ASSESSMENT OF DETERMINANTS OF UMBILICAL CORD INFECTION AMONG NEWBORNS AT PUMWANI MATERNITY HOSPITAL

By

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DECLARATION

I, Lucy Kinanu Joseph, declare that this is my original work and has not been submitted to any other institution for similar purposes.

Signature…… Date…….

CERTIFICATE OF APPROVAL

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DEDICATION

I dedicate this work to my loving husband Joseph Maina Maguta and my children Dorcas and Noel for encouragement, financial and moral support. Thank you Joseph for keeping up with an absent wife. Dorcas and Noel thank you for your understanding and being good girls even when mum was away.

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ABBREVIATIONS AND ACRONYMS

BSc:	Bachelor of Science in Nursing
CI:	Confidence Interval
C/S:	Caesarian section
ERC:	Ethics and Research Committee
IMB:	Information, motivation and behavior
KNH:	Kenyatta National Hospital
MCH:	Maternal Child Health clinic
MSc:	Masters of Science Degree.
MOH:	Ministry of Health
OPD:	Out Patient Department
OR:	Odds ratio
PhD:	Doctor of Philosophy
PMH:	Pumwani Maternity Hospital
PROM	Premature rupture of membranes
SPSS:	Statistical Package for Social Sciences
SVD:	Spontaneous vertex delivery
UCI:	Umbilical cord Infection.
UON:	University of Nairobi
WHO:	World Health Organization

OPERATIONAL DEFINITIONS

- **KNOWLEDGE**: Ability to describe the procedure of umbilical cord care and also the level of education of the care taker.
- **NEONATES**: It refers to babies from day zero up to 28 days after birth.
- **PROM**: It refers to rupture of membranes 48 hours before birth.
- **PRACTICE:** It refers to the activities which are undertaken by care taker in relation to the umbilical cord care
- **UMBILICAL CORD CARE**: In this study the umbilical cord care refers to the care given to the umbilicus of neonates at birth like cutting, tying and caring for the cord.
- **UMBILICAL CORD INFECTION** (**Omphalitis**): Defined as either pus discharge with erythema of the abdominal skin, redness with or without pus and or foul smelling.

ABSTRACT

Background: The umbilical vessels remain patent for a few days following birth which provides direct access to the bloodstream. The cord stump can therefore be an excellent medium for bacteria. Infections are the single most important cause of neonatal mortality and it is estimated that 300 000 infants die annually from tetanus and 460 000 die because of severe bacterial infections, of which umbilical cord infection is a major precursor.
Objectives: The broad objective was to assess the determinants of umbilical cord infection among neonates aged 3 to 28 days attending Pumwani Maternity Hospital.
Methodology: This was a cross sectional descriptive design and 178 mothers with neonates of 3-28 days were selected using systematic sampling method. The data was collected using pre-tested semi-structured questionnaire. Descriptive analysis using means, frequency and proportions was computed. Chi-square test ($p<0.05$) and odds ratio with corresponding 95% confidence interval was used to determine the association between dependent and independent variables. Binary logistic regression analysis was performed to determine the independent factors associated with cord infection.
Results: The findings of the study revealed that the prevalence of umbilical cord infection among neonates was 37.6%. Of these, 49.3% presented with redness and 37.3% with pus discharge while13.4% presented with swelling. The stepwise logistic regression revealed that being female was at [AOR=2.68; 95%CI=1.19-6.04; P=0.017], mothers who had primary school education were at [AOR=7.21; 95%CI=1.62-32.13; P=0.026] and those who had secondary school education [AOR=6.00; 95%CI=1.49-24.20; P=0.010] than those who had college/university education respectively, households getting water through handcart [AOR=8.19; 95%CI=1.37-48.94; P=0.021] compared to those getting piped water, primipara mothers [AOR=10.38; 95%CI=2.35-45.97; P=0.002], babies who initiated breastfeeding after one hour of delivery [AOR=2.61; 95%CI=1.11-6.11; P=0.027]. Babies who bathed with hand/body soap or Dettol [AOR=3.07; 95%CI=1.24-7.58; P=0.015] were factors independently associated with cord infection.
Conclusion: The prevalence of cord infection among neonates was high, indicating that it is a major public health problem. Baby's sex, maternal level of education, parity, source of water, breast-feeding initiation and adding hand/body or Dettol to the baby's bath water were the independent predictors of umbilical cord infection.
Recommendations: More campaigning and sensitization on the contributing factors should be tailored among mothers during ANC visits so as to avoid umbilical cord infections.

CHAPTER ONE: INTRODUCTION

1.0 Background

The umbilical cord plays an essential role in foetal development by connecting the growing foetus with the maternal placenta report by Great Ormond Street Hospital, (2014). It supplies nutrients and oxygen needed for growth and carries away metabolic waste and carbon dioxide (Coyne et al., 2010). The umbilical cord is normally translucent due to Wharton's jelly, but can be stained green due to meconium or yellow if the baby has hyperbilirubinaemia (Levene et al., 2008). After delivery of the newborn the umbilical cord is cut using a sterile technique, and the newborn must make the essential transition to extra-uterine life. The umbilical cord must be clamped (or tied tightly) in order to keep the umbilical vessels occluded to prevent bleeding (Whitemare, 2010).

According to Whitmore et al. (2010) new born infants do not begin to develop their own protective flora until after the first twenty four (24) hours of life. The umbilical cord stump is colonized by bacteria from environmental sources such as the mother's birth canal, skin flora, and the hands of care givers. The unhealed umbilical cord is an important portal for local and invasive infections through the patent vessels that provide direct communication of microorganisms. Omphalitis is an infection of the umbilical stump, defined as either pus discharge with erythema of the abdominal skin or severe redness (more than 2cm extension from the cord stump) with or without pus (Sawardekar, 2004; Mullany et al., 2007).

Data on the incidence of omphalitis in low-income countries is generally scarce and estimates the risk to range between 2 to 77 per 1000 live births in hospital settings. It is even higher in community-based setting which indicated 105 per 1000 live births in Nepal, 217 per 1000 live births in Pakistan and about 197 per 1000 live births in India (Mir et al., 2011). The incidence is even higher in communities that practice application of none sterile home remedies to the cord. One study of neonates admitted to an African general paediatric ward, omphalitis accounted for 28% of neonatal admissions in Tanzania (Winani, 2007). No available data on Kenya.

Infections are the single most important cause of neonatal mortality. It is estimated that 300 000 infants die annually from tetanus. Further 460 000 die because of severe bacterial infections, of which umbilical cord infections are an important precursor (Lawn et al., 2005). Infections account for an estimated 1.44 million (36%) deaths, and about half of deaths in regions with high neonatal mortality rates (Lawn et al., 2005). A substantial proportion of neonatal deaths from infection are treatable as initial cord infections (Mullany et al., 2006). Contamination of the umbilical cord can lead to omphalitis, which may have an incidence as high as 77 per 1000 hospital born infants (Guvenc et al., 1991).

The most encountered risk factors for development of omphalitis in babies are obstructed labour, non-sterile delivery, septic delivery as suggested by prolong rupture of membrane or maternal infection, umbilical catheterization, prematurity, low birth weight (<2500gm) and male sex **(**Nia Fraser et al ., 2006).

1.1. Problem Statement

Newborns are a vulnerable group and therefore need more attention and care. Globally, two thirds of total infant deaths comprise newborns and 99% of these deaths are concentrated in Sub-Saharan Africa and the South East Asian region. Neonatal sepsis is the second leading cause of neonatal deaths globally standing at 7% from prematurity which is at 15% (WHO, 2013). Sepsis is dramatically increasing by an annual rate of between 8-13 % over the last decade (WHO, 2012). Infections are a major contributor to newborn deaths in developing countries with majority of these deaths occurring at home without coming to medical attention (Thaver et al., 2009).

The unhealed umbilical cord is an important portal for local and invasive infections through the patent vessels that provide direct communication of microorganisms to the bloodstream. It is colonized by bacteria from the maternal genital tract and from the environment (Blencowel et al., 2011). As cord infections should be preventable in most cases, it is important to identify best cord care practices to reduce neonatal mortality and morbidity and offer an alternative to widespread potentially harmful traditional practices (Blencowel et al., 2011). In Kenya though there is no available information on the

prevalence/incidence of omphalitis, it is presumed to be a problem. It is also reported that mothers in Nairobi had good knowledge on need for hygiene when cutting the cord, but had poor practices in other aspects of cord care, and were afraid of handling the cord (Obimbo et al., 1999). Therefore, this study sought to determine the factors associated with umbilical cord infection among neonates at Pumwani Maternity Hospital.

1.2. Study Justification

Neonatal sepsis is a major public health issue worldwide. There is no known or available information on study carried out in Kenya to establish the determinants of umbilical cord infection among neonates though the burden of bacterial infection is presumed to be high. In developing countries, little is known about risk factors for umbilical cord infection it has been reported to be 2.2/1,000 in normal term neonates and 8.6/1,000 in preterm neonates (Saez et al 2013). Previous work focused mainly on neonatal tetanus infection, but even where tetanus toxoid coverage rates are high, umbilical cord infections continue if practices at delivery and during the postnatal period do not reduce exposure of the umbilical cord stump to dangerous pathogens (Mullany et al 2006).

This study was conducted to establish the determinants of umbilical cord infections among neonates at Pumwani Maternity Hospital.

1.3 Purpose of Study

The purpose of this study was to assess the determinants of umbilical cord infections among newborns at Pumwani Maternity Hospital. The findings will be used to guide practices in the management of umbilical cord and serve as the scientific basis for quality umbilical cord care improvement among mothers and care givers.

1.4. Objectives

1.4.1. Broad Objective

To assess the determinants of umbilical cord infections among neonates aged 3 to 28 days at Pumwani Maternity Hospital

1.4.2. Specific Objectives

1. To determine the prevalence of umbilical cord infection among neonates aged 3 to 28 days in Pumwani Maternity Hospital Maternal Child Health Clinic.
2. To identify the level of knowledge and practices of cord care among mothers at Pumwani Maternity Hospital.
3. To establish the association of social-demographic and socio-economic status of mothers of neonates aged 3 to 28 days with umbilical cord infection at Pumwani Maternity Hospital.

1.5. Research Variables

1.5.1 Dependent Variable

Umbilical cord infection

1.5.2 Independent Variables

- Demographic data
- Social economic data.
- Place of antenatal care.
- Place of delivery.
- Instruments used to ligate and cut the cord.
- Materials used to clean cord.
- Initiation of breast feeding.
- Rooming inn.

1.6. Research Questions

1. What is the prevalence of umbilical cord infections among neonates aged 3 to 28 days at Pumwani Maternity Hospital?
2. What is the level of knowledge and practices of cord care among mothers at Pumwani Maternity Hospital?
3. What is the association of socio-demographic and economic status of the mothers of neonates aged 3 to 28 days with umbilical cord infection?

1.7. Hypothesis

There is a relationship of knowledge, practices, social-demographic and economic status with prevalence of umbilical cord infection.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

After birth, umbilical cord is an important site for bacterial colonization. A possible consequence of bacterial colonization is cord stump infection (omphalitis), a factor that can greatly increase morbidity and mortality for infants in developing countries. The vessel in the umbilical cord serves as a direct entry site for invasion of pathogenic microorganisms into the circulation of newborn babies, delays in cord detachment may increase risk of bacterial infection. The newborn has no protective flora at birth, and normal skin flora begin to be acquired within 24hours. The first stage of microbial infection is colonization which means the establishment of the pathogen at the appropriate portal of entry. Pathogens usually colonize host tissues that are in contact with the external environment (Mullany et al., 2007).

Newborns are a vulnerable group and therefore need more attention and care. Globally, two thirds of total infant deaths comprise newborns and 99% of these deaths are concentrated in Sub-Saharan Africa and the South East Asian region (Kippenberg et al, 2005).The bacteria that cause neonatal sepsis are acquired shortly before, during, and after delivery. They can be obtained directly from mother's blood, skin, or vaginal tract before or during delivery or from the environment during and after delivery (Edmond and Zaid, 2010). The unhealed umbilical cord is an important portal for local and invasive infections. It is colonized by bacteria from the maternal genital tract and from the environment. Omphalitis can spread to the abdominal wall, the peritoneum, or through the portal vessels leading to systemic sepsis, which if untreated has a high case-fatality (Blencowel et al., 2011).

2.1 Burden of Umbilical Cord Infection among Neonate

Annually about 3.3 million neonatal deaths occur around the world (Oestergaard et al., 2011); of these, more than 30% are caused by infections (Lawn et al., 2005; Mullany et al., 2009). Some of these infections start as umbilical cord infection. Infections are a major contributor to newborn deaths in developing countries with majority of them

occurring at home without receiving medical attention (Thaver et al., 2009). Infections account for approximately 36 percent of neonatal mortality worldwide and ninety nine per cent (99%) of them occurring in the low income and developing countries generally in sub Saharan Africa (Lawn et al., 2005).

Infections are the single most important cause of neonatal mortality, (Thaver et al., 2009). It is estimated that 460,000 infants die annually because of severe bacterial infections, of which umbilical cord infections are a major precursor (Lawn et al., 2005). Cord care practices may directly contribute to infections in the new born which account for a large proportion of the neonatal deaths. Tetanus and other infections are leading causes of neonatal deaths (WHO, 1998). Cord infections contribute significantly to neonatal infection. For instance, a study in India found that, in 47% of infants hospitalized with sepsis, cord infection was the source; and 21% of infants admitted for other reasons had cord infection.

Estimated 30-40% of infections resulting in neonatal sepsis deaths are transmitted at the time of childbirth and during early postnatal period (Blencowel et al., 2011). Neonatal sepsis may stem from local umbilical cord infections that become systemic (WHO, 1998). In developing countries, little is known about risk factors for umbilical cord infection because previous work focused mainly on neonatal tetanus infection, but even where tetanus toxoid coverage rates are high, umbilical cord infections are likely to continue if practices at delivery and during the postnatal period do not reduce exposure of the umbilical cord stump to dangerous pathogens (Mullany et al., 2006).

2.2 Incidence of umbilical cord infections

Data on the incidence of omphalitis in low-income countries is generally scarce, the available data estimate the risk to range between 2 and 77 per 1000 live births in hospital settings, with fatality rates of between 1% and 15% depending on the definition of omphalitis used (Mir et al., 2011). Community-based data show even higher infection rates: for example, 105 per 1000 live births in Nepal (Mullany et al., 2006), 217 per 1000 live births in Pakistan and about 197 per 1000 live births in India (Mir et al., 2011). Remarkably, no data are currently available from most countries in Africa where most

deliveries still occur at home and where neonatal mortality remains high (Lawn et al., 2005).

In Pemba, Tanzania, an omphalitis rate is 1% to 12% based on moderate to severe redness with pus discharge and foul odour (Saunders, 2010). The incidence in developing countries has been quoted to be between 2 and 7 in every 100 live births (Mullany et al 2006).The incidence is even higher in communities that practice application of none sterile home remedies to the cord. One study of neonates admitted to an African general paediatric ward, omphalitis accounted for 28% of neonatal admissions in Tanzania. Hospital-based studies estimate that 2–54 babies per 1000 births will develop omphalitis (Winani, 2007).

There is wide variation in rates of umbilical cord infections among neonates in nurseries in developing countries, with rates ranging from 2 per 1000 to 54 per 1000 live births and case fatality rates ranging from 0 to 15% (Stoll, 2007). A hospital-based study of neonatal omphalitis in Eastern Turkey reported an even higher omphalitis incidence rate of 7.7 per 100 inpatient newborns per year (Guvenc et al., 1991).

