framework

CHAPTER TWO LITERATURE REVIEW

2.1 Introduction

This chapter provides an in depth review of literature on relationship between cord care practices and cord outcome. The chapter also provides a review of literature on influence of socio-cultural, economic and institutional factors on cord care practices and outcomes.

2.2 Effect of cord care practices on cord outcomes

The risk of omphalitis is increased by a number of maternal factors (prolonged rupture of membranes, maternal infection, amnionitis), factors at delivery (non-sterile or home delivery, inappropriate cord care); and neonatal factors (low birth weight, delayed cord separation, leukocyte adhesion deficiency, neonatal alloimmune neutropaenia) (Rokotomalala *et al,* 2010). The effect of topical cord care in preventing cord infection, illness, and death was assessed in a systematic review through a search of the Cochrane pregnancy and childbirth group trials register and the Cochrane central register of controlled trials. Randomized and quasi randomized trials, all from developed countries, compared trials of topical cord care with no topical care and compared different forms of care. Although the study concluded that bacterial colonization could be reduced with antimicrobial applications, the review did not find any evidence that antimicrobials are superior to dry care only in reducing cord infection (Zupan & Garner, 2004). However, in a study carried out in Nepal, the use of chlorhexidine decreased the incidence of omphalitis by 75% and its mortality by 24% compared to dry cord care (Mullany *et al*, 2006a).

Some studies report that various umbilical cord antiseptics can delay umbilical cord separation (Rokotomalala *et al, 2010*; Pezzati *et al,* 2002). For example, triple dye may prolong separation of the cord for up to 8 weeks (Rokotomalala *et al,* 2010). Pezzati and his colleagues evaluated the effect of 8 cord-care regimens for 1,535 healthy term infants on cord separation time and other secondary outcomes. The 8 cord-care regimens studied were: 70% alcohol, natural drying, salicylic sugar powder, triple dye, micronized green clay powder, colloid silver-benzyl-peroxide powder, neomycin-bacitracin powder, and 1% basic fuchsin. With regard to cord separation time, the best results were obtained with salicylic sugar powder (5.6 ± 2.3 days) and green clay powder (6.7 ± 2.2 days). Both forms of treatment proved to be more effective ($P < 0.05$) than the others. They reported that cleaning with alcohol increases the length of time from birth to cord separation but will not prevent colonization of the umbilical area (Pezzati *et al,* 2002). However, in a study comparing the effect of topical application of human milk, ethyl alcohol 96%, and silver sulfadiazine on umbilical cord separation time in newborn infants, the mean cord separation time in the human milk group was significantly shorter than the other three groups ($P < 0.001$) but the mean umbilical cord separation time in the alcohol group was not significantly different from that of control group (no treatment) (Ahmadpour-Kacho *et al,* 2006). Rasvi *et al* (2001) reported that infection of the umbilical cord can delay umbilical cord separation.

Unhygienic cord care practices can contribute to tetanus infections. In one health Programme among the Maasai people, the death rate from neonatal tetanus decreased from 82 per 1,000 in control groups to 0.75 per 1,000 in the intervention group. Part of

the success was in finding solutions such as cleaning the cord stump with milk (Meegan *et al*, 2001). The findings of a matched case control study identified that application of substances such as mustard oil, ghee or *surma* on the umbilical cord, delivery carried out at home, and an illiterate mother of a child are risk factors for NNT (Ahsan *et al*, 2004).

2.3 Socio-cultural and economic factors influencing cord care practices

Place of birth (either heath facility or home delivery) and presence or absence of a skilled birth attendant can directly influence the type of cord care that a neonate will receive. In Kenya, about 56% of births occur outside health facilities and only 44% are conducted by skilled health professionals. TBA continue to play a vital role in delivery, assisting with 28 percent of births (the same percentage as are assisted by nurses and midwives). Relatives and friends assist with 21 percent of births, and for 7 percent of births, mothers do not receive any form of assistance (KNBS, 2010). This could mean that a large proportion of neonates are exposed to unclean cord care at birth and during the neonatal period. During the 2008 KDHS in Kenya, the main reasons given by respondents for not delivering in a health facility were that it was too far away or that there was no transport to get to the facility, or both (42 percent) and that it was not necessary (21 percent). Also cited frequently was that the delivery occurred too fast to get to a facility (18 percent) and that it cost too much to deliver in a facility (17 percent). Very few women said they did not deliver in a facility because there were no female providers at the facility, it was not customary, their husband or family did not allow it, quality of service was poor, or the facility was not open (KNBS, 2010).

In a study conducted in Uganda by, participants said that they prefer to deliver in health units, but they usually do not do so due to the many barriers such as the expensive *maama kit*s required in health units for delivery, labour starting at night in absence of transportation and inaccessible health units that are often closed at night. Other barriers cited in the same study were health workers' rudeness, corrupt tendencies and absenteeism from work (Waiswa *et al*, 2008).

A wide variety of traditional practices and beliefs are associated with care of the umbilical cord. A study in Egypt by Tedbabe *et al* (2014) revealed that cultural beliefs and newborn care practices including cord care practices do not conform to recommended standards and recommends that local perspectives regarding newborn care practices should inform behaviour change messages targeting mothers, grandmothers, TBAs, other female family members and fathers. In many cultures it is strongly believed that the cord should not become dry, so the practice of applying substances to the cord stump aims to make the cord soft, allowing it to separate and heal easily and quickly (Hill *et al*, 2010). In a study carried out in Zambia, focus group participants reported an older practice that is no longer performed of tying the cord with *loozi*, a fibre from the bark of a tree (Herlihy *et al*, 2013).

Cost of cord care usually influences the kind of cord care practiced. In a study conducted in Zambia, nearly all respondents referred to the razor blade as the tool of choice due to its affordability (Herlihy *et al*, 2013). Cost of cord care may indirectly arise from cost

associated with health facility deliveries as reported by respondents in a study in Uganda (Waiswa *et al*, 2008).

