THE EFFECT OF DURATION, TIMING AND EXCLUSIVITY OF BREASTFEEDING ON INFANT MORTALITY IN KENYA

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DECLARATION

I hereby declare that this research project is my original work and has not been presented for a degree in any other university.

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DEDICATION

I wish to dedicate this work to Wairimu Wandai; my mother who continues to instill in me the values of determination, patience and persistence. And even though she stepped into a class only once her love for search of knowledge is un-paralleled and her encouragement and prayers during this program has been unceasing. I also dedicate this work to my son Wandai Gitonga for his keen interest in daddy's homework (this project) may the passion for knowledge remain in you forever.

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ABSTRACT

The study seeks to estimate the effect of duration, timing and exclusivity of breastfeeding on infant mortality in Kenya. Infant Mortality Rate (IMR) in Kenya remains significantly high at 39 death per 1000 live births (KNBS and ICF Macro, 2014). Optimal breastfeeding is one of the low cost high impact intervention recommended to effect further declines in infant mortality. The purpose of the study was to establish the effect of duration, timing and exclusivity of breastfeeding on infant mortality taking into account other socio-economic and demographic factors known to affect infant mortality.

The study utilized secondary data from the Kenya Demographic Health Survey (KDHS 2008/09) with a study population of 4937 births to women of reproductive age (15-49) occurring within three years before the survey. Multivariate logistic regression was the main method of analysis. The dependent variable was occurrence of death during infancy while the independent variables considered for analysis were classified into social-economic and demographic proximate factors. Social-economic factors included wealth index and maternal work status, preceding birth interval, perceived size of infant at birth and sex were included as demographic factors in the multivariate analysis.

The life table analysis results shows that infants who were breastfed for more 6 months had a lower mortality risk than those who breastfed for less than 6 months. Logistic regression results established that duration of breastfeeding have strong influence on infant mortality. Infants who were breastfed for more 6 months were less likely to die than those breastfed for 0-6months (OR: 0.020, P<.001). Timing and exclusive breastfeeding were not significantly associated with infant mortality.

The study found longer duration of breastfeeding highly beneficial to infant survival and therefore recommends renewed efforts in the implementation of policies and programmes which promote optimal breastfeeding. Future data collection efforts should focus on the completeness of breastfeeding data to facilitate adequate exploration of the role of time to initiation and exclusivity of breastfeeding on infant mortality.

CHAPTER 1: INTRODUCTION

1.1 Background of the study

Infant mortality refers to deaths occurring to children within their first year of life. The year 2015 is of global importance, it is the year millennium development goals (MDGs) ought to have been achieved. Of relevance to this study is MDG 4 relating to reduction of child mortality by two third in all countries of the world. Substantial effort to reduce child mortality is observed since 1990 but this progress remains insufficient. Africa as in most of the developing world continues to grumble with unacceptable high rates of child mortality, one reason being the slow decline in infant mortality. Kenya infant mortality rate of 39 deaths per 1000 live births is still high (KNBS and ICF Macro, 2014) majority of these deaths occur due infections that are easily preventable in great part through breastfeeding (Huffman, 2001).

Early and exclusive breastfeeding is one of the essential care interventions that have the greatest effect on infant early days (WHO, 2001). Several studies (Clemens, 1999; Arifeen, 2001; Lawrence, 2010) have shown that breastfeeding confers both immune and non-immune benefits on infants and thus held in high regard as a child survival intervention. The Kenya government through a policy statement in the National Food and Nutrition Security Policy (2011) commits to promote early and exclusive breastfeeding in order to achieve proper nutrition for the newborns. This is operationalized in the 2012-2017 National Nutrition Action Plan and optimal breastfeeding is defined as initiation to breastfeeding within one hour after birth, exclusive breastfeeding up to six months and supplementing breastfeeding after six months up to at least 24 months.

The focus on the importance of breastfeeding is shifting from the traditional duration and exclusivity to include time to initiation of breastfeeding also interchangeably termed as ‘timing’ in this study. Delayed initiation of breastfeeding has been associated with higher mortality among newborn in Ghana (Edmond, 2006), Nepal (Mullany, 2008) and India (Garcia, 2010), and early and exclusive breastfeeding on the other hand is associated with improved newborn survival chances. In Kenya only 58 per cent (KNBS et al, 2010) newborns

are breastfed within an hour after birth and 61 per cent (KNBS and ICF Macro, 2014) of children under age 6 months are breast fed exclusively.

In contrast Kazembe (2007) reports a near universal (97 per cent) initiation of breastfeeding within an hour after birth and 71.4 per cent of children under the age of six months are exclusively breastfed in Malawi and this is credited in part as a contributor to the huge reductions in infant mortality rates in Malawi from a high of 143 deaths per 1000 live births in 1990 to the 2013 rate of 44 deaths per 1000 live births (UN IGME, 2014). It's in this backdrop that breastfeeding practices therefore become an important research area that would inform policy on further reduction of infant deaths in Kenya as it struggles to achieve an under-one mortality rate of 25 deaths per 1000 live births by 2030 as envisioned in the Kenya Population Policy for National Development (2012).

1.2 Problem Statement

Infant mortality rate is not only a measure of health conditions of a country but also an important indicator of economic development. Consequently infant mortality is widely studied all over the world and have been examined in different angles, some have delved into specific determinants of infant mortality. Some have examined the effect of environmental factors on infant mortality (Butz et al, 1982), others have probed a whole spectrum of determinants of infant mortality (Omariba, 2007; Wafula et al, 2012), others into the persisting regional variations in infant mortality in Kenya (Ikamari, 2013) and found that infant mortality not only varied significantly by region but also according to other socio-economic and proximate factors.

Low cost, evidence based interventions to reduce infant mortality for low resource settings like Kenya exists (Darmstdant, 2008) and breastfeeding is one of them. Breastfeeding is a key intervention and has been investigated in at least 3 major ways; duration, timing and exclusivity. Each of them is deemed on its own or in combination to have an impact of infant survival. Due to the age difference in infant mortality breastfeeding is also observed to have varied impact by age. Breast milk is believed to be solely enough to furnish an infant nutritional needs up to the age of 6 months, from which it must be supplemented to adequately satisfy the infant nutritional needs. Breast milk is also observed to have different impact in developed and developing regions and it is believed that exclusive breastfeeding will have its greatest impact in developing countries where water and sanitation are

comprised and would put the infant at risk of contracting infections that would lead to death (Palloni and Millman, 1984).

Several studies have looked at the relationship between breastfeeding and infant mortality in Kenya. Idala (2005) found exclusive breast feeding to associated with higher infant survival chances and Wafula (2012) noted duration of breastfeeding to have one of the strongest positive effects on infant survival. KOyugi (2014) found births in communities with longer breastfeeding period exceeding 13 months to have lower infant mortality. Recently attention has shifted from exclusivity and duration to include time to initiation of breastfeeding and especially among newborns (Edmond, 2006; Mullany, 2008; Garcia, 2010). Debes (2013) calls for improved understanding of the independent or the combined effects of various aspects of breastfeeding on infant outcomes.

It's therefore apparent that the relationship between infant mortality and breastfeeding is not exhaustively studied and different dimensions to understand the phenomenon need to be explored, if further declines are to be effected. It is in this light that this study intends to examine the effect duration, timing and exclusivity of breastfeeding on infant mortality as a contribution to this body of knowledge.

1.3 Research Question(s)

What are the effects of duration, timing and exclusivity of breast feeding on infant mortality in Kenya?

1.4 Objectives

The main objective is to investigate the relationship between duration, timing and exclusivity of breastfeeding and infant mortality in Kenya.

1.5 Specific Objectives

i. To estimate the median time of duration, time to initiation and exclusivity of breastfeeding among infants in Kenya
ii. To determine the probability of survival of infants by duration, time to initiation and exclusivity of breastfeeding.
iii. To determine the effects of duration, time to initiation and exclusivity of breastfeeding on infant mortality when maternal, environmental and socio-economic factors are controlled for.

1.6 Justification

The UN report on child mortality 2014 recommends that governments and other stakeholders rethink strategy to reducing child mortality by adopting a healthy start to life policies and targeted interventions while sustaining the current efforts. The deadline set to achieve millennium development goals is finally here, it's evident that MDG 4 whose aim is to reduce the 1990 child mortality rate by two thirds will not be achieved in the remaining two months, but efforts to contain child deaths must be sustained and or increased. Hill et al (2012) observes that 'despite progress in reducing child mortality worldwide, and an encouraging increase in the pace of decline over the last two decades, MDG 4 will not be met without greatly increasing efforts to reduce child deaths'.