In India, among infants hospitalized for sepsis in Uttar Pradesh, cord infection was the source of the illness in 47% of cases, and 21% of neonates admitted for other reasons had omphalitis. Contrary to previous work, Gram-negative bacteria (39%) were most commonly isolated, especially among those delivered at home (Faridi et al., 2003). A prospective study in urban slums in India reported the incidence of umbilical sepsis is 30/1000 live births (Resti et al., 2010).

A survey was conducted on Umbilical cord infection in Nepal among 17,198 infants. Within two days of delivery, 38% of infants had mustard oil application to their umbilical cords, 7% mud, 2% ash and 1% other substances, such as breast milk, saliva or herbs. The study revealed that certain postnatal care practices, such as the application of unclean substances to an infant's umbilical cord, are associated with the risk of umbilical cord infection among newborns. The total incidence of umbilical cord infection (defined as the presence of pus with moderate or severe redness, or the presence of severe redness) was 5.5 cases per 100 neonates (Mullany et al., 2007).

However there is no study in Kenya carried out showing the prevalence of the umbilical cord infection though neonatal sepsis is the main morbidity and mortality.

2.3 Determinants of Umbilical Cord Infection

Understanding determinants of infections is critical in prevention of the same in the first place. Determinants of umbilical cord infection are categorized into three main groups. These include proximal determinants, intermediate determinants and distal determinants.

2.3.1 Proximal Determinants

Proximate factors that highly contribute to infections and which should be addressed antenatally by health care system include prolonged rupture of membranes, preterm labour, maternal pyrexia, unhygienic intrapartum and postnatal care, low birth weight, and pre lacteal feeding of contaminated foods and fluids (Edmond and Zaidi., 2010).

Prolonged rupture of membrane (PROM), defined as rupture of membrane lasting more than 18 hours before labor, and it's found in approximately 8%-10% of all pregnancies (Popowski 2011). It is an important risk factor for both early onset neonatal sepsis and preterm births. PROM is also associated with premature labour and consequent prematurity (Popowski 2011).

The freshly cut umbilical cord is a prime site of bacterial colonization. Omphalitis is proximally caused by colonization that progress to local signs of infection including pus discharge, redness, swelling, or foul odour. Hospital-based studies from developing countries have reported varying dominance of Gram-positive (mainly Staphylococcus aureus), Gram-negative (mainly Escherichia coli and Klebsiella species), and anaerobic bacteria (Sawardekar, 2004).

2.3.2 Intermediate Determinants

Intermediate determinants of omphalitis include hygiene-related practices. These include type of birthing surface (Quddus et al., 2002), cord care (tying, cutting, topical applications) (Bennett et al., 1997), infant-bathing practices, attendants' hand-washing practices, skin-to-skin contact between mother and newborn, and thermal care of the newborn (Mullany et al., 2006).

Risk factors for neonatal tetanus incidence are related to prenatal care like lack of antenatal care for the pregnant women in a health facility, immunization with tetanus toxoid and delivery at home, untrained persons with failure of simple measures such as hand washing, cleaning of the cord-cutting tool, use of multiple cord ties and application of different material like cow dung and other neonatal factors like prematurity (Ilic et al., 2010).

2.3.3 Distal Determinants

Distal determinants like caretaker literacy levels, socio-demographic, socioeconomic status and socio-cultural factors are associated with neonatal umbilical cord infection (Mullany et al., 2006). Prematurity, low birth weight (<2500gm) and male sex of the neonate are also among the distal determinants of umbilical infection (Nia Fraser et al., 2006).

Maternal Factors

A mother's and newborn's health are inseparable. The important socio-demographic factors that influence newborn mortality and survival are the age of mother at birth, parity and education of mother which could influence the newborn care practices. Association between the mother's age at birth and child mortality has been examined in several studies. Pregnancy complications are higher for women who are under 20 or above 35 years of age, (Ibrahim et al., 1994**).** Findings on safe motherhood indicated that younger mothers are more aware of clean delivery practices and infections such as tetanus that are associated with poor cord care practices (Sharan, 2004).

Education of Mother

The education of the mother has been shown to have a strong influence on the utilization of maternal health services and child survival as educated women are more likely to break away from tradition to use modern means of safeguarding their own health and that of their children and they are better able to use the available services in their community to their advantage and seek quality health services (Magadi *et al.,* 2000). There could be a relationship between the education of the mother and the newborn care practices as concluded that secondary and higher level education had a positive impact on clean cord

care and early breastfeeding practices but a negative impact on thermal care practice (Sobita, 2010).

Socio-Cultural

High rates of umbilical cord infection and sepsis can occur in areas free of tetanus, attributed to unhygienic delivery or immediate postpartum care practices that lead to contamination, (Mullany et al 2006). As cord infections should be preventable in most cases, (Capurro., 2004) it is important to identify best cord care practices and offer an alternative to potentially harmful traditional practices, such as use of traditional herbs mixed with cooking oil or water that has been used to wash an adult woman's genitals (numbati) or application of ash, breast milk, fluid from pumpkin flowers, powder ground from local trees, cow dung, ghee and saliva that may be applied to the cord area and which may be harmful (Mrisho., 2008).

Keeping the New-born Warm

Bathing should be delayed until after 24 hours of birth. If this is not possible due to cultural reasons, bathing should be delayed for at least six hours. Appropriate clothing of the baby for ambient temperature is recommended. This means one to two layers of clothes more than adults, and use of hats/caps. The mother and baby should not be separated and should stay in the same room 24 hours a day skin to skin warming is recommended (WHO, 1998).

Initiation of Breast Feeding

Breast milk contains secretory IgA, lysozymes, white blood cells, and lactoferrin and has been shown to encourage the growth of healthy lactobacilli and reduce the growth of E. coli and other gram-negative pathogenic bacteria, (Edmond et al., 2010). Initiation of breast feeding within the first hour of life is recommended (WHO, 1999).

2.4 Knowledge and Practices of Cord Care among Mothers

A study done in five hospitals in the Puttalam district of Sri Lanka concluded that mothers had poor knowledge about care of the umbilical cord (Quddus et al., 2002). A study was conducted on newborn umbilical cord and skin care in Sylhet District, Bangladesh on umbilical and skin care knowledge and practices for neonates. Umbilical stump care revolved around bathing, skin massage with mustard oil, and heat massage on

the umbilical stump. It concluded that mothers were the principal provider for skin and cord care during the neonatal period and hence great need to ensure that they are empowered with the right knowledge to enable them offer right practices (Quddus et al., 2002).

Umbilical cord care practices among mothers of North-Eastern Nigeria study concluded that mothers were not performing hygienic cord care and there was need for further information on the hygienic practices on topical cord care (Quddus et al., 2002). In South India, it was concluded that awareness and attitude of postnatal mothers towards neonatal care including cord care has lots of gaps especially in those who belong to the lower socio-economic status (Mohamed and Vishnu 2010).

A cross sectional study was conducted in Nairobi, Kenya to determine the knowledge, attitude and practices of mothers regarding care of the newborn umbilical cord. Sample consisted mothers with infants less than 3 months of age attending well child clinic, maternity and newborn units of public health, Nairobi. Of the 307 mothers interviewed, 91 percent and 28 percent mothers knew the need for hygiene whilst cutting and tying the cord respectively. Regarding postnatal cord care, 40 % had good knowledge and 66 % had good practice. The study also reported that 51 % of mothers knew and 54 % practiced postnatal cord care for the appropriate duration of time while 79 % were afraid of handling an unhealed cord. This study concluded that mothers had good knowledge on need for hygiene when cutting the cord, but had poor practices in other aspects of cord care, and were afraid of handling the cord (Obimbo et al., 1999).

As cord infections should be preventable in most cases (Capurro et al., 2004), it is important to identify best cord care practices to reduce neonatal mortality and morbidity and offer an alternative to widespread potentially harmful traditional practices. Examples of such practices include use of traditional herbs mixed with cooking oil or water that has been used to wash an adult woman's genitals or application of ash, breast milk, fluid from pumpkin flowers, powder ground from local trees, cow dung, ghee and saliva that may be applied to the cord area and which may be harmful (Mrisho et al., 2008; Mullany et al., 2007).

Optimal implementation strategies to prevention of neonatal sepsis is organized in two levels (WHO 1999); (1) at birth; washing hands with clean water and soap before delivery, laying the new born on a clean surface and cutting the cord with a sterile instrument (2) post natal; washing hands with clean water and soap before and after care, keeping the cord stump dry and exposed to air or loosely covered with clean clothes, if soiled, the cord should be wiped with clean water (Boiled and cooled in a closed container) and the napkin should be folded below the umbilicus.

2.5 Umbilical Cord Care

Internationally, WHO has advocated since 1998 for the use of dry umbilical cord care (keeping the cord clean without application of anything and leaving it exposed to air or loosely covered by a clean cloth, in case it becomes soiled it is only cleaned with water). World Health Organization recommends topical antiseptics (eg, chlorhexidine) in situations where hygienic conditions are poor and/or infection rates are high (WHO, 1998). However, a Cochrane review (Zupan et al., 2004) (n = 8959 new-borns, 21 studies) published in July 2004 found no benefit on neonatal mortality or rates of disseminated or localized infection of applying antiseptics or antibiotics to the cord stump compared with dry cord care. The findings of this Cochrane review may, however, not be generalizable to the African setting, as most of the included studies (19/21) were from high-income countries and all but 1 were conducted in hospital settings.

In Kenya, clinical guidelines recommend dry cord care (MoH, 2009), however, anecdotal evidence and experience suggest that health care providers vary in their practice, for example, using alcohol, methylated spirit or povidone iodine to clean the cord (Karumbi et al., 2013). Safe and effective topical umbilical cord care for prevention of mortality and cord infections in newborn infants is recommended.

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 is recommended for newborns who are born at home in settings with high neonatal mortality (30 or more neonatal deaths per 1000 live births). Clean, dry cord care is recommended for newborns born in health facilities and at home in low neonatal

mortality settings. 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 (WHO report, 1998).

2.6 Theoretical Framework

The theoretical model for this study is the information–motivation–behavioural skills (IMB) model by Fisher & Fisher., (1992).The constructs of IMB model provide a platform to design interventions that help to induce change in the pattern of health behaviour and plan preventive public health programs. The model conceptualizes psychological determinants of the performance of behaviours that have the capacity to impair or to improve health status. It incorporates and addresses three components; information, motivation and behaviour.

Information component targets understanding of the concepts that lead to behaviour change and the ways and means of achieving the change. Information is a critical determinant of health behaviour performance and includes, relevant research data, health promotion information, preventive or risk details about the disease or behaviour in consideration and information on positive outcomes from behavioural change Fisher and Fisher.,(1992; 2000); Fisher and Fisher, (1993; 1999).

Motivation aspect deals with individual affect and favourable attitude towards positive health behaviours and utilizing existing social support systems to reinforce motivation which is also enhanced by recognizing the possible barriers and finding ways to overcome them. According to this model, motivation acts as a catalyst to health related behaviours and determines whether even well-informed individuals will be inclined to undertake health promotion actions (Fisher, Fisher and Harman, 2003).

The behavioural aspect of the IMB model reflects the psychomotor or ‘action’ component that allows learning of skills required to bring about change in behaviour (Fisher, Fisher and Harman, 2003). Behavioural skills for performance of health promotion actions are critical determinant of whether, people who adopted information and are motivated towards healthy behaviour change, would be capable of effectively bringing about that change, which is dependent on individual self-efficacy in carrying out a health related

behavior (Fisher, Fisher and Harman, 2003). Information and motivation act as tools to develop these behavioural skills.

Interrelationships among the three constructs are used to translate the IMB model into health promotion interventions. It is worth noting that information and motivation are potentially independent constructs which means that well informed individuals are not necessarily motivated to engage in health promotion behaviours or well-motivated individuals are not necessarily well informed about health promotion practices. IMB model brings about a step wise transition in society for effective execution of public health intervention. Firstly, resources are pooled together to establish a proven standard and authenticity of information, research data and surveys that help to determine the information, motivation and behavioural skill factors of the health intervention like the care of the umbilical cord.

Once that is available, behaviour specific interventions are designed and implemented with respect to target health behaviour. Lastly, an evaluation-outcome research is conducted to assess the impact of the IMB model to produce the desired effect. A comparison may be done with the deficits of the earlier faulty health behaviour that persisted before application of the IMB model (Fisher and Harman, 2003).
Hence this model suggests that mothers who are knowledgeable about umbilical cord infection and prevention, are motivated to prevent infection, and perceive themselves as capable of enacting preventive behaviours will act to reduce umbilical cord infection (Fisher. et al. 1998). The IMB model has also been used with other populations to assess the behaviour change on HIV infection and adherence to the treatment of the same and on breast cancer.

2.7 Conceptual Framework: Health Promotion Model

The Health Promotion Model (HPM) was developed by Nola J. Pender, professor emeritus of the Nursing School, and is supported on the concept of health promotion, defined as those focused on the development of resources that can maintain or improve wellbeing.

The Health Promotion Model is a psychological model that attempts to explain and predict health behaviors. This is done by focusing on the attitudes and beliefs of individuals. It seeks to influence behaviors promoting health through positive motivation. It is not isolated to a person(s) but interactive with the environment which is not limited to the physical space occupied, but cultural and social influence within the community. Due to this environmental influence, behaviors that may deter success must be addressed Clinical Assessment for Health Promotion theory plan asks questions about prior behavior, personal influences, interpersonal influences, social support, role models, situational influences, commitment to a plan of action and follows up questions regarding competing demands and preferences.

The model proposes that a person's health-related behavior depends on the person's perception of four critical areas: Severity of a potential illness, Person's susceptibility to that illness, Benefits of taking a preventive action, and barriers to taking that action.
In this study, perception of severity of umbilical cord infection, susceptibility of the illness, educating mothers on the benefits of taking preventive action and addressing the possible barriers like ignorance and influence from friends and relatives would lead to behavior change which is prevention of umbilical cord infection.