2.4 Institutional factors influencing cord care practices

WHO (2013) recommends daily chlorhexidine (7.1% chlorhexidine digluconate aqueous solution or gel, delivering 4% chlorhexidine) application to the umbilical cord stump during the first week of life for newborns who are born at home in settings with high neonatal mortality (30 or more neonatal deaths per 1000 live births) and clean, dry cord care for new-borns born in health facilities, and at home in low neonatal mortality settings. According to WHO (2013b), use of chlorhexidine in these situations may be considered only to replace application of a harmful traditional substance, such as cow dung, to the cord stump. MOH Kenya recommendations vary with 4% chlorhexidine (hibitane) application recommend in MOH 216-Mother and Child booklet (MOH Kenya, 2013) (no specifications on frequency made), dry cord care in the national guidelines on Essential newborn care (MOH Kenya, 2012) (no specifications on frequency made) and daily application of methylated spirit on the cord stump (NCK, 2009).

Knowledge of HCW may influence the practice of cord care since HCW have a responsibility to give health education to mothers/care takers on post-natal care of the newborn. In addition, cord care is usually initiated by HCW for neonates born at health facilities in cord tying, cord cutting and substance application on the umbilical cord. In a study carried out in Zambia, there seemed to be little knowledge of dry cord care as an active clinical guideline by WHO and MOH Zambia (Herlihy *et al*, 2013).

2.5 Summary

Inappropriate cord care and home delivery are some of the factors that increase the risk of omphalitis. Infection of the umbilical cord can in turn delay umbilical cord separation (Rasvi *et al,* 2001). Some studies report that various umbilical cord antiseptics can also prolong the cord separation time (Rokotomalala *et al,* 2010, Pezzati *et al,* 2002). A wide variety of traditional practices and beliefs are associated with care of the umbilical cord. A study in Egypt by Tedbabe *et al* (2014) revealed that cultural beliefs and newborn care practices including cord care practices do not conform to recommended standards and recommends that local perspectives regarding newborn care practices should inform behaviour change messages targeting mothers, grandmothers, TBAs, other female family members and fathers. Cost of cord care usually influences the kind of cord care practiced. Cost of cord care may indirectly arise from cost associated with health facility deliveries as reported by respondents in a study in Uganda (Waiswa *et al,* 2008). Few studies were found on institutional factors affecting the practice of cord care. In one study carried out in Zambia, there was little knowledge of dry cord care as an active clinical guideline by WHO and MOH Zambia (Herlihy *et al,* 2013).

CHAPTER THREE MATERIALS AND METHODS

3.1 Research Design

The study adopted a hospital based frequency matched case-control design with a sample size of 132 (66 cases and 66 controls). The design was used to determine the causal relationship between umbilical cord care factors and umbilical cord outcomes among neonates attending MTRH. The design was appropriate because it was retrospective and allowed for use of relevant data and information from events regarding cord care factors that happened before the study period. An FGD and three KII were also incorporated into the study to expound on the qualitative aspects of the study i.e. socio-cultural, economic and institutional factors affecting cord care practices.

3.2 Variables

3.2.1 Dependent variable

The dependent variable was cord outcome. Cord outcome was categorized as either good or poor whereby poor cord outcome referred to presence of neonatal omphalitis, delayed cord separation, umbilical granuloma and/or neonatal tetanus, while good cord outcome referred to absence of the aforementioned conditions.

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3.2.2 Independent variables

Independent variables were; Age of mother/care taker (<18 years old vs ≥18 years old), birth attendance (skilled vs unskilled, place of delivery (health facility vs home delivery) and source of advice on cord care (HCW vs other source).

3.2.3 Intervening variables

Sterility of cord cutting tool, substance application on the umbilical cord, type of substance applied on the umbilical cord, hand washing before substance application on the umbilical cord and method of bathing neonates before umbilical cord separation (immersion vs sponge bathing).

3.3 Location of the Study

The study was carried out at MTRH in Meru County. MTRH is the largest referral hospital in the County and its catchment population covers the whole of Meru County. The FGD was conducted in Tigania East Sub-county of Meru County while the three KII were conducted in three randomly selected Sub-counties of Meru County. Meru County is has a population of 1,488,984 of whom 212,925 children under 5 years old (KNBS, 2009). The County has 458 health facilities (MOH, 2013). Available statistics indicate that the former Eastern province (in which Meru County is located) has a NMR of 31 deaths per 1000 live births (KDHS, 2008)

3.4 Study population

The study population comprised of all mothers/caregivers of neonates attending MTRH.

3.4.1 Inclusion criteria

For cases the inclusion criteria were; A term neonate (age 2-28 days), poor cord outcome (neonatal omphalitis, prolonged cord separation, umbilical granuloma or neonatal tetanus) and consent by mother/care taker to participate in the study. For the controls, the inclusion criteria were same as for the cases except for absence of a poor cord outcome. For the FGD participants, the inclusion criteria were; Any mother/caretaker of a term neonate who was aged less than six months having been with the neonate every day

throughout his/her neonatal period and willingness to participate. For the KI, the inclusion criteria were being a Sub-county Public Health Nurse and consent to participate.

3.4.2 Exclusion criteria

Comment [DO3]: We can improve on this . Unwillingness to participate cannot be an exclusion criteria. Exclusion criteria ordinarily targets those who are willing to participate in the study and meet the inclusion criteria but due to other factors/reasons are not able to participate

Lack of giving a written informed consent was an exclusion criteria.

3.5 Sampling Technique and Sample size calculation

3.5.1 Sample size

The sample size was determined using a table of sample size calculation (Schlesselman, 1982). This is presented in table 3.1.

Table 3.1: Sample size calculation

Ψ=3.0				
		P=0.2	P=0.5	P=0.8
J	1	66	60	127
	2	47	45	97
	3	41	39	87

Where

Ψ: Odds ratio, estimated at 3.

P: Prevalence of exposure in the control population, estimated at 20% (prorated from 16% reported prevalence in a study by Mullany et al (2009).

J: Number of controls per case, 1.

Thus a sample size of 132

For the FGD, purposive sampling was used in selection of 8 FGD participants. The FGD was conducted in Athing'a Sub-location of Tigania East Sub-county. The sub-location

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Participants for qualitative studies are either selected conveniently or purposively!

was purposively selected out of a total of 325 sub-locations in Meru County. The three KI were purposively selected from a pool of nine SCPHN.