As indicated earlier Kenya's infant mortality rate though declining since 2003 is still high by any standards. Breastfeeding initiation is high in Kenya but optimal breastfeeding being a core indicator of infant and young children nutrition has been on the low in Kenya. Only 58 per cent of infants are put to breast with an hour after birth (KNBS and ICF Macro, 2010), currently only 64 percent of infant are exclusively breastfed (KNBS and ICF Macro, 2014) and children are breast for a mean duration of 12 months. Of the three breastfeeding indicators; time to initiation and exclusivity as shown above are performing poorly, duration of breastfeeding is better but lacking in proper supplementation causing malnutrition (KNBS and ICF Macro, 2010).

The three aspects of breast feeding i.e. duration, timing and exclusivity have largely been studied in isolation in the past. Much emphasis and for the longest time has been on exclusive breastfeeding (Arifeen 2001) (Idala, 2005) (Ogbe, 2008) and infant mortality or duration of breast feeding and infant mortality (Omariba, 2007; Wafula et al, 2012; KOyugi, 2014). Lately time to initiation of breastfeeding is increasingly becoming important due to the defensive characteristics of colostrum produced in the first 3 days of life (Edmond 2006, Mullany 2008, Garcia 2010, Debes 2013). Only two studies in Asia (Debes 2013) and one in Africa (Edmond, 2006) has investigated this relationship and have all found time to initiation to be significantly associated with neonatal mortality and this relation has not been examined for infant mortality.

Due to both country and regional variations in breastfeeding practices and infant mortality, more studies on this area in Africa are required to further affirm or dispute this relationship. 'While both Africa and South Asia are represented, the current analyses are not sufficiently diverse and further research from more countries is needed' (Debes, 2013). This statement only relates to the timing of breastfeeding initiation but an inquiry that would combine the three aspects to investigate their individual as well as their combined effect on infant mortality would be appropriate.

This study therefore will focus its attention on three to inform policy on the potential role that duration, timing and exclusivity of breastfeeding independently would have in reducing infant mortality and 'this could lead to increased emphasis on this intervention as main component of infant mortality reduction programs' (Mullany, 2008).

1.7 Scope and Limitation

The unit of study is an infant whom atleast one of the breastfeeding characteristics could be determined. The study utilized data on 4937 infants born 3 years before the survey obtained from women of reproductive age (15-49) sampled and interviewed as part of the representative nationwide Kenya Demographic and Health Survey (KDHS) 2008/09. The study would have used KDHS 2014 data set but it has not been released for use. This study seeks to establish the survival probabilities of the infants classified as those who breastfed for 0-6 months or longer than 6 months; time to initiation classified as early initiators (<24 hours) or late initiators (24 hours and above) of breastfeeding and exclusive breast feeders classified as 'Yes' or 'No'. The study will also seek to establish the effect of duration, time to initiation and exclusivity of breastfeeding on infant mortality.

The use of retrospective data has an inbuilt disadvantage that effects the completeness of infant's data and implies a number of limitations for the study. One is a due recall bias on breastfeeding data. To minimize on this limitation Palloni and Millman (1984) suggests that we reduce on the years under examination hence the decision to utilize birth histories of the last 3 years preceding the survey instead of 5 years. Further interrogation of data reveals incomplete records for duration of breastfeeding especially for infant who are dead or had stopped breastfeeding were observed.

To allow for proper analysis the study made the assumption that the breastfeeding characteristics of the dead children were similar to those of the live children. The variable 'time to initiation of breastfeeding' also suffered from both misclassification and incompleteness. Heaping of time to initiation at 1 hour, 12 hours and 24 hours after birth was observed by running frequencies on the data. To reduce the effect of such heaping the data was grouped into two; early initiators referring to infants breastfed less than 24 hours after birth and late initiators being those breastfed 24 hours and above after birth. Edmond (2006) however notes that on the cause and time of death, any differential misclassification of type of breastfeeding would have tended to underestimate rather than overestimate effect sizes.

Studies on time to initiation of breastfeeding in respect to infant mortality utilized data from prospective community studies with large number of cases with complete and high reliable breastfeeding information. This cannot be said of retrospective dataset such as KDHS 2008/09 that this study utilized. One way to reduce the effects of reverse causality is to exclude deaths that occurred soon after death say 1 day after birth, though a good measure it would have a negative effect on the sample size. Further excluding those who died within 48 hours to minimize the effect of reverse causality where infant possible severe illness might have affected breastfeeding causing death rather than lack or late initiation of breastfeeding would also have similar impact on sample size and the estimates (Habitch, 1986; Palloni and Millman 1984). However recent studies have shown that even if the deaths were excluded 'residual confounding cannot be completely be discounted as such the study decided to retain the deaths within 48 hours after birth (Edmond, 2006).

To counter such challenges that accompany the use retrospective data, Millman and Palloni (1984) suggest the use of proxy variables to control for deaths early in life e.g. history of previous pregnancies and twin births. This study will exclude twin births and use size of the baby at birth as perceived by the mother as a control for early deaths since low birth weight is significantly associated with infant deaths (Edmond, 2006; Mullany 2008).

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of literature on the effects of breastfeeding on infant mortality and the associated demographic, environmental and socio-economic characteristics. The first section will focus on the theoretical background with which infant mortality is explained followed by an account of empirical finding from related relevant studies; the second part will focus on the main back ground factors influencing infant mortality then finally on conceptual framework.

2.2 Theoretical Background

Infant mortality in developing countries like Kenya can be explained in the context of Omran's epidemiologic Transition theory (Omran, 1971), the theory has a foundation on the premise that mortality is a key factor in population dynamics. The theory postulates that all societies transition through three stages into in the process of modernization. First is the 'age of pestilence and famine' in which societies are characterized by low sanitation and medical advances indicators and therefore life expectancy is below 30 years. The second age is the 'age of receding pandemics' at this stage in the transition, societies sanitation and medical technology indicators improves this helps in averting unnecessary deaths and therefore the high mortality observed in previous age dips considerably improving life expectancy from 30 to 50 years.

Finally societies advance into another stage termed as the 'age of degenerative and man-made diseases'. At this stage the standards of living has greatly improved access to health care and proper sanitation is in place. Infectious diseases pave way for degenerative and man-made diseases. During this stage life expectancy rises considerably with developed society's life expectancy converging at 75 years. From the above exposition Kenya seem to exist in a state two ages of the transition i.e. A state in transition where mortality is caused by infections related to malnutrition and poor sanitation especially in childhood and in stage three where deaths are mainly caused by chronic and degenerative diseases. This is a result of the marked regional differences in access to health care and sanitation improvements which are tied to other development indicators as well as pronounced socio- cultural factors.

Omran (1971) further postulates that there exists age-sex differentials in mortality and childhood survival gradually improves as pandemics recede in response to better living standards, improved nutrition and sanitation and modern public health measures. This means there exists differences in child survivals compared to adult survival, and male- female survival differences at different age and in different societal development stages.

In developed and developing countries mortality indicators differ a great deal, this realization on the cause ways for child mortality in the developed countries were different from those of developing countries led to the development of an analytical framework for the study of child survival in developing countries by Mosley and Chen in 1984 discussed in detail later in the paper. The framework proposes a parsimonious interaction between different biological and socio-economic factors that affect child survival. One such factor is the nutritional factor among other proximate determinants and breastfeeding is a major component. The framework postulates that 'social and economic determinants of child mortality necessarily operate through a common set of biological mechanisms, or proximate determinants, to exert an impact on mortality' (Mosley-Chen, 1984).

2.3 Review of Empirical Studies on Infant Mortality

The role of breastfeeding on infant survival is not in doubt. Several studies have demonstrated this importance. Breastfeeding confers both immune and non-immune benefits to both the infant and the mother. Breastfeeding is said to have three main functions on the survival of an infant, breastmilk is deemed to be hygienic unless compromised through mother's contaminated nipple, of high nutrition value and further provides some defense mechanisms (Ajello, 1982).

Breastfeeding is also said to strengthen the bond between mother and the child and further breastfeeding is known to help in quicker contracting of the uterus and reduce post-delivery hemorrhage making breastfeeding a factor in reducing maternal mortality. As indicated above proximate determinates such as nutrition in which breastfeeding is key necessarily works through socio-economic factors to impact infant survival. Below is a brief empirical expose of each of the breastfeeding variable as well as other proximate and socio-economic factors in relation to infant mortality.