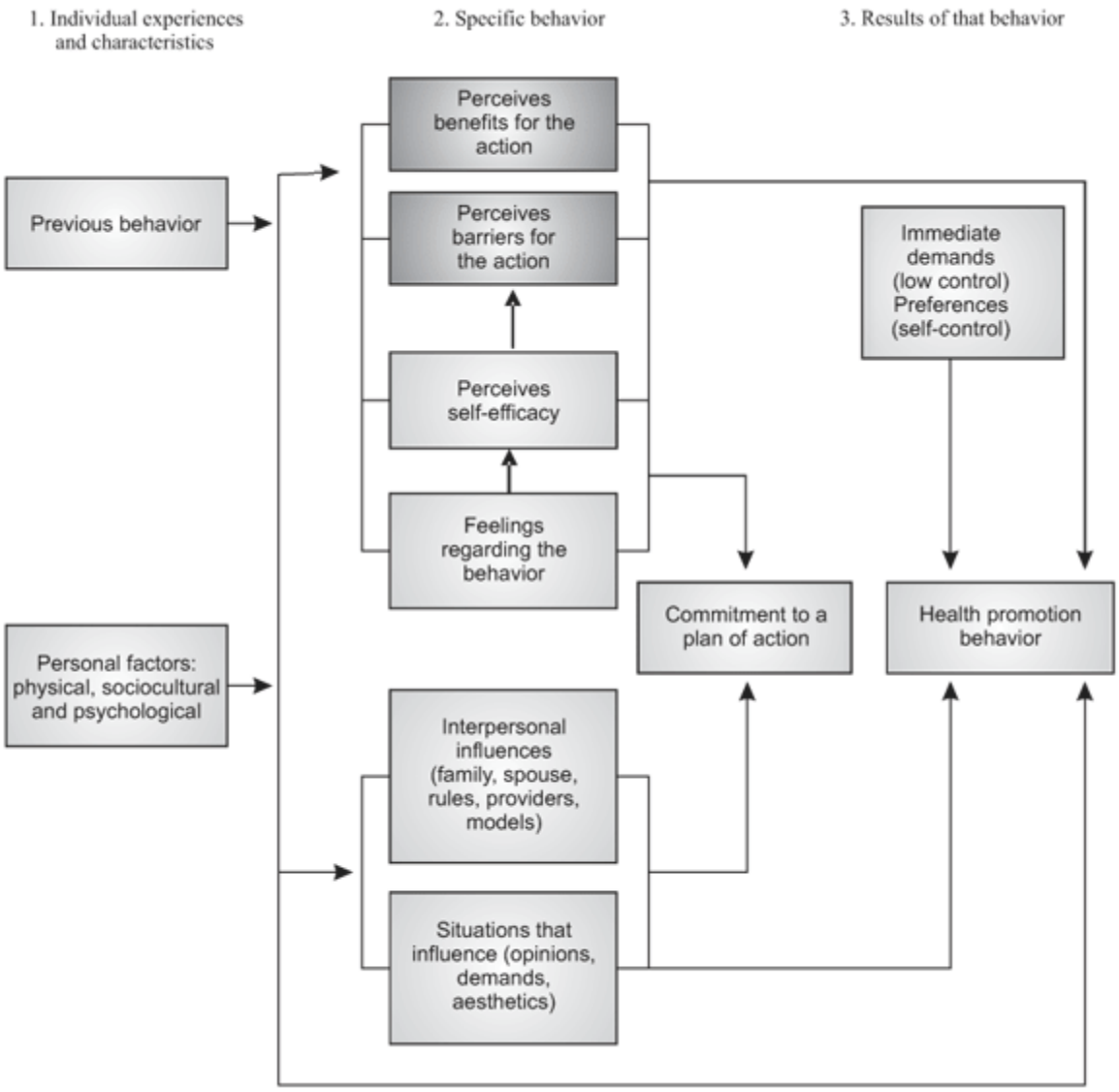

Figure 1 – Diagram of the health promotion model – Fortaleza - 2002.

Figure2.1: Diagram of the Health Promotion Model-Fortaleza- 2002

2.8 Operational Framework

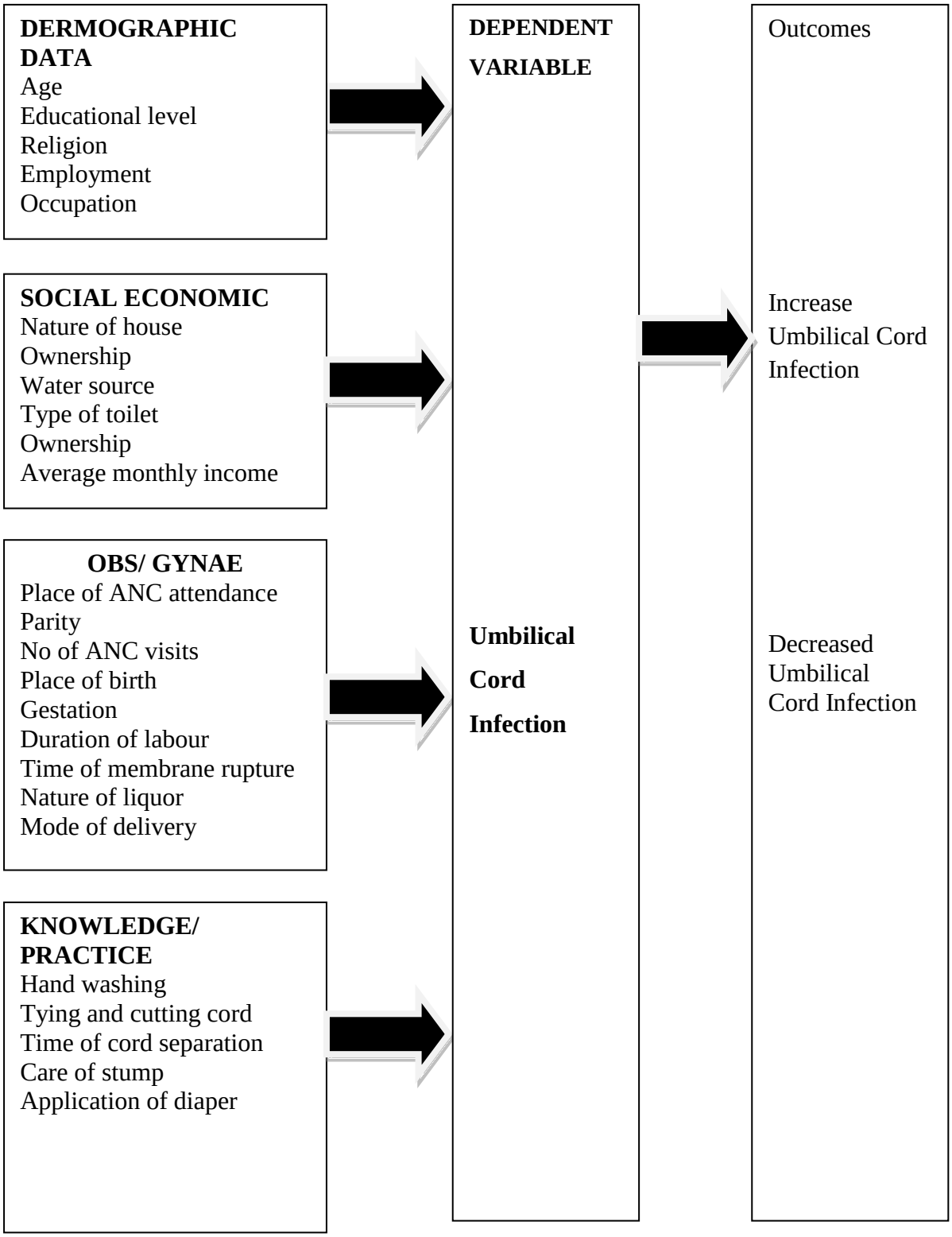

Figure 2.2: Operational Framework

CHAPTER THREE: METHODOLOGY

3.1. Study Design

The study was a cross sectional descriptive study design.

3.2. Study Area

The study was conducted at Pumwani Maternity Hospital which is a referral maternity hospital located on the East of Nairobi City. The Hospital was founded in 1926 by a Charitable Organization called Lady Grigg Welfare League and was named Lady Grigg Maternity. In 1928 the first permanent building was put up at the Hospital and later some extensions were made to give the Hospital a bed capacity of 27. In 1944 the Hospital was taken over by the Municipal Council of Nairobi. The Pumwani Maternity Hospital is a pioneer in the provision of maternity care in Sub-Saharan Africa. The name "Pumwani" is derived from the Swahili word to "breathe" or "relax" which is befitting of a mother who has just delivered a healthy baby.Under the management of the Municipality, Hospital services grew rapidly with bed capacity nearly tripled from 27 to 75 while during the same period deliveries increased from 3000 to 8000 yearly.

The old building that comprised the initial maternity was converted into a School of Midwifery Studies and a Nurses Hostel. Today, it is an Obstetric and referral hospital for delivery of expectant mothers in Nairobi, and adjoining districts. It has 354 Obstetric beds, 144 baby cots and 2 Theatres. Daily normal deliveries are 50 – 100, and Caesarean Sections are 10 – 15. The Hospital falls under the jurisdiction of county Council of Nairobi, however, Pumwani Maternity Management Board, which is appointed by the Minister for Local Government oversees its operation. To date the Hospital remains the largest maternity hospital in the country and Sub-Saharan Africa. It is equivalent to a Provincial Hospital in status and is reported to be third busiest maternity hospital in the African continent.

3.3. Study Population

The study population was neonates accompanied by their mothers/care takers at Pumwani Maternity Hospital. The mothers/care takers were the primary respondents as they provide umbilical cord care to the neonates after delivery.

3.3.1 Inclusion Criteria:

1. All neonates above three days old with their mothers/care takers at Maternal Child Health Clinic of Pumwani Maternity Hospital.
2. Neonates whose mothers consented to participate in the study.

3.3.2 Exclusion Criteria:

1. Neonates whose mothers refused to participate in the study.
2. Neonates below three days of age.

3.4. Sampling method and Sample Size Determination

The sample size was determined by using the following Fischer's formula:

$n = Z^2pq/d^2$

Where: n = the desired sample size

Z =the standard normal deviation at the required confidence level

P = the proportion in the target population estimated to have the desired characteristics

q= 1-p

d= the level of statistical significance set.

The prevalence of umbilical cord infection in neonatal admissions in Tanzania is taken to be 28% (Winani, 2007) and this proportion is used to calculate the sample size as there is no data of any study done in Kenya.

$$n = \frac{(1.96)^2(0.28)(0.72)}{(0.05)^2}$$

$$= \frac{3.8416\ (0.2016)}{0.0025}$$

$$= \underline{0.7744}$$

$$\frac{0.0025}{}$$

$$= 309.78 \quad = 310$$

Sample size adjustment is done since the target population is <10,000 using the following formula.

$$nf = \frac{n}{1 + {}^{n}/_{N}}$$

Where:

nf = The desired sample size for population <10,000

n = Total population (around 400 neonates seen from home in 2 months period as the data collection is expected to take 8 weeks)

N = the calculated sample size.

$$nf = \frac{310}{1 + \frac{310}{400}} = 174.65 = 175$$

The minimum study sample size will be 175.

3.5 Sampling Method and Recruitment Process

Systematic sampling method was used to select study participants. The sampling frame was estimated from the child welfare clinic (MCH) register by calculating the average number of neonates aged 3 to 28 days seen in two (2) months which was the estimated duration of data collection. Approximately 400 neonates were seen in the 2 month duration, this was divided by the minimum adjusted sample size (175) to give the sampling interval of 2.28 approximated to 2. The first neonate to be included in the sample was chosen randomly by blindly picking one of two pieces of paper one with "Yes" and another one "No" named for the first two clients in each day. The one that picks the "Yes" paper then becomes the first participant of the day. After that, every second neonate coming for child welfare clinic and whose care taker consents was included in the sample until the desired sample size was attained.

Recruitment of the participants took place at the waiting room of the child welfare clinic of the Hospital. After the participant's care taker agreed to participate and having duly

filled and signed the consent form, they were interviewed by the research assistant using a semi structured questionnaire. The interviews took place in a private room of the hospital.

3.6. Data Collection

3.6.1 Questionnaire

A pre-tested semi-structured questionnaire translated into Swahili was used to collect the data with the help of three trained research assistants who were 4th year BScN students. They were trained on the general approach of the questionnaire and diagnosis of Omphalitis through physical examination of the neonate. Omphalitis in this study was defined as either pus discharge, erythema of the abdominal skin, redness with or without pus, swelling and/or foul smell. They had practiced the same in the pre-testing process of the questionnaire at Kenyatta National Hospital Child Welfare Clinic where the questionnaire pre-testing was done. The following data was collected: Socio-demographic data, Social economic data, Socio-cultural factors, Place of antenatal care, Place of delivery, Cord ligating materials, Cord cleaning materials, Initiation of breast feeding, Rooming inn, Knowledge and practices of umbilical cord care .

3.6.2 Physical Assessment

Neonates were evaluated for signs of umbilical cord infection (pus, erythema of the abdominal skin, redness, swelling and/or foul smell). Omphalitis was defined as either pus discharge, erythema of the abdominal skin, redness with or without pus, swelling, and/or foul smell. The trained research assistants assessed for any of the above mentioned signs on the neonate. They referred neonates noted to have any of the above signs to the clinician on duty was usually stationed in the triaging room of child welfare clinic. Any participant who was noted to have any other health concern even apart from omphalitis was also referred to the clinician. Information on physical assessment findings was documented on the triaging register and the neonatal card as per the laid down policies of the hospital and entered the findings in the questionnaire.

3.7. Pretesting of the Study Tool

Pretesting of the questionnaire was done at KNH child health welfare clinic. These participants in the pretest do not constitute the data that has been used in the final analysis. The pretest helped me in testing the validity and reliability of the study tool. Also helped in exposing the research assistants to the tool and the general practice of the data collection, documentation and interpretation of the same.

3.8 Data Management

All questionnaires were stored in locked cabinets throughout the study and accessed only by authorized persons so as to ensure confidentiality and to avoid data loss. After data collection, a double entry of the same data was done for accuracy purposes. The data is stored under passwords. Data entered using MS Excel then exported to SPSS for analysis. Coding and verification of the data was done for easy manipulation, analysis and presentation. Data is presented using tables and graphs showing frequency distribution for independent and dependant variables.

3.9 Data Analysis

Quantitative data was analyzed using SPSS version 20. Descriptive analysis was done using means, proportions and frequencies. Pearson's chi-square test and odds ratio (OR) with corresponding 95% confidence intervals (CI) computed to find association between independent and dependant variable (umbilical cord infection). A P-value of 0.05 was considered statistically significant.

3.10. Ethical Considerations

Ethical clearance was sought from Kenyatta National Hospital/University of Nairobi (KNH/UON), Ethics and Research Committee. The consent from the participants was obtained. The participants who met inclusion criteria filled the consent forms (*Appendix III*). The participants were recruited voluntarily and those who wished to withdraw in the course of the study did so at will. The serial numbers were used instead of participants' names on the questionnaires to ensure confidentiality. The questionnaires were kept in a locked box whereby the researcher was the only person to access this locked box. The

study did not expose the participant to any harm since there were no interventions to the participants.

Moreover, study participants found to have umbilical cord infection were referred and advised to see a clinician.

3.11 Expected Outcome and Dissemination Plan

The findings of the study will be presented to the University of Nairobi, School of Nursing. It will also be published and presented in conferences and workshops of relevant stakeholders in this area. Moreover, in part, this study can serve as a baseline for those who may wish to make further research on the area.

3.12. Study Limitations

Language barrier was a limitation considering the illiteracy levels of mothers in this country which might also affect the reliability of participants' response to the questionnaire and state of cord.

Referred infections can affect the results of the study where skin rash or nappy rash etc. can occur together with umbilical cord infection and it is difficult to know precisely if they were independent or related to each other and which one comes first. Maternal conditions like sepsis can also predispose to umbilical cord infection and considering that the study depended only on subjective information from the mother, it could be a limitation.

The study is targeting only Pumwani Maternity Hospital therefore the findings may not be generalizable to other sites.

CHAPTER FOUR: RESEARCH FINDINGS

4.0 Introduction

This chapter presents the findings of the study. The findings are presented and interpreted based on the objectives of the study. A total of 178 mothers/caretakers with neonates aged 3-28 days consented to participate in to the study at Pumwany Maternity Hospital. The results are presented in this sections and cover: socio-demographic characteristics of mothers/fathers; socio-economic characteristics of mothers/fathers; obstetrical factors; knowledge and practice towards child cord care. The results are presented in tables and graphs form.