3.5.2 Sampling Technique

All available eligible cases and controls meeting the inclusion criteria were included in the study until the desired sample size was achieved. Controls were frequency matched to cases on a 1:1 ratio. One FGD was conducted comprising of 8 women of reproductive age who had delivered a live child within the past year. One preceding year was factored so as to control for recall bias. 3 KII were conducted. The KI were purposively selected from a pool of SCPHN. The rationale was that SCPHN are directly responsible for dissemination of guidelines on cord care and supervision of implementation of these guidelines to health care workers in all health facilities in Meru County.

3.6 Pre-testing

The questionnaire was pretested on 10 women, who were not part of the study to assess the validity and reliability of the questionnaire and the Key informant Guide. This helped to remove ambiguities, test the understanding and refine questions in order to meet intended objectives.

3.6.1 Validity

The questionnaire was aligned to the objectives. It was reviewed by supervisors and colleagues to assess its validity in terms of content. Their views were used to refine the questionnaire. Pre-testing also helped improve validity.

3.6.2 Reliability

Reliability was enhanced through review by peers and supervisors to achieve inter-rater reliability. All questions were edited to remove ambiguities. All research assistants were trained on interview methods and examination methods.

3.7 Data collection techniques

Data was collected by the researcher together with research assistants at the IMCI clinic, of MTRH. Eligible neonates were physically examined by the researcher or by a qualified nurse. Their mother/caretaker was then taken through three structured questionnaire by either the researcher or the nurse. Qualitative data was collected by the FGD and three KII .This data provided qualitative information on socio-economic, socio-cultural and institutional factors related to cord care practices. The FGD comprised 8 respondents from Athing'a Sub-location of Meru County. Three KII were conducted. Information sought was on cultural beliefs and practices related to cord care, religious beliefs related to cord care, cost of cord care and influence of HCW, family, friends, neighbors, or other people on cord care practices. Institutional factors studied were: availability of guidelines on cord care, health messages on cord care and cord care practices in health facilities in Meru County.

3.8 Data analysis

Data was analyzed using SPSS version 20. Quantitative data was summarized as means and proportions and summarized in tables. Bivariate analysis was done to determine correlations using fisher's test. Logistic regression was done on factors that had shown statistical significance on bivariate analysis. Odds rations, confidence intervals and p values were displayed to determine strength of associations. Thematic content analysis

was used to analyze qualitative data. Transcripts were first read several times to get an overall picture and then meaningful units were condensed and categorized into broad themes and subthemes for ease of narration.

3.9 Logistical and ethical Considerations

Authority to carry out the research was sought from KU-ERC (Appendix 5) and NACOSTI (Appendix 6). A written informed consent form was completed and signed for every respondent (Appendix 1). Privacy and confidentiality were observed during data collection. Neonates with a poor cord outcome were treated and their mothers/caretakers advised on proper cord care as per the current national guidelines.

CHAPTER FOUR RESULTS

4.1 Demographic characteristics of the respondents

The mean age (in days) for the cases was 12.2 days while the mean age for controls was 13.7 days. Most of the neonates were female (70) while 62 neonates were male. The male to female ratio in the case group was 0.45:0.55 while the male to female ratio in the control group was 0.52: 0.48. All the mothers/caretakers were female. The age range in years for the mothers/caretakers was 17 years to 34 years. Among the cases, there were more mothers/caretakers aged less than 18years (10) compared to the control group (5).

4.2 Distribution of cord outcomes among the respondents

66 cases and 66 controls were recruited in the study. The distribution of the poor cord outcomes among the cases is shown in table 4.1.

Table 4.1 Distribution of poor cord outcomes among the cases

Poor cord outcome	**Number**	**Percentage**
Neonatal omphalitis	30	45
Prolonged cord separation	18	27
Umbilical granuloma	17	26
Neonatal tetanus	1	2
Total	66	100

4.3 Relationship between demographic characteristics and cord outcome

Demographic factors; Sex of the neonate, age of mother/caretaker and education level of mother/caretaker were not significantly associated with cord outcome. Table 4.2 displays the relationship between demographic characteristics and cord outcome.

Table 4.2 Relationship between demographic factors and cord outcome

Demographic characteristic		Cases N=66	Controls N=66	P	OR	95% CI for OR
Sex of neonate	Female	36	34	0.727	1.129	0.6-2.2
	Male	30	32			
Age of mother/caretaker	<18yrs	10	5	0.178	2.179	0.7-6.8
	≥18yrs	56	61			
Education level of mother/caretaker	Secondary	8	16	0.640	1.27	0.3-2.2
	Primary/some primary education	21	33	0.007	4.11	0.7-8.1
	College	37	17			

4.4 Relationship between cord care practices and cord outcome

Home delivery and SBA was protective for poor cord outcome. Dry cord care was significantly associated with poor cord outcome. Not washing hands before substance application on the umbilical cord was significantly associated with a poor cord outcome. However, the confidence interval for the odds ratio is too large (7.7-165) to allow for reliable conclusion on the strength of the association. Of the 22 cases who had a substance applied on their umbilicus, 21 of them had spirit applied and only one had another substance (Vaseline) applied. All the controls who had a substance applied on their cords (42) had spirit applied. Fishers test revealed no significant association between type of substance applied on the umbilical cord and cord outcome (P=0.394). Table 4.3 shows the relationship between cord care practices and cord outcome.

Table 4.3 Relationship between cord care practices and cord outcome

Cord care practices		**Cases N=66**	**Controls N=66**	**P value**	**OR**	**95% CI for OR**
Place of delivery	Health facility	35	61	0.032	0.32	0.103-0.902
	Home	31	5			
Birth attendance	SBA	35	61	0.032	0.32	0.103-0.902
	UBA	31	5			
Sterility of the cord cutting tool	Sterile	35	61	0.409	0.4	0.06-3
	Non sterile	31	5			
Substance application	Yes	22	42			
	No	44	24	0.001	7.1	2.2-23.4
Application of antiseptic	Yes	21	42			
	No	44	24	0.001	7	2.1-25
Hand washing before substance application	Yes	6	36			
	No	16	6	0.000	35.7	7.7-165
Method of bathing	Sponge bathing	16	36	0.519	0.59	0.1-3
	Immersion bathed	50	30			
Advice source	HCW	53	61	0.05	0.33	0.11-1
	Other	13	5			

4.4.1 Relationship between cord care practices and neonatal omphalitis

Dry cord care, home delivery, UBA, seeking advice from a non-HCW and not using sponge bathing were associated with neonatal omphalitis Table 4.4 shows the relationship between cord care practices and neonatal omphalitis.