Habitch (1986) found an association between breastfeeding up to six months of life and improved survival of infants throughout the year. Exclusive breastfeeding ensure reduced chances of infections such diarrhea by minimizing contamination that would occur in preparation of other milks or liquids and solids given to the infant before 6 months of age especially in the context of developing countries. Victoria (1987) in a Brazilian urban area control study found that infants who were completely weaned compared to those exclusively breastfed were 14.2 and 3.6 times at risk of death from diarrhea and respiratory injections. Betran et al (2001) also found that 66 per cent of deaths caused by diarrhea and acute respiratory infections among 0-3 month old infants could be averted through exclusive breastfeeding.

Above diarrhea and acute respiratory infections Huffman (2001) observes that breastfeeding especially exclusive breastfeeding protects against infections and also prevents hypothermia and hypoglycemia in newborns especially among low birth weight and premature babies. This can be understood in the knowledge that breastmilk is the only meal of an exclusively breastfed child which translates to more breastfeeds than non-exclusively breastfed child. The more the infant stays on breast it increases body heat and reduces chances of contracting hypothermia a cause of deaths for infants of up to 7 days old. Breast milk also increases body sugar therefore reducing the risk of hypoglycemia.

Despite these benefits exclusive breastfeeding is hardly practiced in developing countries; Akwara (1994) found that 70 per cent of infants aged 3-4 months were already fed on other diets in addition to breast milk. As a result feeds other than breastmilk in their preparation increases the infant's avenues of contracting infection that can lead to death. Kenya and mostly rural or in the urban informal settlements the source of drinking water is compromised and the toilet facility are rarely improved or unavailable. The preparation for meals for these infants in a hygienic environment is highly compromised and therefore diarrhea infections is a known cause of death.

On a positive note most developing countries like Kenya initiation of breastfeeding is near universal and breastfeeding continue for long periods. Akwara (1994) in Amagoro Division in Kenya found that 99 per cent of the women initiated breastfeeding and continued for long periods of 19-24 months. Of the three measures of breastfeeding, duration of breastfeeding examined in this paper is most used. Longer periods of breast feeding is positively associated

with infant and child survival. Idala (2005) and Wafula (2012) found duration of breastfeeding to have one of the strongest effects on infant mortality.
Children who breastfed for shorter periods (<10 months) tended to experience 95 per cent increased chance of dying than those breastfeeding for longer periods (>11-19) months. K'Oyugi (2014) also found that births in communities with longer breastfeeding duration exceeding 13 months had about 34 per cent lower infant mortality compared to their counterparts. The same study found longer duration of breastfeeding to have beneficial effect on child survival even in lower immunization and higher HIV/AIDS risk situations.

Finally, most literature on time to initiation concerns infants during the first month of life, and they all concur that time to initiation though in varied degree as an important aspect of breastfeeding. Time to initiation of breastfeeding specifically breastfeeding within the first hour after birth is a WHO approved baby friendly initiative and has been recommended as routine for newborn care and has been credited with significant declines in neonatal mortality in different countries (Kazembe,2007; Garcia ,2010) . Several studies have indicated benefits in terms of deaths averted through improved coverage of early breastfeeding. It's in this light that time to initiation has become an important aspect of breastfeeding and in consequence of infant survival due the protective nature of colostrum produced in the first few days of life.

Edmond (2006) conducted a study in Ghana; 'delayed breastfeeding initiation increases risk of neonatal mortality' and found that promotion of early initiation of breastfeeding has the potential to make a major contribution in reducing neonatal mortality and by extension infant mortality; 16 per cent of neonatal deaths could be saved if all infants were breastfed from day one and 22 per cent if breastfeeding were started within the first hour after birth. Mullany (2008) in a study in South Nepal found that approximately 7.7 per cent and 19.1 per cent of all neonatal deaths may be avoided with universal initiation of breast-feeding within the first day or hour of life, respectively.

Garcia (2010) observes that universal early breastfeeding initiation might prevent 3.0 per cent of neonatal deaths in a community study in southern India. Signh and Srivastava (1992) notes that neonatal and post-neonatal deaths were very low for female familiar with the importance of colostrum and feeding it than those who did not know and were also not breastfeeding. Huffman (2001) also concurs that colostrum feeding protects infants from

diarrhea and acute respiratory infections therefore reducing infant mortality from these causes.

Literature is also rich in content on socio economic and proximate factors influencing infant mortality and diverse in geographical coverage. Over the years besides breastfeeding there are a number of demographic, environmental and socio-economic factors that have shown resilience and consistency in predicting infant survival particularly in developing countries and therefore need to be controlled for in this study. Below is brief description.

Maternal age at birth is strongly associated with infant survival, children born to young and old mothers stand high chance of experiencing mortality that those of middle ages. Finlay et al (2011) found that for "women who had their first birth between the ages of 12 and 35, the risk of poor child health outcome are lowest for women who have their first birth between the ages of 27 and 29, the results indicate that both biological and social mechanisms play a role in explaining why children of young mothers have poorer outcomes". Young mothers of ages less than 20 years may have reproductive organs that are not fully developed and this may affect fetal development and future outcome of infant after birth predisposing infants of young mothers to high mortality.

Further, it may be that young mothers are not psychologically prepared and economically engaged and therefore may not provide adequately for the infant in terms of access to health care and nutrition. Omariba (2007) also found that young and old maternal age had negative effect on child health, 'children born when their mother was below 20 years are 22 per cent more likely die, while those born when their mother were aged 35 and above are 37 per cent more likely to die compared to children born whose mothers were aged 20-24'.

Preceding birth interval; the length of the interval is observed to have an influence on infant mortality, children who are born within short intervals have lower chances of survival than those born within long intervals. Ikamari (1998) found short birth intervals to have a strong negative effect on infant mortality. Omariba (2007) notes that child born less than 19 months after their preceding siblings are 48 per cent more likely to die compared to those born 19-35 months after preceding siblings. The mechanism through which preceding birth interval work can be explained is one; that the mother having less time to recover from the previous pregnancy may affect the growth of the fetus resulting to low birth weight which would

significantly affect infant survival outcomes at birth and after. On the other had infants born with a short interval may not experience the full attention and care since breastfeeding is stopped early and there is also competition of other nutritional resources among them.

Over and above, mother affiliated demographic factors, those associated with the infant are found to influence mortality. Birth weight in the context of this study is the size of the infant measured as the perceived size of infant by the mother at birth, this is a subjective measure but has been qualified to closely estimate the actual size of the baby at birth (CBS et al, 1998). Ikamari (2013) found infants who were perceived small at birth had an elevated risk of mortality than their average and large counterparts. The mother nutritional intake directly affects the growth of the fetus and the health of infant at birth. Mother with poor feeding practices will deliver infants who are not fully developed and with low birth weight putting the infant at higher risk of dying.

Household wealth index is also associated with infant survival outcomes. Infants belonging to household in rich household have better survival outcomes than those from poor households. Wafula et al. (2012) found that infants belonging to household in the lower wealth index were associated with a 14 per cent reduced chances of survival in infancy. Rich households are likely to be household of an educated mother or father as such they are aware and capable accessing health care services e.g. access to antenatal care, delivering in a health facility which are associated with better health outcomes for the infant. Related to household wealth is maternal education, an educated mother likely to be living in an urban area where she is able to easily access health services, contribute in family decision making and attend adequately to nutritional needs of the infant. Caldwell (1982) found parental education to have greater influence than income and access to health combined. He states further that though paternal education is important maternal education is more important.

Ethnicity is also a key determinant of infant health outcomes, infants from certain communities have been observed to have better or worse survival chances than others. Omariba (2007) found that children of Luo mothers are three and half times more likely to die than those of Kikuyu after controlling for bio-demographic characteristics. Gyimah (2002) found women in Ghana relative to Asante children the risk of death was significantly higher for among children from other ethnic communities though the differences disappear once the socioeconomic factors are controlled for. Place of delivery is also associated with

infant survival, infants delivered in a health facility are more likely to survive than those delivered at home. Ajaari (2012) notes that mothers who delivered outside a health facility experienced 1.85 times odds of experiencing neonatal mortality.