4.1 Socio-demographic Characteristics of the Mothers and their Spouses

The distribution of socio-demographic characteristics among mothers who participated in this study is shown in Table 4.1. The mean age of the mothers was 24.6 years. The findings also show that about half of the mothers 46.6% (n=83) were within the age group of 23-29 years and about a third 34.3% (n=61) were 16-22 years while the age group of 31-39 were only 19.1% (N=34). The educational level for the mothers was as follows; 33.2% (n=59), in primary, 52.8% (n=94), in secondary and 14.0% (n=25), in tertiary. On religious affiliation, most of the mothers interviewed 94.4% (n=168), were Christian whereas the remaining 5.6% (n=10), were Muslims. Regarding marital status of the mothers, more than two thirds 71.9% (n=127), were married.

Among those mothers who were married, the highest percentage 44.9% (n=57), of their spouse were aged between 26 to 30 years, more than half 56.7% (n=72), of their spouses attended secondary education and most 91.3% (n=116), of their spouses were Christians.

Table 4.1: Socio-demographic Characteristics of the Mothers and their Spouses

Socio-demographic characteristics	Frequency (n=178)	Percentage (%)
Mean age (+SD) of mothers 24.6(±5)		
Mother's age in years		
16-22	61	34.3
23-29	83	46.6
31-39	34	19.1
Mother's level of education		
Primary	59	33.2
Secondary	94	52.8
College/University	25	14.0
Mother's religion		
Christian	168	94.4
Muslim	10	5.6
Mother's marital status		
Married	127	71.3
Single	51	28.7
Mean age (+SD) of spouses 29.6(±4.9)		
Spouse's age in years		
20-25	26	20.5
26-30	57	44.9
31-35	28	22.0
36-40	16	12.6
Not applicable	51	
Spouse's level of education		
Primary	30	23.6
Secondary	72	56.7
College	25	19.7
Not applicable	51	
Spouse's religion		
Christian	116	91.3
Muslim	11	8.7
Not applicable	51	

4.2 Socio-economic Characteristics of Mothers and their Spouses

Table 4.2 below presents the distribution of socio-economic characteristics among respondents (mothers) and their spouses. With respect to occupation, 33.7% (n=60), of

the mothers were unemployed, 14.6% (n=26), were casual workers and 41.6% (n=74), were self-employed. However, only 10.1% (n=18), had permanent job.

A majority of mothers 70.8% (n=126), indicated that they were living in a permanent house. Nevertheless, a large percentage of the respondents 92.7% (n=165), were staying in a rental house. Most of the mothers 93.3% (n=166), had electricity supply while the remaining 6.7% (n=12), were living without electricity. The main source of water of the households was piped at 92.1% (n=164), while the rest 7.9% (n=14), was handcart supplied. Flash toilet was the commonest at 69.1% (n=123), type of toilet used and majority of the respondents 69.7% (n=124) were using communal toilet.

Table 4.2: Socio-economic Characteristics of Mothers

Socio-economic characteristics	Frequency (n=178)	Percentage (%)
Mother's occupation		
None	60	33.7
Casual	26	14.6
Self employed	74	41.6
Permanently employed	18	10.1
Spouse's occupation		
Permanent	38	29.9
Casual	52	40.9
Self	37	29.1
Not applicable	51	
Nature of house		
Permanent	126	70.8
Semi- permanent	20	11.2
Temporally	32	18
Ownership of house		
Self	13	7.3
Rental	165	92.7
Availability of electricity		
Yes	166	93.3
No	12	6.7
Source of water		
Handcart	14	7.9
Piped	164	92.1
Type of toilet		
Pit	55	30.9
Flash	123	69.1
Ownership of toilet		
Communal	124	69.7
Individual	54	30.3

4.2.1: Average Monthly Income of the Household

There was almost equal distribution of monthly income among those who indicated their average monthly income however about half of the mothers 52.2% (n=93), did not know the monthly income of the household (Figure 4.1).

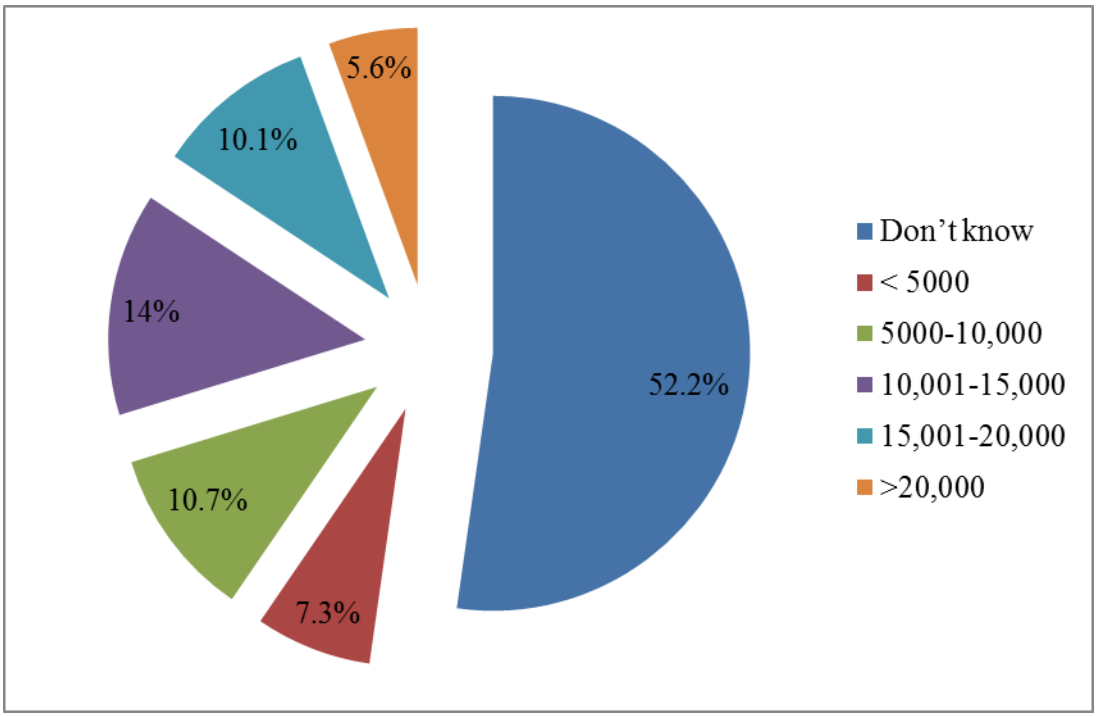

Figure 4. 1: Monthly Income of the Household

4.3 Socio-demographic Characteristics of the Neonates

Table 4.3 shows the description of children by socio-demographic characteristics. The ages of the neonates ranged from 3 days to 28 days with mean age of 11.7 days. Three quarters of the neonates 75.3% (n=134), aged 3 to 14 days while the age category of 15 to 28 days was 25.7% (n=44). The gender distribution among the neonates indicates that there were 53.4% (n=95), females and 46.6% (n=83) males.

The duration of umbilical cord stump to fall off was examined and 60.7% (n=108) of the neonates had experienced between 4 to 7 days while 14.6% (n=26) were between 1-3 days. However, about a quarter 24.7% (n=44) was not fallen off during the data collection. The table further shows that 42.7% (n=76) of the babies had either generalized rash or nappy rash.

Table 4. 3: Distribution socio-demographic Characteristics among the Neonates

Socio-demographic characteristics	Frequency (n=178)	Percentage (%)
Sex		
Female	95	53.4
Male	83	46.6
Age in days		
3 to 14	134	75.3
15 to 28	44	24.7
Birth weight in Kg		
2.0-3.0	84	47.2
3.1-4.2	94	52.8
Duration of cord to fall off		
Not yet	44	24.7
1 to 3 days	26	14.6
4 days and above	108	60.7
Whether the child had generalized/nappy rash		
Yes	76	42.7
No	102	57.3
Mean of age in days (±SD) = 11.7(6.0)		
Mean of birth weight in kgs (±SD) = 3.2(0.4)		

4.4 Obstetrical Factors

The obstetrical factors during pregnancy and delivery among mothers are summarized in Table 4.4. All mothers had attended ANC. About half 53.4% (n=95) of the mothers attended at least the 4 times recommended antenatal care visits while 6.2% (n=11), attended only once during their pregnancy. Almost all mothers 99.4% (n=177) gave birth at full term of pregnancy. All mothers delivered at the health facilities whereby 53.4% (n=95), of them delivered through SVD and the remaining 46.6% (n=83), were through caesarean section. Majority of the mothers 59.0% (n=105), were primiparas. About a third 34.3% (n=61), of the mothers claimed that they had problem during labor.

Table 4.4: Obstetrical Factors

Variables	Frequency (n=178)	Percentage (%)
Place of ANC attendance		
Pumwani	47	26.4
Other public facility	115	64.6
Private	16	9.0
No of ANC visits		
1	11	6.2
2	16	9.0
3	56	31.5
4 and above	95	53.4
Place of birth		
PMH	114	64.0
Other public facility	64	36.0
Gestation		
<38wks	1	0.6
>38wks	177	99.4
Mode of delivery		
C/S	83	46.6
SVD	95	53.4
Parity		
1	105	59.0
2	42	23.6
3 and above	31	17.4
Any problem encountered during labor		
Yes	61	34.3
No	117	65.7

4.4.1 Kind of Problems Encountered During Labor

The mothers were requested to mention the kind of problems faced during labor and the distribution of the problems were as shown in Figure 4.2 below. About a quarter 26.2% (n=47), indicated fetal distress followed by 19.7% (n=35) prolonged labor and same percentage 19.7% (n=35), had breech presentation.

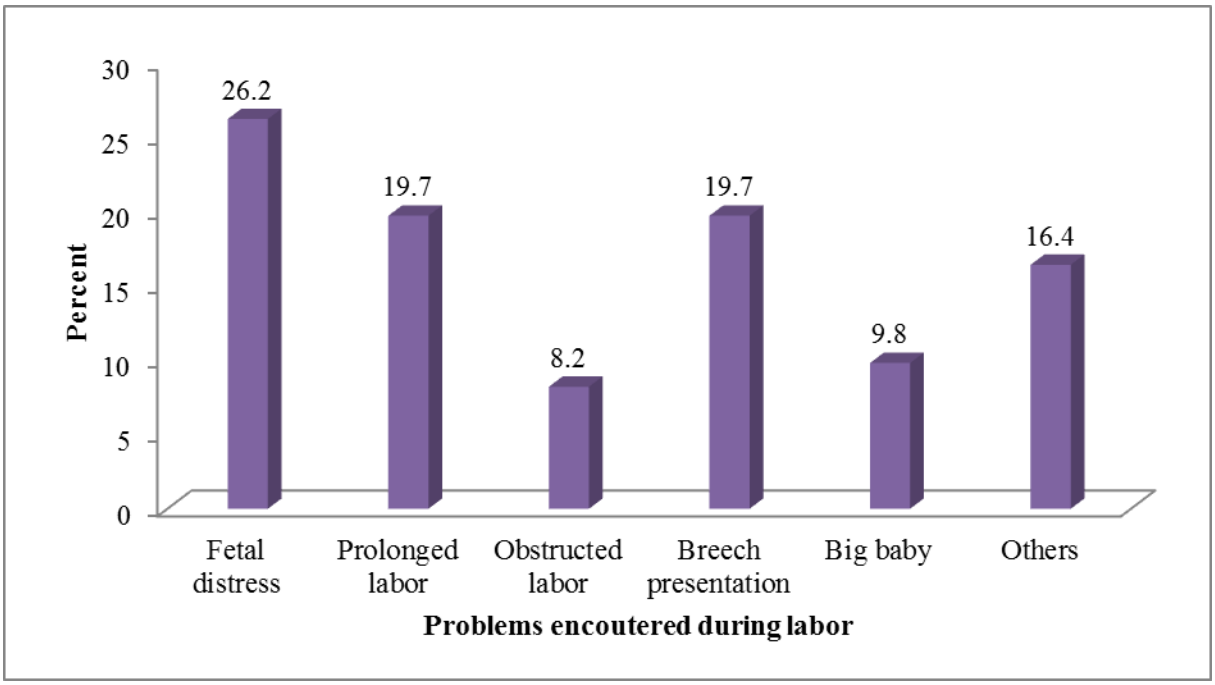

Figure 4. 2: Problems Encountered During Labor

4.5 Mothers' Knowledge and Practices on Cord Care

Surprisingly 59.0% (n=105), of the mothers who participated in the study had never heard of umbilical cord infection. All mothers indicated that scissors were used to cut the umbilical cord. A large percentage of 94.9% (n=169), tied the umbilical cord with a cord clamp while only 5.1% (n=9), used thread. About two thirds 63.5% (n=113), of mothers initiated breastfeeding after one hour of delivery. Most of the mothers 93.3% (n=166), reported that they stay with the baby in the same room (Table 4.5).

Air drying was the main method mentioned by the mothers 54.5% (n=97), as used for caring for the baby's umbilical cord followed by spirit application at 24.7% (n=44), saliva was at 10.7% (n=19) and warm salty water was 10.1% (n=18). Considerable number of mothers 46.1% (n=82), tied the diaper above the cord. Majority of the mothers 84.8% (n=151), bathed their babies every day and 67.5% (n=120), added hand/body soap or Dettol to the bath water (Table 4.5).

Table 4. 5: Mothers' Knowledge and Practices on Cord Care

Variables	Frequency (n=178)	Percentage (%)
Ever heard of umbilical cord infection		
Yes	73	41.0
No	105	59.0
Things used to tie umbilical cord		
Cord clamp	169	94.9
Thread	9	5.1
Things used to cut umbilical cord		
Scissors	178	100.0
Initiation of breast feeding		
>1hour	113	63.5
≤1hour	65	36.5
Staying with the baby in the same room		
Yes	166	93.3
No	12	6.7
Thermal care		
Wearing hat	76	42.7
Warming the room	17	9.6
Wrapping the baby warmly	61	34.3
Skin-to-skin contact	24	13.5
Methods used to care baby's cord		
Apply saliva	19	10.7
Apply spirit	44	24.7
Applying warm salty water	18	10.1
Air dry	97	54.5
Whether wearing the diaper above or below the cord		
Above cord	82	46.1
Below cord	96	53.9

Bathing practice		
Not yet	18	10.1
Every day	151	84.8
Every other day or more	9	5.1
Substances (hand/body soap or Dettol) added to the bath water		
Yes	108	67.5
No	52	32.5
Not applicable	18	
Ways of bathing the baby		
Immersion in water	33	20.6
Pour water over baby	41	25.6
Wipe baby with cloth	86	53.8
Not applicable	18	
How do you wash your hands		
Basin	86	48.3
Running water	92	51.7

4.5.1 Time at which Bathing was started after Delivery

Figure 4.3 below portrays the time at which mothers started to bath their babies; 41(23%), 48(27%), 41(23.6%) and 29(16.3%), had started bathing at 1st day, 2nd day, 3rd day and 4th day and above respectively. However, 19(10.1%), mothers had not started bathing their babies during the time of data collection.