Table 4.4 Relationship between cord care practices and neonatal omphalitis

Cord care practices		**Cases N=30**	**Controls N=66**	**P value**	**OR**	**95% CI for OR**
Place of delivery	Health facility	18	61			
	Home	12	5	0.000	8.1	2.5-26.1
Birth attendance	SBA	18	61			
	UBA	12	5	0.000	8.1	2.5-26.1
Sterility of cord cutting tool	Sterile	18	61			
	Not sterile	12	5	0.142	3.2	0.6-15
Application of antiseptics	Yes	7	42			
	No	23	24	0.000	15	3.9-57.5
Method of bathing	Sponge bathed	5	36			
	Immersion bathed	25	30	0.001	5.7	1.7-19
Advice source	HCW	19	61			
	Other	11	5	0.001	7	2-23

4.4.2 Relationship between cord care practices and delayed cord separation

The study revealed that dry cord care was protective for delayed cord separation. Home delivery, UBA, seeking advice from a non-HCW and use of non-sterile cord cutting tools were significantly associated with delayed cord separation. Table 4.5 shows the relationship between cord care practices and delayed cord separation. All the FGD participants reported to have used spirit for application on the umbilical cords of their neonates. One participant reported the following:

"Sisi tunapaka spirit kwa kitovu sababu inasaidia kitovu kukauka haraka"

When translated, the statement means that the community usually prefers to apply spirit on the umbilicus because it helps the umbilicus to dry faster.

Table 4.5 Relationship between cord care practices and delayed cord separation

Cord care practices		Cases N=18	Controls N=66	P value	OR	95% CI for OR
Place of delivery	Health facility	10	62			
	Home	8	4	0.000	13.6	3.4-53.6
Birth attendance	SBA	10	62			
	UBA	8	4	0.000	13.6	3.4-53.6
Sterility of cord cutting tool	Sterile	10	57			
	Not sterile	8	9	0.000	12.6	3-51
Application of an antiseptic	Yes	6	43			
	No	12	23	0.015	0.18	0.04-0.7
Method of bathing	Sponge bathing	5	36			
	Not sponge bathing	13	30	0.547	2.3	0.8-14
Advice source	HCW	11	62			
	Other	7	4	0.001	10.8	2-43

4.5 Influence of socio-cultural and socio-economic factors on cord care practices

Comment [HE5]: Quantitative data was omitted from the questionnaire due to lengthiness of the questionnaire.

Attendance of birth by skilled versus unskilled birth attendants and cord outcomes: Most of the FGD respondents (6 out of 8) correctly related SBA to higher chances of survival of the neonates. One participant reported the following in Kiswahili language:

"Kujufungulia hospitalini husaidia sana kwa sababu motto akiwa na shida yoyote ya kiafwa anashugulikiwas na watu wenye ujuzi ili asije akafa"

Translated, the statement means that delivering at a health facility is good because in case the baby has a health problem, the problem is dealt with by experts thus saving the life of the baby. However, 2 out of the 8 respondents did not think that SBA was better than UBA in relation to survival of the neonate.

Cord tying and cutting instruments: The following tools were reported by the FGD participants as used in cord tying following a home delivery: Sisal strings from sisal gunny bags**,** nylon strings from nylon gunny bags and **s**trings from old pieces of clothes.

Razor blades and kitchen knives were reported by the FGD participants as used in cord cutting following a home delivery. All the participants reported that the cord tying tools are not usually cleaned before use. As for the cord cutting tools used during a home delivery, it was reported that kitchen knives are usually cleaned with un-boiled water before cord cutting as supported by the following statement:

"Kisu chenye hutumika kukata kitovu huwa kimeoshwa na maji kama kawaida yenye haijachemshwa"

Translated, the statement mean that the knife used to cut the cord is usually cleaned with unboiled water. The following was also reported by one of the participants:

"*Wamama wenye hufanya hiyo kazi ya kusaidia wengine kujifungua kawaida huwa wanatumia wembe imeshaa tumika kukata kitovu cha mtoto"*

Translated, the statement means that TBAs usually cut the umbilical cord with razorblades that have already been used before.

Substance application on the umbilical cord: All the participants including those who had delivered at home reported to have used spirit for routine application on the umbilical cords. One participant reported the following:

"Sisi tunapaka spirit kwa kitovu sababu inasaidia kitovu kukaua haraka"

When translated, the statement means that the community usually prefers to apply spirit on the umbilicus because it helps the umbilicus to dry faster. None of the participants had ever heard of chlorhexidine as a substance used in topical umbilical cord care.

Method of bathing neonates before cord separation: 6 out of the 8 FGD participants reported that they use/used sponge bathing to bath the neonates when the weather is cold but when the weather is hot, they used/use immersion bathing as supported by the following statement:

"Kukiwa na baridi, huwa tunapanguza watoto lakini kukiwa na jua, tunawaosha kwa karai"

Only 2 of the FGD participants reported strictly using sponge bathing to clean their babies before cord separation.

Cultural beliefs and cord outcomes: Traditional beliefs reported were cord tying after cord cutting and routine application of substances that were neither antiseptics nor antibiotics. One participant reported that because of traditional beliefs, some women in their locality tie the remnant of the umbilical cord with a string until it falls off. These strings are usually not cleaned before tying. Substances reported as used in topical application to the umbilical cord were *vaseline* petroleum jelly and boiled water. One participant reported that sometimes ago, women used to apply cow dung from a calf on the umbilical cords of neonates to fasten the process of cord separation.

4.6 Influence of Institutional factors on cord care practices

Knowledge on cord care guidelines: One KI reported using the MOH Kenya Mother and child booklet, 2013 version as the basis for her recommendation on cord care. The other two KIs were not sure about the guidelines that informed their recommendations on cord care. None of the KI was familiar with recommendations on cord care as per the

MOH Kenya Essential new-born Care guideline, 2012 nor the WHO guidelines on post-natal care of the mother and new-born 2013.

Sterility of cord tying and cord cutting tools: All the three KI reported that deliveries at health facilities are usually conducted using sterile equipment's including cord tying and cord cutting tools. According to the KI, all the facilities used cord clamps for cord tying and sterile surgical blades for cord cutting.