Environmental factors are also key determinants of infant survival and two variables used to measure environmental effect is availability or lack thereof a toilet facility and the source of drinking water. Infants belonging to a household with toilet facility have lower mortality risk than those in open defecation or using shared public toilet facility. 'Children belonging to household without a toilet facility experienced higher neonatal and post neonatal mortality (Ikamari, 2013). Further on environmental factors the source of water is an important determinant of infant survival, infants in households with piped water also are at lower risk of mortality than those in household using shared or open water points. 'Children belonging to households without piped water supply had significantly higher risk of neonatal and post neonatal mortality' (Ikamari, 2013)

2.4 Summary of Literature Review

Literature agrees on the importance of breastfeeding on child survival. But the review has also revealed that the impact of breast milk will be different in the diverse settings. Millman (1985) states that the three characteristics of breast milk i.e. hygienic, nutritious and defense have varying degree of advantage for the infants depending on other factors such socio-economic, demographic and environmental factors. For example breast milk may be hygienic and beneficial to an infant in developing countries where the source of water and sanitation may be compromised on the other hand artificial milk may be equally hygienic in developed countries and therefore in light of this breastfeeding will only confer some advantage on an infant who is exclusively breastfed over bottle fed infant in the developing country.

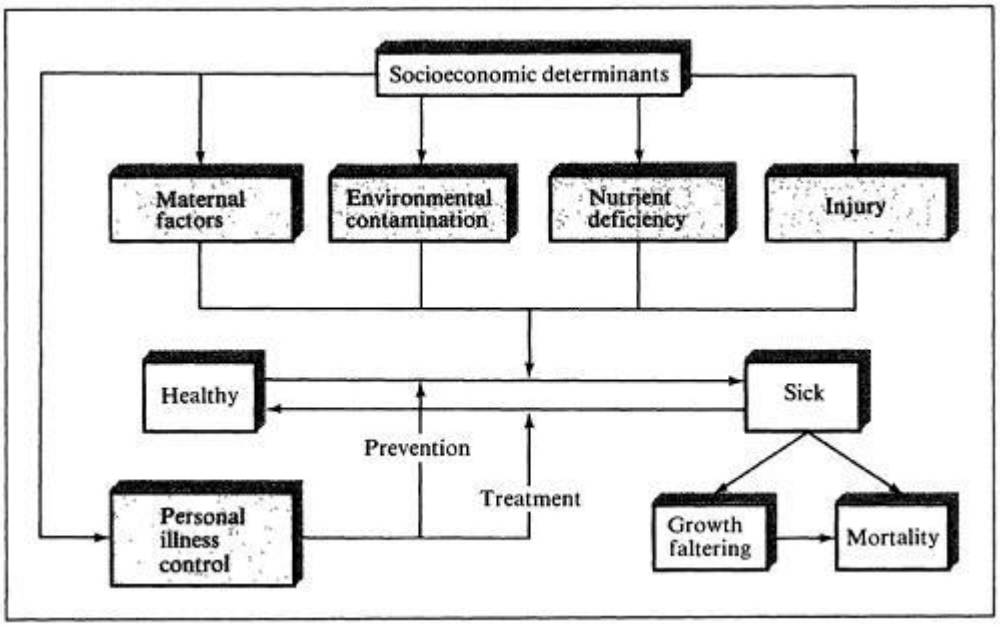
It is therefore always prudent to have in mind the different aspects of breastfeeding will have varying impact on child survival depending on the prevailing background characteristics. However breastfeeding will have its most impact felt in developing countries such as Kenya where initiation of breastfeeding is high and so is infant mortality. The challenge therefore being implementation of optimal breastfeeding practices.

2.5 Conceptual Framework

The study utilized the 1984 Mosley-Chen analytical framework which is widely used for the study of childhood mortality in developing countries. The framework aims to bridge the gap in the understanding of biological and social factors determining the survival of children previously studied differently by researchers. The framework categorizes these factors as proximate factors and socio- economic factors. Proximate factors are grouped into five broad categories which include maternal factors such as age and parity, environmental factors such as sanitation, air and water availability or lack thereof, nutritional factors such consumption of nutrients, Injuries whether accidental or intentional and finally personal illness prevention which refer measures taken to control or seek treatment such as immunization, antenatal and postnatal services.

On the other hand socio economic factors are grouped into three, they include individual factors e.g. maternal education, paternal education, then household factors such household income, household shelter and community factors which include availability of health services and policy environment etc. The framework states that socio- economic factors necessarily work through proximate determinates to affect child survival as illustrated below.

Figure 2-1: Conceptual framework for child mortality



Source: Mosley, W. H., & Chen, L. C. (1984). An analytical framework for the study of child survival in developing countries. *Population and development review*, 25-45.

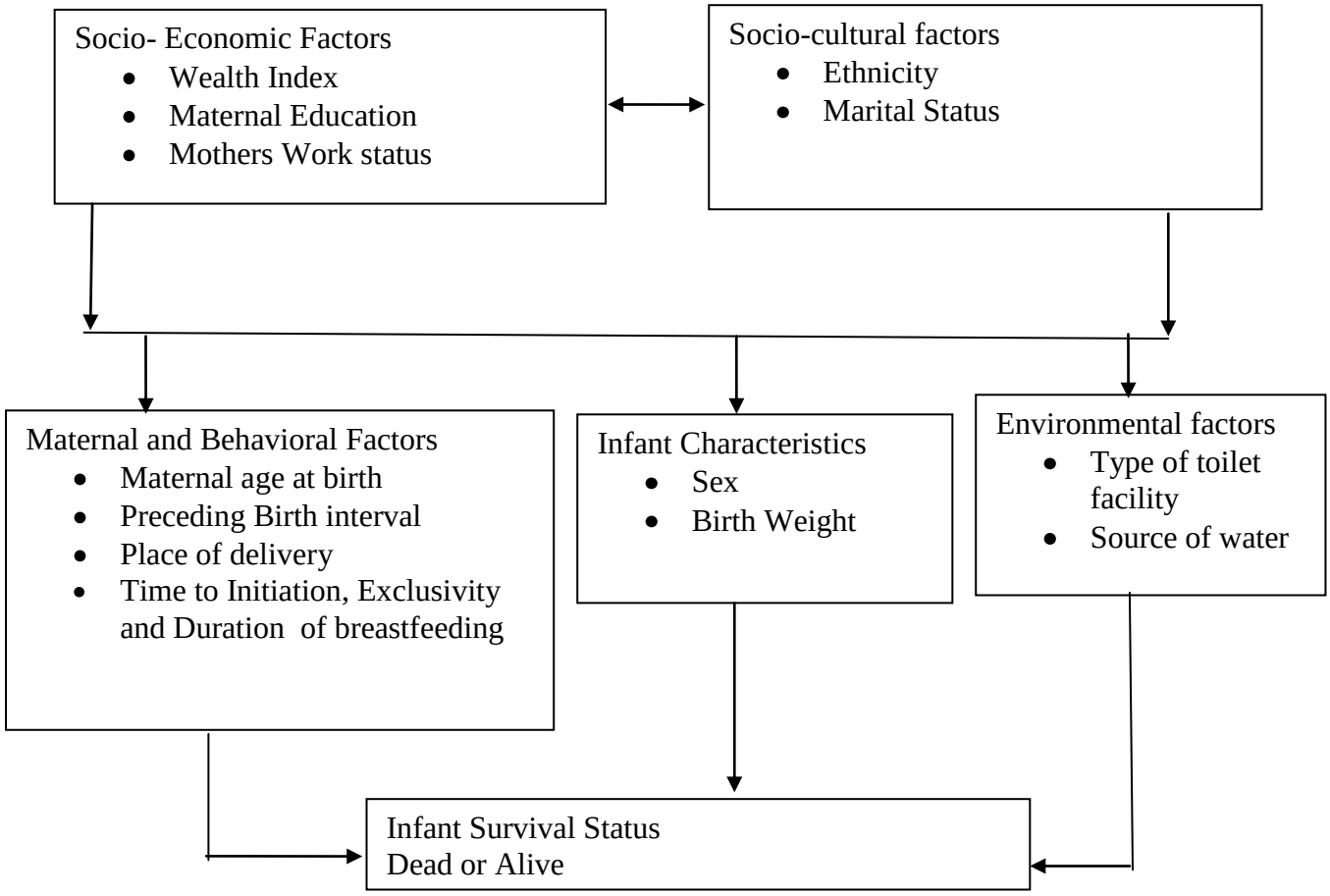
The proximate determinants include maternal factors (age, parity and birth interval), environmental contamination factors, nutrient deficiency, injury and personal illness prevention. The background or socio-economic characteristics work through these five factors to affect the survival of the child. The nutritional factor is the proximate determinant under investigation and how is influenced by socio economic characteristics to affect child survival.