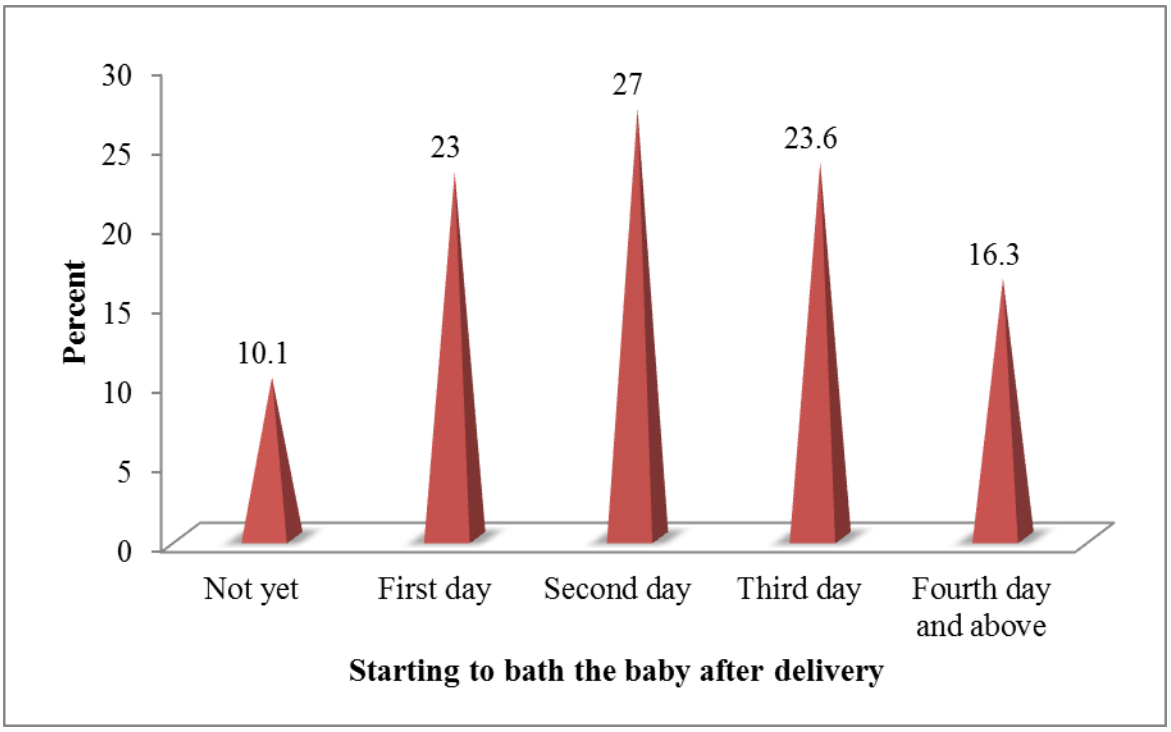

Figure 4. 3: Time at which Bathing was Started after Delivery

4.5.2 Hand Washing Practices

More than half 56.2% (n=100), of the mothers reported that they wash their hands after toileting while a small percentage of 8.4% (n=15), wash their hands before changing the baby (Figure 4.4).

N.B: The percentages are taken to total responses as some respondents gave more than one response.

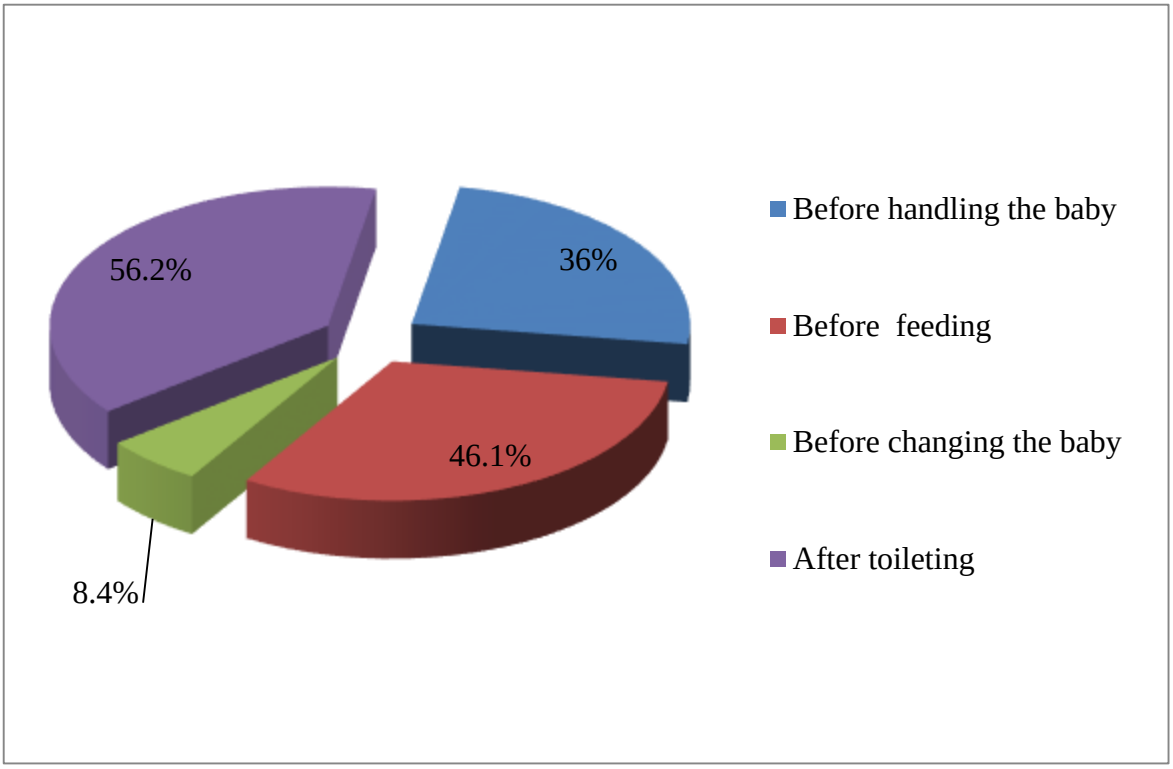

Figure 4. 4: Hand Washing Practices

4.6 Prevalence of Umbilical Cord Infection

Figure 4.5 shows the distribution of umbilical cord infection among the neonates aged 3 to 28 days. The prevalence of umbilical cord infection was found to be 37.6% (n=67), with 95% confidence interval of 30.48% to 44.72%.

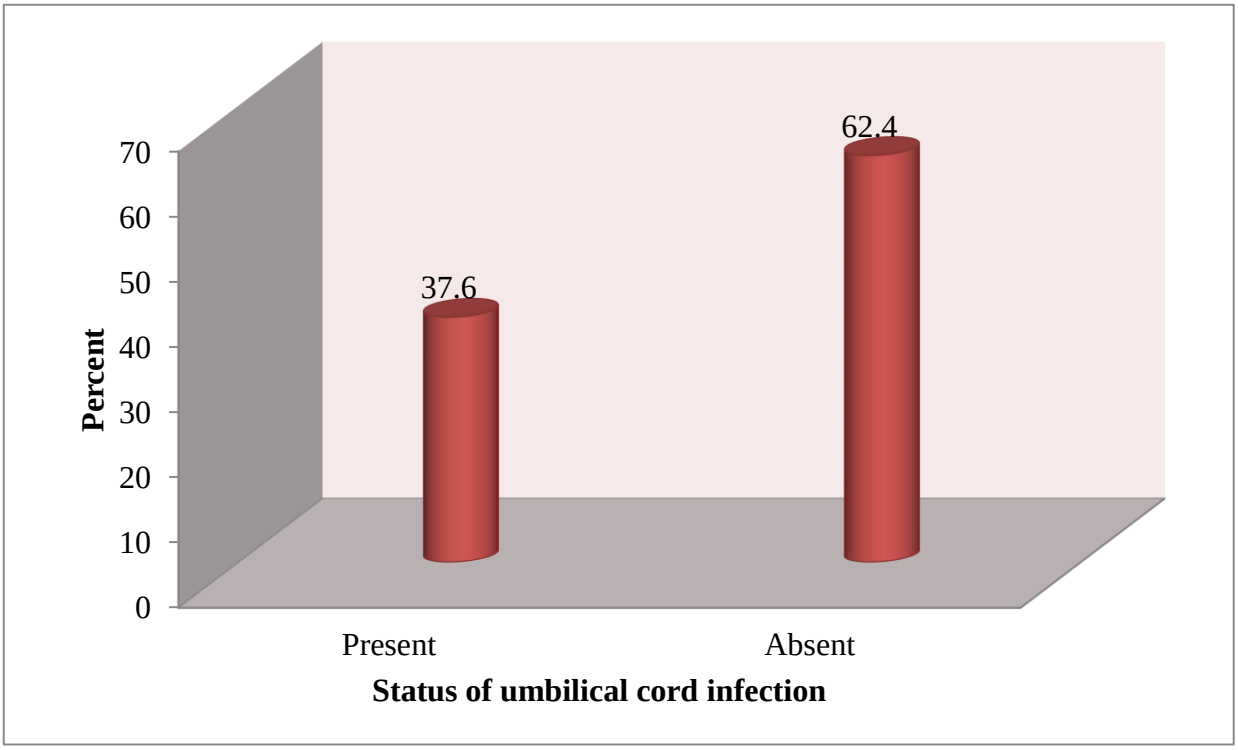

Figure 4. 5: Percentage of Umbilical Cord Infection

4.7 Description of Umbilical Cord Infection

Among those who had umbilical cord infection, 49.3% (n=33), presented with redness, 13.4% (n=9) presented with swelling and 37.3% (n=25) presented with pus discharge as indicated in Figure 4.6.

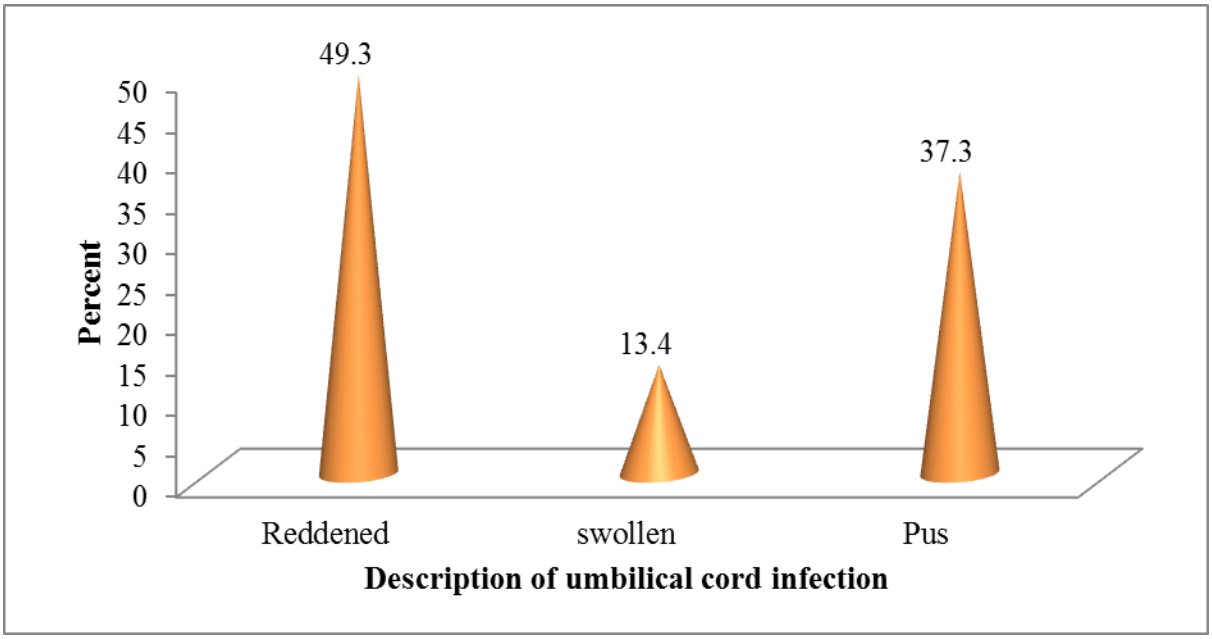

Figure 4. 6: Description of Umbilical Cord Infection

4.8 Association between Socio-demographic Characteristics and Umbilical Cord Infection

Table 4.6 shows the relationship between socio-demographic characteristics and umbilical cord infection. There was a significant higher proportion of umbilical cord infection among female babies (46.3%) **[OR=2.25; 95%CI=1.20-4.22; P=0.011]** than male babies (27.7%). Babies with generalized/nappy rash were significantly more likely to develop umbilical cord infection (46.1%) than those who did not experience generalized/nappy rash (31.4%), **[OR=1.87; 95%CI=1.01-3.45; P=0.046]**. Mothers who attended primary school had significantly increased proportion of babies with umbilical cord infection (43.9%) **[OR=3.44; 95%CI=1.14-10.36; P=0.028]** compared to those attended college/university (18.5%).

Table 4.6: Association between Socio-demographic Characteristics and Cord Infection

Variables	Cord infection		OR	95%CI		χ^2 value	χ^2 test P value
	Present, n(%)	Absent, n(%)		Lower	Upper		
Baby's Sex							
Female	44(46.3%)	51(53.7%)	**2.25**	**1.20**	**4.22**	**6.53**	**0.011**
Male	23(27.7%)	60(72.3%)	1.00				
Baby's age in days							
3 to 14	48(35.8%)	86(64.2%)	0.73	0.37	1.47	0.76	0.382
15 to 28	19(43.2%)	25(56.8%)	1.00				
Whether the child had generalized/nappy rash							
Yes	35(46.1%)	41(53.9%)	**1.87**	**1.01**	**3.45**	**4.00**	**0.046**
No	32(31.4%)	70(68.6%)	1.00				
Mother's age in years							
16-22	29(47.5%)	32(52.5%)	1.90	0.79	4.55	2.04	0.153
23-29	27(32.5%)	56(67.5%)	1.01	0.43	2.37	0.00	0.985
31-39	11(32.4%)	23(67.6%)	1.00				
Mother's level of education							
Primary	25(43.9%)	32(56.1%)	**3.44**	**1.14**	**10.36**	**4.81**	**0.028**
Secondary	37(39.4%)	57(60.6%)	2.86	0.99	8.21	3.80	0.051
College/University	5(18.5%)	22(81.5%)	1.00				
Mother's religion							
Christian	64(38.1%)	104(61.9%)	1.44	0.36	5.75	0.26	0.608
Muslim	3(30.0%)	7(70.0%)	1.00				
Mother's marital status							
Married	48(37.8%)	79(62.8%)	1.10	0.56	2.17	0.08	0.778
Single	19(37.3%)	32(62.7%)	1.00				

Father's age in years							
20-25	11(42.3%)	15(57.7%)	1.22	0.34	4.38	0.10	0.758
26-30	24(42.1%)	33(57.9%)	1.21	0.39	3.79	0.11	0.741
31-35	7(25.0%)	21(75.0%)	0.56	0.15	2.09	0.76	0.385
36-40	6(37.5%)	10(62.5%)	1.00				
Father's level of education							
Primary	13(43.3%)	17(56.7%)	1.97	0.63	6.11	1.37	0.242
Secondary	28(38.9%)	44(61.1%)	1.64	0.61	4.42	0.94	0.331
College/University	7(28.0%)	18(72.0%)	1.00				
Father's religion							
Christian	45(38.8%)	71(61.2%)	1.69	0.43	6.71	0.57	0.451
Muslim	3(27.3%)	8(72.7%)	1.00				

Abbreviations: OR= Odds Ratio, CI= Confidence Interval, χ^2= Chi-square

4.9 T Test Analysis of Birth Weight and Umbilical Cord Infection

T test was conducted to examine if there were differences in mean of birth weight of the baby and umbilical cord infection (Table 4.7). However, there was no significant association between them (P= 0.457)

Table 4. 7: T Test Analysis of Birth Weight and Umbilical Cord Infection

Group variable	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Umbilical cord infection							
Present	67	3.1299	0.38613	0.04717	-0.745	176	0.457
Absent	111	3.1748	0.39161	0.03717			

4.10 Association between Socio-economic Characteristics and Umbilical Cord Infection

An analysis of the relationship between socio-economic characteristics and umbilical cord infection is presented in Table 4.8. The proportion of cord infection among babies was significantly lower among households with electricity supply (34.9%) **[OR=0.18; 95%CI=0.05-0.69; P=0.006]** when compared to those households without electricity

supply (75.0%). Households getting water through handcart had significantly high prevalence of babies with umbilical cord infections (64.3%) **[OR=3.29; 95%CI=1.05-10.28; P=0.032]** than to those getting water through pipe line (35.4%). Mothers using communal toilets had significantly increased proportion of babies with umbilical cord infection (42.7%) **[OR=2.13; 95%CI=1.05-4.32; P=0.033]** compared to those using individual/private toilets (25.9%).