Substance application on the Umbilical cord: All the three KI said that they recommended substance application on the umbilical cord stumps. However, their recommendations varied with regard to the substance recommended for application. Only one KI recommended 4% hibitane. The other two KI reported that they recommend saline solution for topical applications on the umbilical cord stumps. The KI who reported recommending 4% hibitane was not sure about the frequency of substance application. However, the two KI who recommended application of saline solution on the umbilical cord stumps recommended application of saline twice per day.

CHAPTER FIVE DISCUSSION

5.1 Introduction

This chapter explains and discusses findings of the study including associations between cord care factors (Birth attendance, sterility of cord cutting tools, substance application on the umbilical cord, type of substance applied, hand washing before substance application, method of bathing neonates and source of advice on cord care) and cord outcome, associations between cord care practices and specific cord outcomes, sociocultural factors affecting cord care practices and institutional factors affecting cord care practices.

5.2 Relationship between demographic characteristics and cord outcomes

There was no significant association between demographic characteristics and cord outcome. There is a dearth of information with regard to relationship between demographic characteristics and cord outcomes.

5.2 Relationship between cord care practices and cord outcomes

Health facility delivery, SBA and receiving advice on cord care from a HCW were protective for poor cord outcome (OR=0.32, 0.32 and 0.33 respectively). Dry cord care was associated with poor cord outcome (P= 0.001, OR 7.1). Not washing hands before routine substance application on the umbilical cord was associated with poor cord outcome (P=0.000, OR=35.7). However, the confidence interval for OR in this association is too large (7.7- 165) to allow for conclusion on the strength of that association. This is mostly likely a result of a small sample size. Health facility delivery and SBA are more likely associated with clean delivery practices (WHO 2013) and

advice on cord care that would predispose to a good cord outcome since trained health professionals are involved in SBA.

Dry cord care was seven times more likely associated with a poor cord outcome than routine substance application (OR=7.1, CI for OR=2.2-23.4). This is probably because of microbial colonization of the umbilicus that eventually leads to infection. WHO (2013) recommends routine application of 4% chlorhexidine for the first one week of life on the cords of neonates born at home in countries with high neonatal mortality (more than 30 neonatal deaths per 1000 live births) and dry cord care for neonates born in a health facility. MOH Kenya in the Mother and Child booklet (2013) recommends application of 4% chlorhexidine on the cords of all neonates regardless of the place of birth but no specifications on frequency and length of application are provided. Despite the recommendation of hibitane (chlorhexidine) by WHO and MOH Kenya as the preferred substance for application on the umbilical cords of newborns, none of the participating neonates had it applied on their cords. Spirit was applied on 98% of neonates who had a substance applied on their cord stumps while petroleum jelly was applied on 2% of neonates who had a substance applied on their cords. All the FGD participants also reported to have used spirit for application on the umbilical cords of their children when they were neonates. Fishers test revealed no significant association between types of substance applied and cord outcome (P=0.394).

Most of the FGD participants (6 out of 8) reported that SBA accords higher chances of survival to neonates as compared to UBA. Kitchen knives were reported by the FGD

participants as the tools most commonly used in cord cutting following home delivery. One FGD participant reported that TBAs use non sterile razor blades to cut the umbilical cord following home delivery. All the KI reported that following skilled deliveries at health facilities, the umbilical cord is always cut using a sterile cord cutting tool.

Sponge bathing was protective for poor cord outcome compared to immersion bathing (OR=0.59, CI 0.1-3). Most of the FGD participants (6 out of 8) reported that the weather is what determines whether neonates will be sponge bathed or immersed in a basin.

In a study comparing tub bathing (a method of immersion bathing) and sponge bathing there was no differences in cord healing scores (Bryaton *et al,* 2004). WHO and MOH have not made any recommendations on method of bathing the neonate with regard to cord care.

5.2.1 Relationship between cord care practices and neonatal omphalitis

Home delivery, UBA and seeking advice from a non-HCW were associated with neonatal omphalitis (P=0.00, OR=8.1, P=0.00, OR=8.1 and P=0.001, OR=7 respectively). Similarly dry cord care and not using sponge bathing were associated with neonatal omphalitis (P=0.00, OR=15 and P=0.001, OR= 5.7 respectively). A study conducted in Nigeria revealed that unclean delivery practices contribute to contamination of the umbilical cord and increased risk of cord infection (Akani *et al,* 2004).

Neonates who had dry cord care were 15 times more likely to develop neonatal omphalitis than neonates who received routine substance application (OR=15, CI for OR= 3.9-57.5). Failure to apply an antimicrobial substance on the umbilicus especially

following home deliveries is likely to result in bacterial colonization and consequent infection of the umbilicus (WHO 2013). These findings concur with those of Janssen et al (2003) in a study whereby infants who had dry cord care were significantly more likely to have umbilical cord infection compared to infants who had triple dye/alcohol applied on their umbilical cords. In a study in southern Nepal, use of chlorhexidine (an antiseptic) decreased the incidence of omphalitis by 75% (Mullany *et al*, 2006). However the findings differ from a study by Shoaeib *et al* (2005) in which the incidence of cord infection was significantly lower among newborns that had dry cord care compared to neonates who had alcohol applied to their cords. Zupan and Garner (2004) through a systematic review, failed to find evidence that antimicrobials are superior to dry cord care only in reducing umbilical infection. They however found evidence of reduced bacterial colonization with antiseptic use. In a systematic review involving Five Randomized Controlled Trials, four studies reported the incidence of omphalitis following chlorhexidine application to the cord. The pooled effect was a 30% reduction (95% CI 20% to 38%) in the rate of omphalitis (WHO 2013).

Neonates who were not consistently bathed using sponge bathing (i.e. were bathed using immersion method or sometimes sponge bathing) were 6 times more likely to have neonatal omphalitis than neonates who were consistently bathed through sponge bathing (OR=5.77, CI for OR=1.7-19). There are no recent studies comparing method of bathing with occurrence of neonatal omphalitis. MOH Kenya and WHO have not recommended any particular method of bathing neonates with regard to cord care.