Breastfeeding provides nutrients and protection against illness to the infant and socio economic factors work through it to influence infant survival. The protective nature of colostrum contained in the early breast milk is well documented and for this reason it's often referred to us the 'first immunization' since it protects the newborn from infection like diarrhea among others. Exclusive breastfeeding helps protect the infant from infections such as diarrhea since there is minimal contamination and longer breastfeeding duration has been found to improve child growth and survival.

Infant mortality in this case will be the outcome variable and the exposure variable being breastfeeding measured in the three dimensions of duration, time to initiation and exclusivity. Time to initiation of breastfeeding categorized as early or late, duration of breast feeding classified into two; 0-6 months or 6 months and above while exclusive of breastfeeding classified as 'Yes' or 'No'. A host of demographic, environmental and socio-economic factors will be used will be used to control for the effect of each breastfeeding variable. Further inclusion of infant characteristic was based on review of literature due to their importance especially in early infancy (Edmond, 2006; Mullany, 2008; Ikamari, 2013)

2.6 Operational Framework

Figure 2-2: Operational framework for infant Mortality



Source: Idala, 2005

2.7 Operational hypothesis

Therefore the hypothesis was that infants who breastfed less than six months, initiated breastfeeding late and were not exclusively breastfed are more likely to die than their counterparts who breastfed for more than 6 months, initiated breastfeeding early and were exclusively breastfed.

CHAPTER 3: DATA AND METHODS

3.1 Introduction

This chapter presents the source of data and the methods of data analysis. The source of data is discussed first and thereafter the methods of data analysis are described.

3.2 Sources of Data

This study utilized data from the Kenya Demographic and Health Survey (2008/09) undertaken by Kenya National Bureau of Statistics and ICF Macro International of USA as part of the global demographic and health survey programs for developing countries. The Kenya Demographic Health Survey (2014) key indicator report has been released but the data set was not available for use though would have been preferred especially due the large sample sizes in comparison. The KDHS (2014) did show a major decline in infant mortality but still high compared to the target as set out in Kenya Population Policy for National Development (2012).

Birth history information for the last 3 years was collected from 8,444 women of reproductive age 15–49 years under the reproduction section of the Woman's questionnaire. Under this section the woman is asked to list all the births and for each child date of birth, sex and survival status is indicated i.e. dead or alive, for each birth, information on current age of the child if alive, and if dead the age at death is also indicated. Information on breastfeeding was also obtained from section 4 of the woman questionnaire on pregnancy and postnatal care. Of the 8,444 women, 4937 reported a total of 4,937 births 3 years before the survey. A detailed description of the survey including the sampling procedure, quality of the data, and the descriptive information on infant mortality, fertility, and family planning among others is available in the country report (KNBS & ICF Macro International, 2010).

3.3 Methods of Analysis

To calculate the median duration of any breastfeeding and exclusive breastfeeding the study utilizes the numerators and denominators calculated for the proportions any breastfeeding, and exclusive breastfeeding by time since birth (Rutstein and Rojas, 2006). Numerators and denominators are each smoothed by a three-group moving average. From the lowest time-since-birth group, each group is examined to see whether the proportion breastfeeding or

exclusively breastfeeding is less than 0.5. The value of median is determined by linear interpolation of percentage of first group below 0.5 and previous group percentage using the following formula:

Median = mi-1 + (p i-1 – 0.5)/(p i-1 – p i) x (w i), **(3.1)**

where p i is the proportion breastfeeding or exclusively breastfeeding, for the first group where the proportion is below 0.5, p i-1 is the proportion breastfeeding and exclusively breastfeeding for the preceding group, mi-1 is the midpoint value for the preceding group, and w i is the time width of the group taken as the difference between the midpoint value of the current group and the preceding group. The median length in months of breastfeeding were determined for breastfeeding variables 'duration of breastfeeding' and 'exclusive breastfeeding' variables. The median 'time to initiation of breastfeeding' could not be determined due to categorical format in which data exists in the data set.

The study also utilized the life table technique, the Trussell version of the Brass method (UN, 1990). This helped to show possible differentials in mortality risk for the different breastfeeding variables and is also appropriate in showing what proportion of a population which will survive past a certain time and of those who survive at what rate do they die or fail. The technique also takes into account how circumstances or certain characteristics increase or decrease probability of survival in this case the various breastfeeding behaviors.

The study estimated infant mortality by calculating the probability of dying for duration of breastfeeding, exclusivity and time to initiation of breastfeeding variables, i.e. for duration of breastfeeding the infants are categorized as those who breastfeed 0-6 months and those who breastfed 6 months and above, for time to initiation of breastfeeding infants will be categorized as early meaning those put to breast within 24 hours after birth and late initiators meaning those who started breastfeeding 24 and above hours after birth and for exclusive breasting the infants are categorized as 'Yes' or 'No'.

The life table technique were used to generate the ${}_nq_x$ values or the probability of dying from ${}_nm_x$ values generated by using the formula:

Risk of dying during infancy (d) = Dead Infants/Exposure time (in months)

This gave the death rate which was converted into probability of surviving infancy values using the formula;

$$ {}_nP_x = EXP(-12*d) \quad \textbf{(3.2)} $$

To obtain the ${}_nq_x$ values of interest to this study the formula below was used

$$ 1- \ {}_np_x, $$

the resultant which in turn was multiplied by 1000 to obtain Infant Mortality Rate (IMR) per 1000 live births.

Logistic regression analysis was used to answer objective 3 to estimate the net effect of breastfeeding when socio-economic, demographic, environmental factors are controlled for. Logistic regression analysis is best suited for the analysis of dichotomous dependent variables such as the survival status of the infant i.e. dead or alive. In this case an infant is classified as dead or alive depending on the status at first birth day. Habitch (1986) recommends logit analysis as an appropriate technique for estimating relative risk as in this case when comparing the risks between different categories of the background factors. The regression function takes the form;

$$ f(z) = \frac{1}{1+e^{-z}} \quad \textbf{(3.3)} $$

This function is well-suited for modeling a probability because the values of f(z) ranges from 0 to 1 as z varies from $-\infty$ to $+\infty$.

The relationship of a dichotomous variable with its predictors is quantified with **the odds ratio**. Since odds (D) $= \frac{Pr(D)}{1-Pr(D)}$, odds(Y=1) $= \frac{p}{1-p}$. **(3.4)**

The "logit" is the natural log odds of the event, Y=1, that is,

$$ \text{logit } [p] = \ln [\text{odds}(Y = 1)] = \ln \left[\frac{p}{1-p} \right] \quad \textbf{(3.5)} $$

$$ \text{logit } [p] = \beta_0 + \beta_1 X_1 + ... + \beta_k X_k \quad \textbf{(3.6)} $$

The logits can take on any values between $-\infty$ to ∞ while Pr(Y=1) can only take on values between 0 and 1.

$$ \text{Odds}(Y=1) = e^{\beta_0+\beta_1 X_1+...+\beta_k X_k} \quad \textbf{(3.7)} $$

This formulation helps in clarifying the meaning of the maximum likelihood coefficients: e^{β_i} gives the change in the odds for Y when there is a unit change in the predictor X_i, i = 1,.., k

First a bivariate analysis was carried out in order to establish the gross effects of each breastfeeding variable i.e. duration of breastfeeding, time to initiation of breastfeeding and exclusivity of breastfeeding on infant mortality and also for each of the covariates. The

bivariate results were used in part to qualify variables that were used in the final model of multivariate logistic regression. Logistic regression was used since apart from showing the strength of association it also shows the direction. For each of the breastfeeding variables infants were categorized into two. For time to initiation the infants categories are early or late initiators (Edmond, 2006) for exclusivity as 'Yes' or 'No' and duration of breastfeeding as those breastfed for 0-6 months or more than 6 months (Idala, 2005).

The three breastfeeding variables were each analyzed separately. Three models were fitted for each of the breastfeeding variable and controlled for using covariates chosen on the basis of significance from the bivariate analysis and their importance in literature. Model I contains the breastfeeding variables alone due their importance in this study and as indicated in literature in each of the multivariate analysis for the three breastfeeding variables. Model II contain Model I plus socio – economic variables i.e. wealth index and maternal work status; Model III will have Model I plus model II and incorporate both demographic and proximate factors.