Table 4. 8: Association Between socio-economic Characteristics and Umbilical Cord Infection

Variables	Cord infection		OR	95%CI		χ^2 value	χ^2 test
	Present, n(%)	Absent, n(%)		Lower	Upper		P value
Mother's occupation							
None	26(43.3%)	34(56.7%)	1.53	0.51	4.62	0.57	0.451
Casual	11(42.3%)	15(57.7%)	1.47	0.42	5.13	0.36	0.549
Self employed	24(32.4%)	50(67.6%)	0.96	0.32	2.87	0.01	0.942
Permanently Employed	6(33.3%)	12(66.7%)	1.00				
Nature of house							
Permanent	44(34.9%)	82(65.1%)	0.61	0.28	1.33	1.54	0.214
Semi-permanent	8(40.0%)	12(60.0%)	0.76	0.24	2.35	0.24	0.628
Temporally	15(46.9%)	17(53.1%)	1.00				
Ownership of house							
Self	5(38.5%)	8(61.5%)	1.04	0.33	3.32	0.00	0.949
Rental	62(37.6%)	103(62.4%)	1.00				
Availability of electricity							
Yes	58(34.9%)	108(65.1%)	**0.18**	**0.05**	**0.69**	**7.65**	**0.006**
No	9(75.0%)	3(25.0%)	1.00				
Source of water							
Handcart	9(64.3%)	5(35.7%)	**3.29**	**1.05**	**10.28**	**4.60**	**0.032**
Piped	58(35.4%)	106(64.6%)	1.00				
Type of toilet							
Pit	24(43.6%)	31(56.4%)	1.44	0.75	2.76	1.22	0.270
Flash	43(35.0%)	80(65.0%)	1.00				
Ownership of toilet							
Communal	53(42.7%)	71(57.3%)	**2.13**	**1.05**	**4.32**	**4.53**	**0.033**
Individual	14(25.9%)	40(76.1%)	1.00				

Abbreviations: OR= Odds Ratio, CI= Confidence Interval, χ^2= Chi-square

4.11 Obstetric Related factors Associated with Umbilical Cord Infection

Table 4.9 shows the bivariate analysis of relationship between obstetrical related factors and occurrence of umbilical cord infection. There was a significant increase in proportion of babies with umbilical cord infection among primipara mothers (44.8**%) [OR=3.38; 95%CI=1.28-8.91; P=0.014]** than those with 3 parity and above (19.4%).

However, there was no significant association (P<0.05) observed between umbilical cord infection of the baby and the other obstetrical related variables.

Table 4. 9: Obstetric Related factors Associated with Umbilical Cord Infection

Variables	Cord infection		OR	95%CI		χ^2 value	χ^2 test
	Present, n(%)	Absent, n(%)		Lower	Upper		P value
Place of ANC attendance							
Pumwani	18(38.3%)	29(61.7%)	1.86	0.52	6.67	0.91	0.339
Other public facility	45(39.1%)	70(60.9%)	1.93	0.59	6.35	1.17	0.280
Private	4(25.0%)	12(75.0%)	1.00				
No of ANC visits							
1	6(54.5%)	5(45.5%)	2.73	0.77	9.67	2.43	0.119
2	6(37.5%)	10(62.5%)	1.37	0.45	4.11	0.31	0.580
3	26(46.4%)	30(53.6%)	1.97	1.00	3.91	3.80	0.051
4 and above	29(30.5%)	66(69.5%)	1.00				
Place of birth							
PMH	41(36.0%)	73(64.0%)	0.82	0.44	1.54	0.38	0.538
Other health facility	26(40.0%)	38(59.4%)	1.00				
Mode of delivery							
C/S	29(34.9%)	54(65.1%)	0.81	0.44	1.48	0.48	0.487
SVD	38(40.0%)	57(60.0%)	1.00				
Parity							
1	47(44.8%)	58(55.2%)	**3.38**	**1.28**	**8.91**	**6.04**	**0.014**
2	14(33.3%)	28(66.7%)	2.08	0.70	6.25	1.72	0.190
3 and above	6(19.4%)	25(80.6%)	1.00				
Problems encountered during labor							
Yes	22(36.1%)	39(63.9%)	0.90	0.48	1.72	0.10	0.754
No	67(37.6%)	111(62.4%)	1.00				

Abbreviations: OR= Odds Ratio, CI= Confidence Interval, χ^2= Chi-square

4.12 Relationship between Child Cord care Knowledge/Practices and Umbilical Cord Infection

The relationship of knowledge/practice on child cord care by mothers and umbilical cord infection among neonates is shown in Table 4.11. Mothers who ever heard of umbilical cord infection tend to have significantly reduced prevalence of babies with cord infection (27.4%) **[OR=0.47; 95%CI=0.25-0.89; P=0.019]** compared to those who indicated otherwise (44.8%). The proportion of umbilical cord infection was lower among babies whose umbilical cord was tied with cord clamp (36.1%) than with thread (66.7%). However, this difference was not significant [OR=0.28; 95%CI=0.07-1.17; P=0.065].

Babies who initiated breastfeeding after one hour of delivery were significantly more likely to develop cord infection (45.1%) **[OR=2.52; 95%CI=1.28-4.95; P=0.007]** than those who initiated one hour and less (24.6%). Babies whose mothers applied saliva to care the cord had significantly higher prevalence of umbilical cord infection (64.3%) **[OR=4.41; 95%CI=1.36-14.28; P=0.013]** than babies whose mothers practiced air drying (29.0%). Babies who bathed with hand/body soap or Dettol had significantly more babies with cord infection (43.5%) **[OR=2.31; 95%CI=1.11-4.82; P=0.023]** than those babies who bathed without any substances to the bath water (25.0%). Similarly, mothers who were using basin to wash their hands tend to have significantly more babies with cord infection (50.0%) **[OR=2.91; 95%CI=1.55-5.48; P=0.001]** than those who were using running water (25.6%).

Table 4.10: Relationship between Child Cord Care Knowledge/Practices and Cord Infection

Variables	Cord infection		OR	95%CI		χ^2 value	χ^2 test P value
	Present, n(%)	Absent, n(%)		Lower	Upper		
Ever heard of umbilical cord infection							
Yes	20(27.4%)	53(72.6%)	**0.47**	**0.25**	**0.89**	**5.53**	**0.019**
No	47(44.8%)	58(55.2%)	1.00				
Equipment used to ligate the umbilical cord							
Cord clamp	61(36.1%)	108(63.9%)	0.28	0.07	1.17	3.40	0.065
Thread	6(66.7%)	3(33.3%)	1.00				
Initiation of breast feeding							
>1hour	51(45.1%)	62(54.9%)	**2.52**	**1.28**	**4.95**	**7.40**	**0.007**
≤1hour	16(24.6%)	49(75.4%)	1.00				
Staying with the baby in the same room							
Yes	60(36.1%)	106(63.9%)	0.40	0.12	1.33	2.35	0.125
No	7(58.3%)	5(41.7%)	1.00				
Thermal care							
Wearing hat	36(47.4%)	40(52.6%)	1.80	0.69	4.71	1.44	0.230
Warming the room	7(41.2%)	10(58.8%)	1.40	0.39	5.06	0.26	0.608
Wrapping the baby warmly	16(26.2%)	45(73.8%)	0.71	0.26	1.98	0.43	0.513
Skin-to-skin contact	8(33.3%)	16(66.7%)	1.00				
Methods used to care for baby's cord							
Apply saliva	9(64.3%)	5(35.7%)	**4.41**	**1.36**	**14.28**	**6.12**	**0.013**
Apply spirit	20(44.4%)	25(55.6%)	1.96	0.94	4.06	3.26	0.071
Applying warm salty water	9(47.4%)	10(52.6%)	2.20	0.81	5.98	2.40	0.121
Air dry	29(29.0%)	71(71.0%)	1.00				
Whether wearing the diaper above or below the cord							
Above cord	32(39.0%)	50(61.0%)	1.12	0.61	2.05	0.12	0.725
Below cord	35(36.5%)	61(63.5%)	1.00				
Bathing practice							
Not yet (3-13 days)	7(38.9%)	11(61.1%)	1.27	0.24	6.82	0.08	0.778
Every day	57(37.7%)	94(62.3%)	1.21	0.29	5.04	0.07	0.791
Every other day or more	3(33.3%)	6(66.7%)	1.00				
Bathing was started after delivery							
First day	17(41.5%)	24(58.5%)	1.15	0.54	2.44	0.13	0.724
Second day	16(33.3)	32(66.7%)	0.81	0.39	1.69	0.32	0.573
Third day and above	34(38.2%)	55(61.8%)	1.00				

Substances (hand/body Soap or Dettol) added to the bath water							
Yes	47(43.5%)	61(56.5%)	**2.31**	**1.11**	**4.82**	**5.14**	**0.023**
No	13(25.0%)	39(75.0%)	1.00				
Ways of bathing the baby							
Immersion in water	13(39.4%)	20(60.6%)	0.90	0.40	2.05	0.06	0.807
Pour water over baby	11(26.8%)	30(73.2%)	0.51	0.23	1.15	2.65	0.104
Wipe baby with cloth	36(41.9%)	50(58.1%)	1.00				
How do you wash your hands							
Basin	44(50.0%)	44(50.0%)	**2.91**	**1.55**	**5.48**	**11.33**	**0.001**
Running water	23(25.6%)	67(74.4%)	1.00				

Abbreviations: OR= Odds Ratio, CI= Confidence Interval, χ^2= Chi-square

4.13 Multivariate Analysis of factors Associated with Cord Infection among Neonates

Stepwise logistic regression was applied to identify the variables independently associated with umbilical cord infection among neonates aged 3 to 28 days (Table 4.11). Twelve (12) factors that showed significant association (P $\leq$0.05) during bivariate analysis were considered together in multivariate analysis. Upon fitting the factors using binary logistic regression and specifying *'backward conditional'* method with removal at p<0.05, six (6) factors remained in the final analysis as shown in Table 4.11.

Female babies were 2.68 fold more likely to develop cord infection compared to their male counterparts **[AOR=2.68; 95%CI=1.19-6.04; P=0.017]**. Babies whose mothers attained primary education and secondary school education were about 7 and 6 times respectively more likely to acquire cord infection than those whose mothers had college/university education**, ([AOR=7.21; 95%CI=1.62-32.13; P=0.026]** and **[AOR=6.00; 95%CI=1.49-24.20; P=0.010]** respectively). Households getting water through handcart had significantly about 8 fold more likely to have babies with cord infections compared to those getting water through pipe line **[AOR=8.19; 95%CI=1.37-48.94; P=0.021]**. Primipara mothers had 10.38 times more likely to have babies with umbilical cord infection than mothers with three parity and above **[AOR=10.38; 95%CI=2.35-45.97; P=0.002]**. Babies who initiated breastfeeding after one hour of delivery were about 2.5 times more likely to develop cord infection than those who

initiated one hour and less **[AOR=2.61; 95%CI=1.11-6.11; P=0.027]**. Babies who bathed with hand/body soap or Dettol were significantly 3 times more likely to contract umbilical cord infection than those who bathed without any substance added to the bath water **[AOR=3.07; 95%CI=1.24-7.58; P=0.015]**.

Table 4.11: Multivariate Analysis for factors Associated with Cord Infection among Neonates

Predictor	AOR	95%CI		χ^2 test
		Lower	Upper	P value
Full model				
Baby's sex				
Female	3.13	1.28	7.67	0.013
Male	1.00			
Mother's level of education				
Primary	3.09	0.59	16.19	0.183
Secondary	3.70	0.85	16.06	0.080
College/University	1.00			
Availability of electricity				
Yes	0.36	0.05	2.44	0.293
No	1.00			
Source of water				
Handcart	6.87	0.98	48.03	0.052
Piped	1.00			
Ownership of toilet				
Communal	0.92	0.30	2.77	0.879
Individual	1.00			
Parity				
1	5.10	0.93	27.94	0.060
2	1.59	0.26	9.74	0.614
3 and above	1.00			
Ever heard of umbilical cord infection				
Yes	0.61	0.25	1.46	0.262
No	1.00			
Initiation of breast feeding				
>1hour	2.16	0.86	5.43	0.102
≤1hour	1.00			
Methods used to care for baby's cord				
Apply saliva	3.00	0.74	12.21	0.142
Apply spirit	1.65	0.61	4.42	0.324
Applying warm salty Water	0.58	0.14	2.35	0.449
Air dry	1.00			

Substances (hand/body soap or Dettol) added to the bath water				
Yes	2.64	0.98	7.12	0.056
No	1.00			
How do you wash your hands				
Basin	1.76	0.73	4.28	0.209
Running water	1.00			
Whether the child had generalized/nappy rash				
Yes	1.34	0.53	3.35	0.534
No	1.00			
Final/reduced model				
Baby's sex				
Female	**2.68**	**1.19**	**6.04**	**0.017**
Male	**1.00**			
Mother's level of education				
Primary	**7.21**	**1.62**	**32.13**	**0.026**
Secondary	**6.00**	**1.49**	**24.20**	**0.010**
College/University	**1.00**			
Source of water				
Handcart	**8.19**	**1.37**	**48.94**	**0.021**
Piped	**1.00**			
Parity				
1	**10.38**	**2.35**	**45.97**	**0.002**
2	2.99	0.62	14.48	0.174
3 and above	**1.00**			
Initiation of breast feeding				
>1hour	**2.61**	**1.11**	**6.11**	**0.027**
≤1hour	**1.00**			
Substances (hand/body soap or Dettol) added to the bath water				
Yes	**3.07**	**1.24**	**7.58**	**0.015**
No	**1.00**			

Abbreviations: AOR= Adjusted odds Ratio, CI= Confidence Interval, χ^2= Chi-square

CHAPTER FIVE: DISCUSSION

5.0 Introduction

This chapter discusses the findings from quantitative data and recommendations based on research findings of the independent variables associated with umbilical cord infection. The findings demonstrate that baby's sex, maternal level of education, parity, source of water, breast-feeding initiation and adding hand/body or Dettol to the baby's bath water are the independent predictors of umbilical cord infection among neonates aged 3-28 days. To our knowledge, this is the first study that has been conducted in Kenya to determine the contributing factors of cord infection at Pumwani Maternity Hospital.