5.2.2 Relationship between cord care practices and delayed cord separation

Findings indicate that Home delivery, UBA and seeking advice from a non-HCW were associated with delayed cord separation (P= 0.00, OR 13.6, and P= 0.001, OR=10.8 respectively). Similarly, use of non-sterile cord cutting tools was associated with delayed cord separation (P=0.00, OR 12.6). However, the CI for OR is too larger (3-51) to allow for solid conclusion on the strength of that association. Dry cord care was protective for prolonged cord separation (P=0.015, OR 0.18). All the FGD participants including those who had delivered at home reported to have used spirit for routine application on the umbilical cords. One participant reported that the spirit is often applied on the umbilical cord to fasten the healing process. This finding concurs with studies by Rokotomalala *et al* (2010), Ahmadpour-Kacho *et al* (2006), Shoeib *et al* (2005) and Zupan & Garner (2004) where it was reported that various umbilical cord antiseptics prolong the umbilical cord separation time. For example, triple dye may prolong separation of the cord for up to 8 weeks (Rokotomalala *et al*, 2010). In study by Ahmadpour-Kacho *et al* (2006), comparing the effect of topical application of human milk, ethyl alcohol 96% and silver sulfadiazine on umbilical cord separation time in new born infants, it was reported that the mean cord separation time in the human milk group was significantly shorter than the other three groups ($p<0.001$). Shoaeib *et al* (2005) reported that the mean cord separation time was longer among neonates who had alcohol applied on their cords as compared to neonates who had received dry cord care.

Neonates who were bathed through immersion and those who were not consistently bathed through sponge bathing were twice more likely to have prolonged cord separation

than neonates who were consistently bathed through sponge bathing (OR=2.3, CI for OR=0.8-14). The author found only one study on association between method of bathing and prolonged cord separation. In the study comparing Tub bathing (a method of immersion bathing) and sponge bathing, no differences in cord healing scores were found (Bryaton *et al,* 2004).

5.3 Influence of socio-cultural and economic factors on cord care practices

Most of the FGD participants (6) were able to correctly relate SBA to higher chances of survival of the neonates. However, two of the women did not think that SBA was better than UBA in relation to survival of the neonate.

All the tools reported as used for cord tying following home deliveries are usually non sterile. Similarly, most tools used in cutting the umbilical cord following home deliveries are usually non sterile. However, a study conducted in Uganda reported that for both facility and home births, the umbilical cord is usually cut with some form of 'sterile' equipment, usually a new razorblade (Waiswa *et al,* 2008).

All the participants including those who had delivered at home reported to have used spirit for routine application on the umbilical cords. They claimed that the cord separated faster if spirit was applied than if spirit as not applied. None of the participants had ever heard of chlorhexidine as a substance used in topical umbilical cord care. In many cultures it is strongly believed that the cord should not become dry, so the practice of applying substances to the cord stump aims to make the cord soft, allowing it to separate and heal easily and quickly (Hill *et al,* 2010). In a study carried out in Zambia, FGD

participants reported an older practice that is no longer performed of tying the cord with *loozi*, a fibre from the bark of a tree (Herlihy *et al*, 2013). Waiswa *et al* (2008) in a study conducted in Uganda reported that cord-care practices including application of substances such as baby powder, spirit, herbs, soapy water, and salty water are believed to help the cord to dry/heal faster to enable women get back to their routine chores early. The fast healing of the cord is also believed to stop the pains that women feel following birth of a new-born baby.

Most of the FGD participants (6 out of 8) reported that when it's cold, they use/used sponge bathing to bath the neonates but when the weather is hot, they immerse/immersed their babies in a basin and bath them. Only 2 women reported strictly using sponge bathing to clean their babies before cord separation. No studies were found on socio-cultural factors influencing method of bathing with regard to cord outcome.

Traditional beliefs reported were cord tying after cord cutting and routine application of cow dung on the umbilical cord. A study conducted in Egypt revealed that cultural beliefs and newborn care practices including cord care practices do not conform to recommended standards (Tedbabe *et al,* 2014).

5.4 Influence of institutional factors on cord care.

Only one out of the three KI was familiar with current recommendations on cord care. In a study carried out in Zambia, health care workers had little knowledge of dry cord care as an active clinical guideline by WHO and MOH Zambia (Herlihy *et al*, 2013). All the KIs reported that deliveries at health facilities are usually conducted using sterile

equipment's including cord tying and cord cutting tools. All the KIs reported that they recommended substance application on the umbilical cord stumps. However, their recommendations varied with regard to the substance recommended for application.

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

1. Demographic factors (sex of the neonate, age of mother/caretaker and education level of caretaker) were not significantly associated with cord outcome.
2. Dry cord care was significantly associated with neonatal omphalitis. Application of antiseptics on the umbilical cord was significantly associated with delayed cord separation but was protective for neonatal omphalitis. Unskilled birth attendance, home delivery and receiving advice on cord care from a non-health care worker were significantly associated with neonatal omphalitis and delayed cord separation.
3. The study indicated that there were prevailing socio-cultural practices on cord care that contradict national and international recommendations on cord care practice including application of petroleum jelly on the umbilical cord and use of non-sterile cord cutting tools.
4. Findings of the study indicate a gap in knowledge of HCW with regard to national and international guidelines on cord care.

6.2 Recommendations

1. MOH Kenya should promote use of antiseptics for cord care as the study has indicated that use of antiseptics is protective for neonatal omphalitis.
2. MOH Kenya should conduct nationwide dissemination of current guidelines on cord care to health care workers especially in peripheral health facilities in order to harmonize cord care practice.

6.3 Further research

1. Randomized controlled trials on association between application of antiseptics on the umbilical cord versus dry cord care and neonatal omphalitis.
2. A survey of health worker knowledge, beliefs and perceptions on cord care.