The use of models will allow the study to examine the effect of background variables that are 'assumed to be distant to the event of death and how they change as the proximate determinants are added to the model' (Omariba, 2007). This disaggregation of background characteristics helps in determining the relative contribution of each of the factors on the risk of death in infancy. This will also help policy makers to identify factors that could be of importance in designing of intervention at infancy.

3.4 The dependent and independent variables

This section introduces the variables used in the analysis. The first section deals with dependent variable definition and measurement while second section explains the independent variables.

3.4.1 Dependent Variable

The dependent variable is the survival status of the infant i.e. dead or alive at first birth date and categorized as dead= 1 and alive=0 for purposes of this study. The study used children file in the KDHS 08/09 data set as reported by the sampled women aged between 15-49 years in the last three years from the date of survey.

3.4.2 Independent Variables

The independent variables were selected variables as informed by literature review on their influence on infant mortality. In this section they include both socio economic factors and proximate factors.

Social Economic Factors.

The socio-economic factors include individual factors such as maternal education and household wealth**.** They are discussed below in detail.

Wealth index: This variable measures the household wealth. The variable was categorized into two groups namely: rich or poor, the reference category is 'poor'. Infants who belong to poor households are more likely to die than those belonging to the rich.

Maternal Education: This variable measures the level of education of the mother. The variable was categorized into three groups namely: No Education, Primary or Secondary and above, the reference category is 'No education'. Infants who belong to mothers with no education are more likely to die than those belonging to mothers with education.

Maternal work status: This variable categorizes the respondent by whether they work at home or away. The reference category is' away'. Infants of respondents who work away from home are more likely to die than those who work from home.

Demographic and Proximate Factors

The demographic and proximate factors are factors that are said to exert their influence through socio economic factors. Below is brief discussion on each.

Preceding Birth interval: The variable helps in identifying differentials in length of time in between births. It is categorized into: Less than 18 months and 18 months and above, the first births are also included in the 18 months and above group. The reference category was 'less than 18 months'. Infants born less than 18 months apart are more likely to die than those born 18 months or more apart.

Maternal Age at Birth: The variable measures the risk of having premature or an infant with complications as well capability to care for infants especially among young mothers. The variable is categorized into those less than 20years and above 34 years put together and those

aged 20-34 years. The reference category was '<20and>34 years'. Infants belonging to women aged <20and>34 years are more likely to die than those of women aged 20-34 years.

Sex of the Infant: Male and female mortality differentials are important at this early age. The reference category was 'Male'. Male infants are more like to die in their first year of life than female infants.

Size at Birth: This variable indicates the vulnerability of infants at birth by size at birth. It is measured as the mother's perception of the infants in size at birth i.e. small, average or large. The reference category is "small". Infant perceived as small in size at birth are like to die than those perceived to be average or large.

CHAPTER 4: BREASTFEEDING AND INFANT MORTALITY IN KENYA

4.1 Introduction

This chapter discusses results of the study showing how selected social-economic, demographic and proximate variables explain infant mortality in Kenya. First it explains the background characteristics of the respondents and then continues to outline and discuss the life table, bivariate and multi-variate results of the analysis.

4.2 Back ground characteristics of Study population

The description of background characteristics of the study sample are presented in table 4.1. The results show that out of a total of 4937 births, majority (95.3 per cent) were alive while 4.7 per cent were dead. A majority of these infants breastfed for a period of more than 6 months (75.9 per cent) while 24.1 per cent breastfed for 0-6 months. In terms of when they started breastfeeding 86.1 per cent were early initiators while 13.9 per cent were late initiators. On exclusive breastfeeding only 17.1 per cent were exclusively breastfed while 82.9 per cent were not.

Distribution by wealth index show 46.4 per cent births belong to poor households while 53.6 per cent belong to rich households. In terms of maternal work status births belonging women who work at home were 49.6 per cent compared to 50.4 who work away from home. Births occurring less than 18 months apart were 7.6 per cent while 92.4 per cent births occurred 18 months and above apart. Distribution by maternal age at birth; infants born to women aged less than 20 years and above 34 years were 28.7 per cent while those born to women aged 20-34 years were 71.3 per cent.

Table 4.1: Distribution of births by covariates

Variable Name	N	per cent
Child alive?		
Alive	4703	95.3
Dead	234	4.7
Duration of breastfeeding		
0-6 Months	1163	24.1
> 6 Months	3653	75.9
Time to Initiation of breastfeeding		
Late initiators	667	13.9
Early initiators	4139	86.1
Exclusive Breastfeeding		
No	3450	82.9
Yes	714	17.1
Wealth Index		
Poor	2290	46.4
Rich	2647	53.6
Maternal Work Status		
Away	1406	50.4
Home	1385	49.6
Maternal age at Birth		
<20 and > 34 years	1417	28.7
20- 34 Years	3520	71.3
Preceding Birth Interval		
< 18 Months	374	7.6
18 Months and above	4563	92.4
Sex		
Male	2539	51.4
Female	2398	48.6
Size of Infant at Birth		
Small	842	17.2
Average	2526	51.7
Large	1519	31.1

Source: Computed by author using KDHS 2008/09

Distribution by sex indicate female births were 48.6 per cent while male births were 51.4 per cent. A majority (51.7 per cent) of infant were average in size as perceived by mothers at birth while those perceived to be small and large were 17.2 per cent and 31.1 per cent respectively.

4.3 The effect of breastfeeding on infant mortality in Kenya

This section presents results of the life table and logistic regression modeling carried out to establish the effect of breastfeeding on infant mortality in Kenya when controlling for other covariates. The median duration of breastfeeding for all infants in the study was 6 months, but this hides a huge disparity between infants who breastfed for less than 6 months and those who breastfed longer than 6 months. Among infants who breastfed less than 6 months the median duration of breastfeeding was 3 months compared to 9 months for those who breastfed for more than 6 months. The median time of exclusive breastfeeding among the exclusively breastfed infants was 2 months.

The life table analysis involved calculating the number of infants dead before their first birth day. The second involved calculating the exposure time in months for each child whether dead or alive disaggregated by duration of breastfeeding, whether exclusively breastfed or not and finally whether they were initiated into breastfeeding early or late. For children who died below 12 months of age and those alive but had not attained the age of 12 month their exposure time were calculated as time since birth, for those who died after 12 month or were still alive after 12 months their exposure time was reduced to 11 months. After calculating the exposure time, infant mortality rate for each of the group were calculated the results of the life table analysis are presented in table 4.2 below.

The logistic regression modeling process involved conducting a bivariate analysis for each of the breastfeeding variable assessing their predictive ability, then each of the independent variables as indicated in the operational framework. For each of the breastfeeding variable the multivariate regression model was fitted with background variables some significant in the bivariate stage and others due to their importance in literature and to the current study. The results of the bivariate analysis for variables that were significant and other selected due to their importance in literature are presented in table 4.3 and those of multivariate analysis are presented in table 4.4, 4.5and 4.6.

The table 4.2 shows an infant mortality rate of 55.5 births per 1000 live births for the last 3 three years before the survey in Kenya. The table also show the differentials in the risk of dying by various breastfeeding behaviors. Infants who breastfed for longer than 6 months have a lower risk of dying than those who breastfed for less than six months. The infant

mortality rate for those who breastfed for 0-6 months is 338.6 per 1000 live births compare to 6.7 per 1000 live births for those who breastfed for more than 6 months. The IMR for the infant breastfed less than 6 months was extremely high due to two reasons, one being concentration of deaths at age zero months i.e. 140 of the 212 deaths in the analysis occurred at zero months meaning that for most of the infants by default breastfed for less than 6 months.