5.1 Prevalence of Umbilical Cord Infection

The finding of the study showed that the prevalence of umbilical cord infection among neonates was high at 37.6% (n=67), while in other developing countries it is 6.18% (Sawardekar, 2004) and in the developed world is around 0.7% (Mullany et al., 2006). However, the figure is relatively comparable to a study conducted among neonates admitted to an African general paediatric ward in Tanzania (Winani, 2007) which reported omphalitis at 28%. No previous study on the prevalence of omphalitis has been reported in Kenya, to our knowledge. The results further showed that 49.3% (n=34), of the neonates with cord infection presented with redness, 37.3% (n=66) presented with pus discharge while swelling was at 13.4% (n=24). The percentage of pus discharge was high which indicated the severity of infection in this study. The prevalence of neonatal cord infection varies with considerable fluctuation over time and geographical location and even from hospital to hospital. These variations may be related to the nature of labour conduction and environmental conditions (Sawardekar, 2004) and also knowledge and practice of cord care by mothers.

Pumwani Maternity Hospital nurses were on strike/go slow during the time of the data collection. Very few nurses were on duty alongside those on managerial posts. More so strike may imply dissatisfied workers with grievances and unmet needs, affecting their attitude and motivation to work.

This could have compromised the quality of care like observation of aseptic techniques and hand washing practices during delivery.

In addition, work overload on the few nurses could affect the general labour monitoring. This study depended on only the subjective information from the mothers which was mostly based on what they had been told by the health care provider during labour. They were asked if they had encountered any problem during labour and 26.2% (n=47), indicated that they had foetal distress, 19.7% (n=35) indicated that they had prolonged labour and 8.2% (n=16) had obstructed labour. Skilled management of labour using a partograph, to monitor progress and the condition of a woman and her baby during labour, is key to the appropriate prevention and treatment of prolonged labour and all its complications (USAID 2010). Considering the prevailing strike, partographing of labour may not have been feasible at the time of data collection and this could have highly contributed to the prevalence of omphalitis. Inadequate Health education to the mothers concerning labour, breast feeding and general care of self and the neonate could also have contributed to the high prevalence of omphalitis among the neonates in this study.

5.2 Factors Associated with Umbilical Cord Infection

In this study interestingly female babies were found more likely to develop cord infection compared to their male counterparts after adjustment was made for other associated factors. This could be due to some preference/favouritism towards male children with concomitant disregard for daughters. It has been reported that more male infants were treated with beneficial cord care than the female infants probably because of the preference of the male child over the female (Labeodan, 2005). However, the finding contradicts with two hospital-based reports from developing countries that reported increased risk among males (Sawardekar, 2004; Faridi et al., 1993). These differences could be closely linked with culture or traditional norms and gender issues which could influence maternal attitudes towards girl child. This might be a reflection of preferential treatment among the opposite sex and provision of better quality of umbilical cord care. There is need for further research on this area.

The result of this study indicated that late initiation of breastfeeding was a predicting factor for umbilical cord infection. Babies who were initiated breastfeeding after one hour of delivery were about 2.5 times more likely to develop umbilical cord infection than those initiated within one hour of birth. This is in agreement with a study carried out in Tanzania by Mullany et al. (2009) who reported that breast-feeding within the first hour after birth was associated with lower risk of infection (Mullany et al., 2009). There are several biological mechanisms thought to account for the synergy between initiation of breastfeeding and cord infection. Breast milk contains secretory IgA, lysozymes, white blood cells, and lactoferrin and has been shown to encourage the growth of healthy lactobacilli and reduce the growth of Escherichia coli and other gram-negative pathogenic bacteria (Edmond et al., 2010). Initiation of breast feeding within the first hour of life is also recommended by WHO (WHO, 1998).

According to this study, the educational level of mothers had a strong relationship with the umbilical cord status of their babies. Babies whose mothers had attained primary level education and those who had secondary school education were seven and six times respectively more likely to acquire umbilical cord infection than those whose mothers had college/university education. The reasons for the increased prevalence of cord infection in this group may include poor hygiene, overcrowding in homes, lack of clean, safe water and poor cord care practices (Ogunlesi et al., 2011; Ogunlesi and Ogunfowora, 2010). It has also been reported by Sobita, (2010) that higher level of education among mothers with new-born babies had a positive impact on clean cord care practice. This may perhaps further underscore the importance of female education.

In this study, mothers whose households were getting water through handcart were significantly more likely to have babies with umbilical cord infection compared to those getting piped water. Such water may be got from unsafe sources. Water can harbour dangerous micro-organisms especially bacteria. This might put both mothers and their babies at grave risk of contracting a potentially fatal infection. Moreover, the water might be contaminated in the process of collecting it from the source all the way to the consumers. Mothers using this kind of water may transfer the micro-organisms to their

babies or the babies might contract the infection while bathing. But there are no previous reports of the role of using water from handcart on umbilical cord infection.

Parity was significantly associated with umbilical cord infection among the babies. Babies of Primiparas mothers were more likely to have umbilical cord infection than those born of multiparous mothers who had more than three deliveries. Babies of multiparous mothers could be less likely to have umbilical cord infection because of experience gathered by mothers over time from previous deliveries. A study carried out on risk factors for neonatal sepsis in Soweto, South Africa demonstrated that first birth remained strongly associated with sepsis (Schrag et al., 2012). Furthermore, there is evidence that primiparity is a risk factor for sepsis (Soman et al., 1985). This could be because women delivering for the first time typically have longer duration between rupture of membrane and delivery. This longer duration between rupture of membrane and delivery may in turn contribute to umbilical cord infection. Besides this, primiparous mothers are more likely to be influenced by other caregivers on the umbilical cord care. There is therefore increased need for health education on care of the umbilical cord for primiparous mothers.

The study revealed that babies who bathed with hand/body soap or Dettol were significantly more likely to contract umbilical cord infection than those who bathed without any hand/body soap or Dettol. According to CDC guidelines of hand hygiene (2003), hand soap and antiseptic products, can become contaminated or support the growth of microorganisms and can spread the same from one person to another. This could explain this occurrence and it can be argued that the hand/body soaps served as a medium of micro-organism transmission. However, no previous studies were found to support this association between umbilical cord infection and hand/body soap use. WHO (1998) advocates for dry umbilical cord care (keeping the cord clean without application of anything and leaving it exposed to air or loosely covered by a clean cloth). However, WHO recommends topical antiseptics (eg, chlorhexidine) in situations where hygienic conditions are poor and/or infection rates are high (WHO, 1998).

Even though availability of electricity, using communal toilets, ever heard of umbilical cord infection, applying saliva on baby's umbilical cord, washing hands in a basin and babies having generalized/nappy rash were significantly associated with umbilical cord infection at the bivariate analysis. Nevertheless, it was not significant after adjustment was made for other variables at multivariate analysis. Most of these variables are socio-economic characteristics and there is evidence that socioeconomic factors could predispose neonates to sepsis including umbilical cord infection. This relationship of culture proven sepsis and lower socio-economic status has been identified in other studies (Ogunlesi et al., 2011; Ogunlesi and Ogunfowora, 2010).

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This section contains conclusions, recommendations and recommendation for further research.

6.2 Conclusions

The findings of the study revealed that the prevalence of umbilical cord infection among neonates was high (37.6%). Of these, 49.3% presented with redness and 37.3% with pus discharge while13.4% presented with swelling.

Multivariable logistic regression analysis shows that the significant associated factors with umbilical cord infection were:

- Female babies were 2.68 fold more likely to develop cord infection compared to their male counterparts.
- Babies whose mothers attended primary school were about 7 times and attended secondary school were 6 times more likely to acquire cord infection than to those whose mothers attended college/university respectively.
- Households getting water through handcart were about 8 fold more likely to have babies with cord infections compared to those getting water through pipe line.
- Babies from primipara mothers were 10.38 times more likely to have umbilical cord infection than multiparous mothers who had three deliveries and above.
- Babies who initiated breastfeeding after one hour of delivery were about 2.5 times more likely to develop cord infection than those who initiated one hour and less.
- Babies who bathed with hand/body soap or Dettol were 3 times more likely to contract umbilical cord infection than those who bathed without any substance added to the bath water.

6.3 Recommendations

The following recommendations are made based on the findings of this study:

1. Mothers should be advised to initiate breastfeeding within 1hour of delivery (as per the WHO recommendation) through campaigning by the Ministry of Health.
2. It is also recommended that standard of living and education of women should be improved by the government.

6.4 Areas of Further Research

Further studies are required in the future to cover the following subjects:

1. Similar studies on community and hospital based need to be carried out to determine the prevalence of cord infection and its associated factors and also to generate more supportive evidence.
2. Analytical research or prospective study needs to be done to cater for specific risk factors of cord infection among neonates.
3. To carry out regular collection of haphazard swabs in the hospitals to avoid high incidence of bacterial infections leading to sepsis.

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APPENDICES

Appendix I: Informed Consent Form

TITLE: **Assessment Determinants of Umbilical Cord Infection among Neonates at Pumwani Maternity Hospital.**

Researcher: **LUCY KINANU JOSEPH.**

School of Nursing Sciences

University of Nairobi

Cell: 0725909246

E-mail: kinanulucy13@gmail.com

Supervisors:

1. **MRS. EUNICE ODHIAMBO,**

   E-mail: ajode@uonbi.ac.ke

   Phone No. 0722358164.

2. **Dr. JAMES MWAURA,**

   E-mail: jmwaura@uonbi.ac.ke

   Phone No. 0722790202.

INTRODUCTION

You are cordially invited to participate in this research which will be carried out at Pumwani Maternity Hospital**.**

Study purpose

The purpose of this study is to assess the determinants of umbilical cord infection among newborns at Pumwani Maternity Hospital.

Procedure

If I agree to participate, I understand that:

1). The study is done in partial fulfillment for the award of Master of Science in Nursing degree
of the University of Nairobi.

2). I was selected randomly to participate in this study.

3). I will participate in the study at Pumwani maternity hospital at my convenient time.

4). A questionnaire that will take 30 – 45 minutes to complete will be filled.

Benefits

There are no direct benefits for me. However it will help in understanding of the determinants of umbilical cord infection among neonates at Pumwani Maternity Hospital. Moreover, any neonate noted to have signs of cord infection will be referred to the clinician on duty who is usually stationed in the triaging room of child welfare clinic.

Risk

There are no potential risks foreseen to be involved as I will only be required to respond to questions in the questionnaire and the state of my baby's umbilical cord examined by the researcher and incase found infected my baby will be taken to clinician and treated.

Confidentiality

The results of this study will be discussed with me. All other information except for this disclosure will be considered confidential and used only for research purpose. My identity will be kept confidential in as far as the law requires.

Questions

The research assistant or principal investigator will answer all my questions.

Right to refuse or withdraw

My participation is entirely voluntary but essential to the success of this study. I am free to refuse to take part or withdraw at any given time without affecting my future relationship with the school of Nursing of the University of Nairobi or PMH.

In case you would want to know the results of this study or you have any complaints, dissatisfaction or disagreements, please do not hesitate to contact the following:

1. Lucy Kinanu Joseph, Phone No. 0725909246.
2. Chairman KNH/UON-ERC, Box 20723 Kenyatta National Hospital. Tel 020-2726300-9, Extension 44102.

Consent

I have been clearly explained and fully understand the nature and purpose of this study and freely consent to participate.

Respondent's signature ……. Date ……

I the undersigned have fully explained the relevant details of this study to the person whose signature has been appended above.

Investigator's/Research assistant's signature …… Date ……..

Appendix II: Ridhaa Ya Kushiriki Katika Utafiti

UTANGULIZI

Kwa unyenyekevu unaombwa kushiriki kwa utafiti utakaofanyika hapa hospitali ya uzazi ya pumwani.

Jina la Utafiti

UCHUNGUZI WA VIGEZO VINAVYOCHANGIA MAAMBUKIZI YA KITOVU KWA WATOTO WACHANGA KATIKA HOSPITALI YA UZAZI YA PUMWANI.

Mtafiti

Lucy Kinanu Joseph, Shule ya Uuguzi, Chuo Kikuu cha Nairobi.

Wasimamizi;

Eunice Odhiambo, Numbari ya simu; 0722358164

Dr. James Mwaura, Nambari ya simu; 0722790202

Kusudi la Utafiti

Lengo la utafiti ni kuhakikisha tathmini ya vigezo vinavyochangia maambukizi ya kitovu kwa watoto wachanga hospitali ya uzazi ya pumwani.

Utaratibu

Nikikubali kushiriki, ninaelewa kwamba:

1) Utafiti huu unafanyika kwa ajili ya kutimiliza tuzo ya uzamili wa sayansi ya shahada ya uuguzi katika chuo kikuu cha Nairobi.

2) Nilichaguliwa nasibu kwa kushiriki katika utafiti huu.

3) Nitashiriki katika utafiti hapo katika hospitali ya Hospitali ya uzazi ya Pumwani.

4) Nitatakiwa kujibu maswali katika dodoso itakayochukua muda wa dakika 30-45 na pia motto wangu atangaliwa kama ana dalili zozote za maambukizi ya kitovu.

Faida

Hakuna faida ya moja kwa moja kwa ajili yangu. Hata hivyo, itasaidia katika kuelewa vigezo vinavyo chaangia maambukizi ya kitovu kwa watoto wachanga katika hospitali ya uzazi ya pumwani.

Hatari

Hakuna uwezekano wa hatari kuwepo kwani nitatakiwa tu kujibu maswali kwenye dodoso itakayochukua munda kama wa dakika 30-45. Pia kitovu cha mtoto wangu

kitaangaliwa na mtafiti na kikiwa kina maambukizi, mtoto wangu ataonekana na daktari na atatibiwa.

Siri

Matokeo ya utafiti huu yatajadiliwa pamoja nami. Habari yoyote nyingine isipokuwa hii itazingatiwa siri na kutumika tu kwa madhumuni ya utafiti. Utambulisho wangu utakuwa siri na kutumika tu kwa madhumuni ya utafiti. Utambulisho wangu utakuwa siri kama sheria inavyohitaji.

Maswali

Msaidizi wa utafiti au mkuu wa uchunguzi ndiye atakaye jibu maswali yangu.

Haki ya kukataa au kujiondoa

Ushiriki wangu ni kabisa hiari lakini muhimu kwa mafanikio ya utafiti huu. Mimi ni huru kukataa au kujiondoa wakati wowote bila ya kuathiri uhusiano wangu baadaye na shule ya uuguzi ya chuo kikuu cha Nairobi au hospitali ya uzazi ya Pumwani.

Kama ungependa kujua matokeo ya utafiti ama una malalamiko yoyote , tafadhali usisite kuwasiliana na wafuatao:

1. Lucy Kinanu Joseph, Phone No. 0725909246
2. Mwenyekiti KNH/UoN-ERC, SLP 20723 Hospitali ya Taifa ya Kenyatta, Nambari ya simu 020-2726300-9 Ugani 44102

Ridhaa

Nimeelezwa kikamilifu na kuelewa asili ya lengo la somo hili na kwa uhuru napeyana ridhaa ya kushiriki.

Sahihi ya aliyehojiwa …… Tarehe ……

Mimi mtafiti, kwa kikamilifu nimeeleza maelezo muhimu ya utafiti huu kwa mtu ambaye saini yake imewekwa hapo juu.

Sahihi ya mpelelezi/msaidizi wa utafiti …… Tarehe ……

Appendix III: QUESTIONNAIRE

SERIAL NUMBER (Nambari).……

DATE (Tarehe): _____

TOPIC: ASSESSMENT DETERMINANTS OF UMBILICAL CORD INFECTION AMONG NEONATES AT PUMWANI MATERNITY HOSPITAL.