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APPENDICES

Appendix 1: informed consent form for research

Title of Project:
Relationship between cord care factors and cord outcomes among neonates attending Meru Teaching and Referral Hospital
Principal Investigator: Esther Hiuhu-Master of Public Health Student, Kenyatta University

Purpose of the Study: The purpose of this research study is to find out how cord care practices affect cord outcomes among neonates attending Meru Level 5 Hospital. The findings of this study will shed light on the burden of disease posed by poor cord care practices in the catchment area of Meru Level Five Hospital and also be used to make recommendations to the Ministry of Health on policy and practice of cord care in Kenya.
Procedures to be followed: You will be asked to answer some questions regarding the practice of cord care and factors influencing cord care practices.
Duration: It will take about 15 minutes to complete the survey.
Statement of Confidentiality: Your participation in this research is confidential. Your name will not be recorded on the questionnaire. The data obtained will be treated with utmost confidentiality and only the researcher will have access to it. In the event of a publication or presentation resulting from the research, no personally identifiable information will be shared.
Right to Ask Questions: Please contact the researcher on 0721848320 in case of any questions after the questionnaire session is over.
Benefits of participation: All participants will benefit from health education regarding infant feeding, immunization and postnatal care.
Voluntary Participation: Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer.
If you agree to take part in this research study and the information outlined above, please sign your name and indicate the date below.

_____
Participant Signature or thumbprint

_____
Date

_____
Name and signature of person Obtaining Consent

_____

Date

Appendix 2: Questionnaire

Introduction

This questionnaire is part of a study on the relationship between cord care factors and cord outcomes among neonates attending Meru Teaching and Referral Hospital. The study is being conducted in partial fulfillment of the requirements for the attainment of a Master of Public Health degree at Kenyatta University by the researcher.

Date of data collection_____

Serial No.	Stem	Possible response	Code	Response	Skip pattern: Go to question:
1	Age of the care taker in yrs.	< 18	1		2
		>18	2		
2	Sex of the caretaker	Male	1		3
		Female	2		
3	Relationship of the respondent to the neonate	Mother	1		4
		Father	2		
		Other	3		
4	Residence of the neonate (district)	Imenti North	1		5
		Imenti South	2		
		Imenti Central	3		
		Tigania East	4		
		Tigania West	5		
		Igembe North	6		
		IIgembe South	7		
		Other (specify)			
5	Occupation of respondent	Specify			6
6	Level of education	No formal education	1		7
		Some primary school education	2		
		Completed pry school but not completed secondary school education	3		
		Completed secondary school education by not completed	4		

		college/university education			
		In college or university/completed college/university	5		
7	Age of neonate in days	Specify			8
8	Gestation of the neonate at birth	Pre-term	1		If answer is 1, move to the next respondent. If answer is 2, go to q9
		Term	2		
9	Sex of the neonate	Male	1		10
		Female	2		
10	Has the neonate had any of the following symptoms? Tick	Reddening of the umbilicus	1		11
		Pus at the umbiluicus	2		
		Swelling of the umbilicus	3		
11	If yes in any response in 10 above, when did the symptoms appear?	Reddening of the umbilicus			12
		Pus at the umbilicus			
		Swelling of the umbilicus			
12	Does the neonate have a diagnosis of neonatal omphalitis	Yes	1		13
		No	2		
13	Has the baby had the following symptoms occurring in sequence: History of inability to suck Stiffness and/or Convulsions	Yes	1		14
		No	2		
14	Does the neonate have a diagnosis of neonatal tetanus	Yes	1		15
		No	2		
15	Is the baby's cord still attached for a baby who is >10 days old?	Yes	1		16
		No	2		
16	Does the baby have an umbilical granuloma?	Yes	1		17
		No	2		

	(Check)				
17	Where was the baby born?	Health facility	1		If answer is 2 or other, go to q 18. If answer is 1, go19
		Home	2		
		Other (Specify)	N/A		
		Don't Know	4		
18	Was the neonate's delivery attended by a skilled birth attendant?	Yes	1		19
		No	2		
		Don't Know	3		
19	If the neonate was born at home, what was used to tie the cord	Specify	N/A		20
		Don't know	1		
20	If the neonate was born at home, was the cord tying item dirty, clean or sterile?	Sterile	1		21
		Clean	2		
		Dirty	3		
		Don't know	4		
21	If the neonate was born at home, what was used to cut the cord	Specify	N/A		22
		Don't know	1		
22	If the neonate was born at home, was the cord cutting item dirty, clean or sterile?	Sterile	1		23
		Clean	2		
		Dirty	3		
		Don't know	4		
23	If the neonate was born at home, did the person who tied the cord wash hands before tying it?	Yes	1		24
		No	2		
		Don't know	3		
24	If the neonate was born at home, did the person who cut the cord wash hands before cutting it?	Yes	1		25
		No	2		
		Don't know	3		
		No	2		
		Don't know	3		
		Don't know			
25	Has any substance been applied to the umbilicus	Yes			If yes, go to 29. If no, go to 34
		No			
		Don't			
26	If yes in 28 above, what was applied?	Hibitane	1		30
		Spirit	2		
		Swabbing with boiled water	3		
		Swabbing with non boiled water	3		
		Cow dung	4		

		Other (Specify)			
27	If yes in 28 above, how many times was the substance applied per day	3 times per day	1		31
		Other (Specify)	2		
		Not consistently	3		
		Don't know	4		
28	If yes in 28 above, did the person(s) who applied the substance wash hands before the procedure?	Yes, always	1		33
		Yes but not always	2		
		No	3		
		Don't know	4		
29	If yes in 32 above, was the hand washing done with soap?	Yes, always	1		34
		Yes but not always	2		
		No	3		
		Don't know	4		
30	Has the baby been bathed since it was born?	Yes	1		If yes, go to 31, if no, go to 32
		No	2		
31	If yes in 30 above, which method was used?	Immersion in water	1		37
		Sponge bathing	2		
		Both	3		
		Other	4		
		Don't know	5		
32	Have you received any advice or health education regarding cord care?	Yes	1		If yes, go to 38, if no, go to 40
		No	2		
33	If yes in 37 above, who gave the advice/health education?	A health professional	1		39
		A family member	2		
		A neighbor	3		
		A friend	4		
		Other	5		
34	If yes in 37 above, state the advice/heath education that you were given.	Specify	N/A		40
35	Did the mother of the neonate suffer from a genito-urinary tract infection during the last two weeks of pregnancy?	Yes	1		If yes, go to 41, if no, end the session.
		No	2		
		Don't know	3		
36	If yes in 40 above, what was the diagnosis	Specify	N/A		42
		Don't know	1		

37	If yes in 40 above, what were the signs and symptoms?	Pain on urination	1		End of questionnaire
		Yellow discharge per vagina	2		
		Green discharge per vagina	3		
		Smelly discharge per vagina	4		
		Other (specify)	N/A)		

Appendix 3: Key Informant Interview Guide

This key informant interview guide is part of a proposal in a study on the relationship between cord care practices and poor cord outcomes among neonates attending Meru Level Five Hospital. The study is being carried out in partial fulfillment of the requirements for the attainment of a Master of Public Health degree at Kenyatta University. The information provided in this study will be treated with utmost confidentiality. The respondent is free to withdraw from the study at any point during the interview.