Table 4.2: Life table results of probabilities of dying during infancy in Kenya

Variable Name	No. of Infants Dead	Exposure Time	Risk of Death During infancy	${}_nP_x$	${}_nq_x$	IMR Per 1,000 live births
Duration of Breastfeeding						
0-6 Months	190	5515	0.0345	0.6614	0.3386	338.6
>6months	22	39010	0.0006	0.9933	0.0067	6.7
Average	**212**	**44525**	**0.0048**	**0.9445**	**0.0555**	**55.5**
Time to initiation of breastfeeding						
Late Initiators	16	660	0.0242	0.7476	0.2524	252.4
Early Initiators	68	6237	0.0109	0.8774	0.1226	122.6
Average	**84**	**6897**	**0.0122**	**0.8640**	**0.1360**	**136.0**
Exclusive Breastfeeding						
No	18	5042	0.0036	0.9581	0.0419	41.9
Yes	88	7323	0.0120	0.8657	0.1343	134.3
Average	**106**	**12365**	**0.0086**	**0.9022**	**0.0978**	**97.8**
National Average	**234**	**45502**	**0.0051**	**0.9402**	**0.0598**	**59.8**

Source: Computed by author using KDHS 2008/09

This results shows the effect of a huge number of deaths measured against short period of exposure. The second being incompleteness of breastfeeding data for most of the breastfeeding variables. Out of the 234 dead infants used in this study only 212 had complete record on duration of breast feeding. It was worse for the other breastfeeding variables with only 84 and 106 dead infant with complete records for exclusive and time to initiation respectively. Incompleteness of records reduces the sample size required for to obtain accurate estimates.

The average IMR of 55.5 deaths per 1000 live births among infants with complete records on duration of breastfeeding and the national average are close estimates in comparison to the reported figure in KDHS 2008/09 of 52 deaths per 1000 live births (KNBS and ICF Macro, 2010).

In terms of time when the infant was first put to breast late initiators were found to have higher probability of dying than early initiators. The early initiators had an IMR of 122.3 deaths per 1000 live births compared to 252 deaths per 1000 live births for those who initiated breastfeeding late. For those exclusivity breastfed the results were inconsistent and those exclusively breast had an IMR of 134 deaths per 1000 live births compared to 134 per 1000 live births for those exclusively breastfed. This inconsistency can be explained by incomplete breastfeeding data for this variable and the few cases available for analysis taking into account the irregular distribution of deaths between two categories.

Bivariate Analysis

The bi-variate analysis results are presented in Table 4.3. The table illustrates that duration of breastfeeding is significantly associated with infant mortality. Infants who breastfed for more than 6 months were 0.031 times less likely to die than those who breastfed for less than 6 months. In terms of preceding birth interval, infants born 18 months and above apart were 0.495 less likely to die than those who were born less than 18 months apart. Infant perceived by mothers to be small in size at birth had an elevated risk of dying than those perceived to be average (OR: 0.519, $P<0.05$) and large (OR: .0632, $P<0.05$).

Table 4.3: Odds ratios from bivariate logistic regression predicting the association of infant mortality and various covariates.

Variable Name	B	S.E	Sig.	Exp(B)
Duration of breastfeeding				
0-6 Months(RC)				
>6months and Above	-3.473	.228	.000	.031
Model Parameters	**R2**	**28.5**	**P-Value**	**.000**
Time to Initiation of breastfeeding				
Early initiators(RC)				
Late Initiators	-.425	.266	.110	.654
Model Parameter	**R2**	**.200**	**P-Value**	**.092**
Exclusive Breastfeeding				
No(RC)				
Yes	-.012	.262	.963	.988
Model Parameter	**R2**	**.000**	**P-Value**	**.963**
Wealth Index				
Poor(RC)				
Rich	.064	.135	.635	1.066
Model Parameter	**R2**	**0.00**	**P-Value**	**0.634**
Maternal work status				
Away(RC)				
Home	-.041	.169	.807	.960
Model Parameter	**R2**	**.000**	**P-Value**	**.807**
Maternal Age at Birth				
<20/>34 Years(RC)				
20-34 Years	-.125	.145	.388	.882
Model Parameter	**R2**	**.000**	**P-Value**	**.391**
Preceding Birth Interval				
<18 Months(RC)				
18months and Above	-.703	.198	.000	.495
Model Parameter	**R2**	**7.000**	**P-Value**	**.001**
Size of infant at Birth				
Small (RC)				
Average	-.657	.171	.000	.519
Large	-.460	.183	.012	.632
Model Parameter	**R2**	**.900**	**P-Value**	**.001**

Source: Computed by author using KDHS 2008/09

Table 4.4 presents the results on duration of breastfeeding as associated with infant mortality. Duration of breastfeeding is significantly associated with infant mortality. Model I which includes duration as the only variables show that infant breastfed for more than 6 months were 0.021 less likely to die than those who breastfed for 0-6 months.

Table 4.4: Adjusted odds ratios obtained from a logistic regression model for predicting association between infant mortality and duration of breastfeeding, KDHS 2008/09

	Model I		Model II		Model III	
Variable Name	**B**	**Exp(B)**	**B**	**Exp(B)**	**B**	**Exp(B)**
Duration of Breastfeeding						
0-6 Months(RC)						
>6 Months	-3.872	.021***	-3.871	.021***	-3.888	.020***
Wealth Index						
Poor(RC)						
Rich			-.219	.803	-.191	.826
Maternal work status						
Away(RC)						
Home			-.078	.925	-.067	.936
Preceding Birth Interval						
<18 Months(RC)						
18 Months and Above					-.648	.523***
Maternal age at birth						
<20/>34 Years(RC)						
20-34 years					-.189	.828
Sex of Infant						
Male (RC)						
Female					-.187	.829
Size of infant at birth						
Small(RC)						
Average					-.471	.624**
Large					-.110	.896
R2		**34.8**		**34.9**		**36.0**
P- Value		**0.000**		**0.000**		**.000**

*****P<0.05 **P<0.01**

Source: Computed by author using KDHS 2008/09

Model II introduces wealth index and maternal work status into the model. The results indicate a non-significant relationship between wealth index, maternal work status and infant mortality. However, duration of breastfeeding is still significant and infants who breastfed for more than 6 months are 0.021 times less likely to die. Model III adds mother and infant factors onto model II. Preceding birth interval is significantly associated with infant mortality, infants born less than 18 month apart are likely to die than those born more than 18 months apart(OR: 523, $P<0.05$). Breastfeeding is still highly significant and infants who breastfed for more than 6 months are 0.02 less likely to die than those who breast fed for less than 6 months.

The overall analysis results show that duration of breastfeeding is significantly associated with infant mortality and the relationship remain largely unchanged even after controlling for other factors. This concurs with literature that have found duration of breastfeeding to be a key factor determining infant survival (Wafula et al, 2012; Omariba, 2007). This is also confirmed by the life table results which shows the differentials in the probability of dying between those who breastfed 0-6 months and for more than 6 months. Preceding birth interval retains its significance showing an independent influence on infant survival. This concurs with literature which have shown that infants born less 18 months apart have an elevated risk of dying (Omariba, 2007; Ikamari, 1998)

Exclusive breastfeeding.

Exclusive breastfeeding both at bivariate and multivariate level is insignificantly associated with infant mortality. The results of the multivariate analysis are presented in Table 4.5. In Model I those who exclusively breastfed are 1.015 more likely to die than those who did not. Introduction of socio-economic factors in Model II improves the relationship though not significantly. Infant exclusively breastfed are 0.948 less likely to die than those who did not and finally in Model III with inclusion of mother and infant characteristics, infants who were exclusively breastfed were 0.916 times less like to die compared to those who were not exclusively breastfed. Despite this preceding birth interval and perceived size of the infant at birth seem to exert independent influence on infant mortality. Infants born 18 and above months apart were 0.243 times less likely to die than those born less than 18 months apart.

Table 4.5: Adjusted Odds Ratios obtained from a logistic regression model for predicting association between infant mortality and exclusivity of breastfeeding, KDHS 2008/09

	Model I		Model II		Model III	
Variable Name	**B**	**Exp(B)**	**B**	**Exp(B)**	**B**	**Exp(B)**
Exclusive Breastfeeding						
No (RC)						
Yes	.015	1.015	-.054	.948	-.088	.916
Wealth Index						
Poor(RC)						
Rich			-.492	.611	-.368	.692
Maternal work Status						
Away(RC)						
Home			.527	1.693**	.519	1.680
Preceding Birth Interval						
<18 Months(RC)						
18 Months and Above					-1.415	.243***
Sex of Infant						
Male(RC)						
Female					-.112	.894
Size of Infant						
Small(RC)						
Average					-.988	.372***
Large					-.339	.712
Maternal age at birth						
<20/>34 Years(RC)						
20-34 Years					-.150	.861
R2		**0.0**		**1.7**		**6.9**
P-Value		**0.966**		**0.036**		**(0.000)**

*****P<0.05, **P<0.01**

Source: Computed by author using KDHS 2008/09

In terms of perceived size at birth infants who were average in size were 0.372 times less likely to die than those perceived to be small. Though this analysis was affected by low numbers, the result are suggestive of the inverse relationship between exclusive breastfeeding and infant mortality. This concurs with literature which has shown that perceived size of infant at birth is associated with infant survival. Infant perceived to be small at birth are more likely to die than those deemed average or large (Edmond, 2006; Ikamari 2013). Those born small are predisposed to be frail and therefore having difficulties in breastfeeding. For this reason it is more of low birth weight causing death rather than breastfeeding or lack of it. On preceding birth interval literature reveals that longer birth intervals allows the mother to fully recover from the previous pregnancy it also means that the infant may breastfeed longer consequently improving both health outcomes of the mother and the infant.