(JINA LA UTAFITI): UCHUNGUZI WA VIGEZO VINAVYOCHANGIA MAAMBUKIZI YA KITOVU KWA WATOTO WACHANGA KATIKA HOSPITALI YA UZAZI YA PUMWANI.

INSTRUCTIONS (MAAGIZO)

You are kindly requested to fill inn this questionnaire as correctly and completely as possible (Tafadhali unaombwa kujaza dodozo hili kwa ukweli na ukamilifu iwezekanavyo).

Do not write participant's name on the questionnaire. (Usiandike jina kwenye dodozo)

Please respond with a tick (√) to ONLY the correct response in the box provided for questions with options to choose from (Itikia kwa kuweka alama hii (√) kwa jibu lililosahihi PEKEE katika kisaduku kilichopeyamwa).

Respond as required (briefly) to the rest of the questions (kwa maswali hoyo mengine tafadhali jibu kwa kifupi jinsi inavyo hitajikana).

DERMOGRAFIC DATA; CARE TAKER (Habari ya mlizi)

1. Age in years: _____
   Umri (miaka) _____
2. Level of education: Primary ☐ , secondary ☐ , College ☐, none ☐
   Masomo Yako: Msingi ☐ , upili ☐, chuo ☐, hakuna ☐.
3. Religion: Christian ☐, Muslim ☐, others……. (Specify).
   Dini: Ukristo ☐ , uislam ☐, zingine ---------- (eleza)
4. Married: Yes ☐ No ☐,
   Umeolewa: ndio ☐, la ☐.

5. Employment: Yes ☐ No ☐
   Ajira: Ndio ☐, la ☐

SOCIAL ECONOMIC DATA (Hali ya kiuchumi).

1. Nature of house: Permanent ☐ , semi- permanent ☐ , temporally {timber, iron sheet, mud ☐.
   Aina ya nyumba: Mawe ☐ , mawe na mbao ☐
2. Ownership: Self ☐ , rental ☐
   Umiliki: binafsi ☐, kukondisha ☐
3. Water source: Piped ☐ , River ☐ , well ☐ .
   Chanzo cha maji: Mfereji ☐, mto ☐ , kisima ☐
4. Type of toilet: pit ☐, flash ☐ , Others……..(specify)
   Aina ya choo: shimo ☐, choo cha maji ☐, zingine---------- (eleza)
5. Ownership: Individual ☐, Communal ☐, public ☐, others…….(specify)
   Umiliki: Binafsi ☐, jumuiya ☐, umma ☐, zingine---------- (eleza)
6. What is the average monthly income of the household: ……
   Wastani wa kila mwezi mapato ya kaya ----------.

Spouse information (Habari ya mume)

6. Age…….
   Umri {miaka} ----------
7. Educational level: Primary ☐, secondary ☐, College ☐ none ☐.
   Masomo Yake: Msingi ☐, upili ☐, chuo ☐, hakuna ☐.
8. Religion: Christian ☐, Muslim ☐, others……. (Specify).
   Dini: Ukristo [ ], uislam ☐, zingine ---------- (eleza)
9. Employment: Yes ☐ No ☐
   Ajira: Ndio ☐, la ☐
10. Occupation: permanent ☐, casual ☐, self ☐, none ☐
    Kazi: Kudumu ☐, kawaida ☐, binafsi ☐, hakuna ☐.

OBS/ GYNAE REPORT (Habari ya uja uzito)

1. Place of ANC attendance: Pumwani ☐, Other public facility ☐, Private ☐ None ☐

   Clinic kabla ya kujifungua: Pumwani ☐, hospitali ya serikali ☐, hospitali ya binafsi ☐ hakuna ☐.
2. Parity: ……

   Usawa: ----------
3. No of ANC visits……

   Ulienda cliniki kabla ya kujifungua mara ngapi ----------.
4. Place of birth: PMH ☐, other public facility ☐, Private ☐ Home ☐.

   Ulijifungulia wapi: Pumwani ☐, hospitali ya serikali ☐, hospitali ya binafsi ☐ nyumbani ☐.
5. Gestation: …….

   Ulijifungua mimba ikiwa na miezi ngapi----------
6. Duration of labour……..

   Uchungu wa kuzaa ulichukua muda gani----------
7. Duration of membrane rupture…….

   Ulichukua mda gani tangu utando kupasuka na kujifungua----------
8. Nature of liquor……..

   Majimaji ya uzazi yalikuwa rangi gani----------
9. Mode of delivery: ……

   Jinsi ya kujifungua----------

BABY'S REPORT (Habari za motto)

1. Sex Male ☐ Female ☐.

   Jinsia: mume ☐, mke ☐
2. Age in days: ----------

   Umri (siku) ----------
3. Birth weight: ……..

Uzito wa kuzaliwa ----------

4. Cried at birth: Immediately ☐, ≤5minutes ☐, ≥ 6minutes ☐.
   Kulia wakati wa kuzaliwa: mara moja ☐, kabla ya dakika tano ☐, baada ya dakika tano ☐
5. Initiation of breast feeding: ≤1hour ☐ more than 1hour ☐.
   Kuansisha kunyonyesha: kabla lisaa limoja ☐, baada ya lisaa limoja ☐.
6. Has the child experience any of the following health problems during interview
   a. Generalized rash
   b. Nappy rash
   c. Others: _____

KNOWLEDGE (Ufahamu)

1. When do you wash Hands and how? ----------
   Unanawa mikono wakati gani? ----------
2. What do you use to tie the umbilical cord? Cord clump ☐, Thread ☐, others……. (Specify).
   Unatumia nini kufungia kitovu? Chaka ya kitofu ☐, uzi ☐, zingine---------- (eleza)
3. What is used to cut the umbilical Cord? Scissors ☐, Razor blade ☐, Knife ☐, others…… (Specify).
   Unatumia nini kukata kitovu? Makasi ☐, wembe ☐, kisu ☐, zingine---------- (eleza).
4. How long does an umbilical cord take to separate? ----------
   Kitofu uchukua siku ngapi kuachana? ----------
5. How do you care for umbilical cord stump? Nothing ☐, spirit ☐, others----------(specify)
   Kiziki cha kitovu hutuzwa aje? Hakuna ☐, spirit ☐, zingine---------- (eleza)
6. What should be done in case the umbilical cord stump is soiled? ---------- (Explain).

Kiziki cha kitovu kikichafuka hufanywa aje? ---------- (eleza)

7. How should the Diaper/Napkin be applied? …… (Explain).
   Diaper / Kitambaa inafungwa aje? ---------- (eleza)
8. When should breastfeeding be initiated? ----------
   Mtoto akizaliwa anafaa kuanzishwa kunyonya baada ya mda gani? ----------

PRACTICE:

1. When do you wash your hands? ----------
   Ni lini unanawa mikono? ----------
2. How do you wash your hands? ----------
   Ni vipi unanawa mikono? ----------
3. What was used to tie your baby's umbilical cord? Cord clamp ☐, Thread ☐, others……. (Specify).
   Ni nini ilitumiwa kufunga kitovu cha mototo wako? Chaka ya kitofu ☐, uzi ☐, zingine---------- (eleza)
4. What was used to cut your baby's umbilical cord? Scissors ☐, Razor blade ☐, Knife [ ], others…… (Specify).
   Ni nini ilitumiwia kukata kitovu cha mototo wako? Makasi ☐, wembe ☐ ,
   kisu ☐, zingine---------- (eleza).
5. What do you apply on your baby's umbilical cord? Air dry ☐, Spirit ☐, Chlohexidine ☐, others……. (Specify).
   Unatunza aje kiziki cha kitovu cha motto wako? Hakuna ☐, spirit ☐, zingine---------- (eleza)
6. What do you do in case the umbilical cord of your baby is soiled? ---------- (Explain).
   Unafanya aje kama kiziki cha kitovu kimechafuka? ---------- (eleza).

7. How do you apply Diaper/Napkin on your baby?……(Explain-observe)

   Unamfung aje Diaper / Kitambaa motto wako? ---------- (eleza).

8. When did you initiate breastfeeding to your child? ----------

   Ulianzisha kunyonya motto wako baada ya mda gani? ----------

9. Do you always stay with your baby in the same room? Yes ☐, No ☐.

   Unakaa na mtoto kwa chumba kimoja kila wakati? Ndio ☐, la ☐.

Cord status and assessment

1. Has your child's umbilical cord ever appeared; Reddened ☐, swollen ☐, pus ☐, bad smell ☐.

   Je kiziki cha kitovu cha mtoto wako kimewahi kuwa; Chekundu ☐, kufura ☐, usaa ☐, ama harufu mbaya ☐.

2. How long did the umbilical cord stump take to fall off? ----------

   Kiziki cha kitovu cha motto wako kilianguka nyuma ya mda gani? ----------

3. Status of the umbilical cord currently (assessed by the researcher):

   _____

4. Action taken

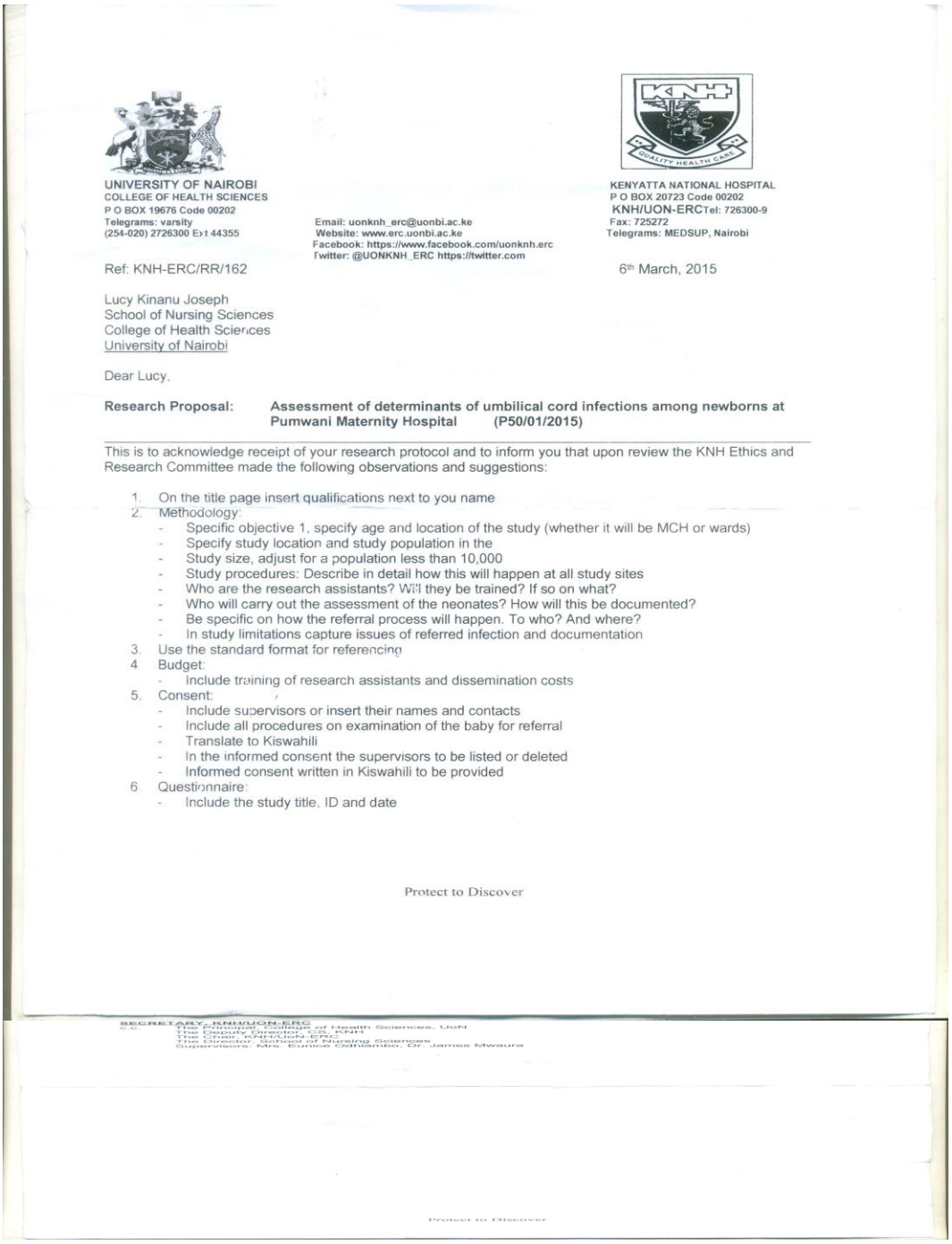
   _____

RESEARCH ASS. NAME: _____

Sign_____ Date: _____

PRINCIPAL RESEARCHER: Sign_____ Date: _____

Appendix IV: Approval Letter from KNH/UON, Research and Ethics Committee



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KENYATTA NATIONAL HOSPITAL
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Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/RR/162

6th March, 2015

Lucy Kinanu Joseph
School of Nursing Sciences
College of Health Sciences
University of Nairobi

Dear Lucy,

Research Proposal: **Assessment of determinants of umbilical cord infections among newborns at Pumwani Maternity Hospital (P50/01/2015)**

This is to acknowledge receipt of your research protocol and to inform you that upon review the KNH Ethics and Research Committee made the following observations and suggestions:

1. On the title page insert qualifications next to you name
2. Methodology:
   - Specific objective 1, specify age and location of the study (whether it will be MCH or wards)
   - Specify study location and study population in the
   - Study size, adjust for a population less than 10,000
   - Study procedures: Describe in detail how this will happen at all study sites
   - Who are the research assistants? Will they be trained? If so on what?
   - Who will carry out the assessment of the neonates? How will this be documented?
   - Be specific on how the referral process will happen. To who? And where?
   - In study limitations capture issues of referred infection and documentation
3. Use the standard format for referencing
4. Budget:
   - Include training of research assistants and dissemination costs
5. Consent:
   - Include supervisors or insert their names and contacts
   - Include all procedures on examination of the baby for referral
   - Translate to Kiswahili
   - In the informed consent the supervisors to be listed or deleted
   - Informed consent written in Kiswahili to be provided
6. Questionnaire:
   - Include the study title, ID and date

Protect to Discover

SECRETARY, KNH/UON-ERC
c.c. The Principal, College of Health Sciences, UoN
The Deputy Director, CS, KNH
The Chairman, KNH/UON-ERC
The Director, School of Nursing Sciences
Supervisors: Mrs. Eunice Odhiambo, Dr. James Mwaura

Protect to Discover

Appendix V: Approval Letter from Pumwani Maternity Hospital

NAIROBI CITY COUNTY

Telephone: 020 344194
Web.www.nairobi.go.ke

City Hall
P. O. Box 30075 - 00100
Nairobi
Kenya

COUNTY HEALTH SERVICES:
PUMWANI MATERNITY HOSPITAL

PMH/DMOH/75/0272/2015

21st April 2015

TO:
Lucy Kinanu Joseph
School of Nursing
University of Nairobi

RE: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that the research entitled "**Assessment of determinants of Umbilical Cord Infections among Newborns at Pumwani Maternity Hospital)**" has been approved.

You are expected to pay Kshs. 6000/- only.

You are hereby allowed to collect data. We look forward to receiving a summary of the research findings upon completion of the study.

Yours sincerely,

DR. L.O. KUMBA
MEDICAL SUPERINTENDENT