Designation of the key informant_____

1 What is usually used to tie the umbilical cords of babies born in the health facilities/hospital?
2 With regard to question 1 above, are the tools used to tie the umbilical cords usually sterile?
3 What is usually used to cut the cord the umbilical cords of babies born in the health facilities/hospital?
4 With regard to question 3 above, are the tools used to cut the umbilical cords usually sterile?
5 What recommendations are mothers/caretakers given with regard to topical substance application on the umbilical cords?
6 What are the current MOH guidelines on cord care?
7 What guidelines are followed with regard to cord care in the health facilities?

Appendix 4: FGD Guide

This FGD guide is part of a proposal in a study on the role of cord care practices in determining poor cord outcomes among neonates attending Meru Level Five Hospital. The study is being carried out in partial fulfillment of the requirements for the attainment of a Master of Public Health degree at Kenyatta University. The information provided in this study will be treated with utmost confidentiality. The respondent is free to withdraw from the study at any point during the interview.

Number of participants_____

1. What is the importance (in relation to the neonate) of delivering at a health facility
2. What is the importance (with regard to the neonate) of having a delivery conducted by a skilled birth attendant?
3. Why do some women prefer to deliver at home
4. Why do some women prefer to have their births attended by a TBA?
5. What instrument(s) are used to tie the umbilical cord of a baby who is delivered at home?
6. What tools are used to cut the umbilical cord of a baby who is delivered at home?
7. Are the tools used to tie and cut the cord at home usually cleaned or boiled before use?
8. Are there any substances that are applied on the cords of newborns. If yes, list all the ones you have heard of.
9. How are newborns bathed in the at home?
10. Do you know of any cultural beliefs associated with cord care?

Appendix 5: Approval for Research, KU ERC

Comment [DO6]: Attach

Appendix 5: Approval for Research, KU ERC

KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE

Fax: 8711242/8711575
Email: kuerc.chairman@ku.ac.ke
kuerc.secretary@ku.ac.ke
Website: www.ku.ac.ke

P. O. Box 43844
Nairobi, 00100
Tel: 8710901/12

Our Ref: KU/R/COMM/51/164

Date: May 8th, 2013

Hiuhu Esther Mumbi
School of Public Health
Kenyatta University
P. O. Box 43844, Nairobi.

Dear Ms. Hiuhu,

APPLICATION NUMBER PKU/114/I100 OF 2013 – 'RELATIONSHIP BETWEEN UMBILICAL CORD CARE FACTORS AND UMBILICAL CORD OUTCOMES AMONG NEONATES ATTENDING MERU LEVEL FIVE HOSPITAL'.

1. IDENTIFICATION OF PROTOCOL

The application before the committee is with a research topic, 'Relationship between Umbilical Cord Care Factors and Umbilical Cord Outcomes Among Neonates Attending Meru Level Five Hospital'. received on *5th April 2013.*

2. APPLICANT

Hiuhu Esther Mumbi
School of Public Health
Kenyatta University
P. O. Box 43844, Nairobi.

3. SITE

Meru Level Five Hospital, Kenya

4. DECISION

The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (section 7.2.1.3) and the Kenyatta University Ethics Review Committee Guidelines, and is of the view that against the following elements of review,

(i) Scientific design and conduct of study,
(ii) Recruitment of research participant,
(iii) Care and protection of research participants,
(iv) Protection of research participant's confidentiality,
(v) Informed consent process,
(vi) Community considerations.

AND APPROVED and that the research may Proceed ON CONDITION that you incorporate its advise below.

5. ADVICE/CONDITIONS

With respect to matters of scientific design and conduct of study and recruitment of research participants, the following specific conditions must be fulfilled in writing before an approval can be granted. The manner of fulfilling these should be outlined and submitted to KU-ERC as soon as possible.

1. The benefits to the participant should be indicated.
2. The consent form should be attached. It should be written not verbal.
3. Revise the work plan.

When replying, kindly quote the application number above.

If you accept the decision reached and advice and conditions given please sign in the space provided below and return to KU-ERC a copy of the letter.

KENYATTA UNIVERSITY OFFICE OF THE CHAIRMAN P.O. ETHICS REVIEW COMMITTEE NAIROBI
08 MAY 2013

PROF. NICHOLAS K. BROWN
CHAIRMAN: KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE

I ESTHER MUMBI HIUHU accept the advice given and will fulfill the conditions therein.

Signature ..... Dated this day 17 of JUNE 2013.

cc. Vice-Chancellor
Director: Institute for Research Science and Technology

Appendix 6: Approval for Research, NACOSTI

Comment [DO7]: Attach

Appendix 6: Approval for Research, NACOST

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471, 2241349, 254-020-2673550
Mobile: 0713 788 787 , 0735 404 245
Fax: 254-020-2213215
When replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: NCST/RCD/12A/013/109 Date: 15th July 2013

Esther Mumbi Hiuhu
Kenyatta University
P.O. Box 43844-00100
Nairobi.

RE: RESEARCH AUTHORIZATION

Following your application dated 8th July, 2013 for authority to carry out research on *"Relationship between umbilical cord care factors and umbilical cord outcomes among neonates attending Meru Level Five Hospital."* I am pleased to inform you that you have been authorized to undertake research in Imenti North District for a period ending 30th September, 2013.

You are advised to report to the District Commissioner, District Education Officer and Medical Officer of Health, Imenti North District before embarking on the research project.

On completion of the research, you are expected to submit two hard copies and one soft copy in pdf of the research report/thesis to our office.

DR. M. K. RUGUTT, PhD, HSC.
DEPUTY COUNCIL SECRETARY

Copy to:

The District Commissioner
The District Education Officer
The Medical Officer of Health
Imenti North District.

Appendix 7: Map of study area (Meru County, Kenya)