Palloni(1984) observes that the highest impact of optimal breastfeeding practices are to be found in low resource setting, where access to health care is constrained by distance and professional care. Even more important is the sanitation aspect where breastfeeding cuts avenues in which the child may contract infection due to contamination especially in the first six months. Exclusive breastfeeding tries to eliminate these avenues avoiding contamination that may come in consuming contaminated water and food cooked with such waters.

Time to initiation of breastfeeding

Both bivariate and the multivariate analysis didn't yield significant relationship between infant mortality and time to initiation of breastfeeding, but the variable was retained due to its importance to the study. Table 4.6 shows that even though the expected relationship did not emerge as with exclusive breastfeeding instead the reverse is observed in all models where early initiators were found to be more likely to die than late initiators.

Table 4.6: Adjusted Odds Ratios obtained from a logistic regression model for predicting association between infant mortality and Time to initiation of breastfeeding, KDHS 2008/09

	Model I		Model II		Model III	
Variable Name	B	Exp(B)	B	Exp(B)	B	Exp(B)
Time to Initiation of breastfeeding						
Late Initiators (RC)						
Early initiators	.372	1.451	.394	1.482	.451	1.569
Wealth Index						
Poor(RC)						
Rich	-3.505	.030	-.247	.781	-.168	.845
Maternal work Status						
Away(RC)						
Home			.219	1.245	.214	1.239
Preceding Birth Interval						
<18 Months (RC)						
18 Months and Above			-3.506	.030	-.947	.388***
Sex of Infant						
Male(RC)						
Female					-.178	.837
Size of Infant						
Small (RC)						
Average					-.483	.617
Large					-.234	.792
Maternal age at birth						
<20/>34 Years(RC)						
20-34 Years					-.155	.856
R2		**0.2**		**0.6**		**2.4**
P-Value		**0.228**		**0.208**		**0.017**

*****P<0.05**

Source: Computed by author using KDHS 2008/09

The adjusted odds ratios changed but the insignificance of the relationship remained even after controlling for other covariates. Preceding birth interval was also found to have significant association with infant mortality. Infants who were born 18 and above months apart were 0.388 times less likely to die than those who were born less than 18 months apart.

The Table 4.6 also shows that early initiators are at greater risk than late initiators. This result contradict literature where late initiators are shown to have higher risk (Edmond, 2007; Mullany, 2008). In Model 1 the early initiators are shown to be 1.451 times more likely to die and the risk is higher at 1.482 times and 1.569 times for early initiators in model II and Model III respectively. As indicated above low numbers of cases that had complete breastfeeding information on time to initiation might have affected the analysis and negatively impacted on the estimates.

The study reveals what many other studies in developing countries have found that breastfeeding is a key determinant of infant survival. The study found that though for majority of infants breastfeeding is initiated adherence to recommended behavior is low i.e. that is when an infant is first put to breast, how they are breastfed especially in their first 6 months and for how long. The study found adherence to exclusive breastfeeding was low in that by age 2 months most infants after were introduced to other milks, liquids and solids. In terms of duration of breastfeeding the study found that by age 9 months most infant were still breastfeeding.

Optimally the infant is supposed to be put to breast immediately after birth, breastfed exclusively for six months and finally after six months supplementation is required and breastfeeding is supposed to continue at least up to 24 months. But this rarely so, for instance in some communities in Kenya the infants are starved off the first milk perceived not ‘clean’ and are fed on other fluids until the milk clears. Unknown to these mothers first milk contains both immune and non-immune characteristics important to the infant growth and development.

Though this study did not reveal significant relationship between infant mortality and exclusive breastfeeding as well as time to initiation their significance is well documented and cannot be ignored. Arifeen (2001) and Mullany (2008) among others have registered results on the importance of both time to initiation and exclusivity of breastfeeding.

On data quality such incomplete records Hsieh (1989) states that ‘the power of the study varies both with the number of events and the number of individuals at risk’. The effect on the incompleteness of data in this study is evident affecting the accuracy and even in some cases reversing the expected results. This was evident in Table 4.5 and 4.6. Future efforts on data collection should ensure completeness of breastfeeding data to allow for robust exploration in this area.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the study, conclusion and recommendations for further research and policy. The recommendations are based on study findings.

5.2 Summary

The general objective of the study was find out if there exists differentials in the survival of infants by their breastfeeding behaviors and the effect of breastfeeding on infant mortality in Kenya. The study particularly sort to find out if breastfeeding behaviors would retain their influence on infant mortality after controlling for socio-economic and other proximate factors. The study utilized secondary data obtained from the Kenya Demographic and Health Survey (KDHS 2008/09) carried out by the Kenya National Bureau of Statistics (KNBS) and a sample of 4937 infants born three years preceding the survey was used.

Logistic regression was used to assess how the covariates influence infant mortality. Life table analysis was used to derive cohort infant mortality rates for the different categorization of breastfeeding behaviors. Socio-economic factors though didn't reflect any significance were included in the final models due the expanded explanatory power of the model when introduced and due to their importance in literature. Infants belonging to rich household had lower risk of dying than those in poor household this relation was however not significant. Infants of women who worked away from home had an elevated risk of dying compared to those whose mothers worked at home, of which, the association too, was not significant and was so only observed in the bivariate analysis. This is because mothers working at home were able to give more attention and care to their children than those who worked away from home.

Preceding birth interval and size of infant at birth retained influence on infant mortality in the multi variate analysis in all the three sets of analysis. Preceding birth interval was strongly associated with infant mortality and so was size of the infant at birth. Infant who are spaced by more than 18months are more likely to survive than those spaced less than 18 months. The perceived size at birth had a weak association in relation to infant mortality, infant of average size were less likely to die than those perceived small at birth.

Duration of breastfeeding has a huge influence on infant mortality even after controlling for both socio-economic and proximate factors. Infants' breastfed for more than 6 month were less likely to die than those breastfed for less than 6 months. Though the other two regressions carried out for exclusivity and timing didn't produce expected results their effect on infant mortality is well documented in literature.

5.3 Conclusion

Selected social economic and cultural factors were not significantly associated with infant mortality. Preceding birth interval and size of infant retained their influence on infant mortality in both bivariate and multi variate analysis levels. Infant who breastfed for more than 6 months are less likely to die than those who breastfed for 0-6 months. In terms of preceding birth interval infants who were spaced for 18 months and above were less likely to die than those who were spaced less than 18 months. Perceived size of infant at birth was also significantly associated with infant mortality average sized infants were found less likely to die than those perceived to be small.

In conclusion, duration of breastfeeding remains a key determinant in infant in Kenya. Preceding birth interval and size of infant at birth were also found to exert independent influence on infant mortality. Future data collection efforts should increase vigilance on breastfeeding data to improve the predictive power of these variables.

5.4 Recommendations

This section gives recommendation based on the literature review and the analysis done. The section is divided into two; one section outlines the recommendations for further research while the other for policy and program implementation.

5.4.1 Recommendations for further research

Future researchers should consider further the effect of exclusivity and time to initiation of breastfeeding on infant mortality where analysis was highly affected by incompleteness of data. Infant mortality would also be appropriately be studied as neonatal mortality and post-neonatal mortality since factors affecting the two seem largely different and could also have affected the current estimates. In terms of data requirements KDHS survey being a retrospective in nature may introduce recall bias especially on the sensitive issues surrounding the dead infants. To adequately study effect of breastfeeding on infant mortality and reduce bias introduced by memory lapse prospective data would be more appropriate.

5.4.2 Recommendations for Policy

From the findings, it is clear that there is need to increase antenatal educative programmes on importance of breastfeeding for longer durations. Nutritional requirements of pregnant women should be re-emphasized to improve fetal health and therefore improve the size of infants at birth. Modern family planning should also be encouraged to help in the spacing of children as we have found that preceding birth interval is a key determinant for infant survival.

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