DETERMINANTS OF CHILD MORTALITY AND MORBIDITY IN SOUTH SUDAN

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DECLARATION

I declare that this work is my original work and has not been submitted for any other award of degree or published at any institution of higher learning.

..... 7th/Jan/2017.....

Signed Date

APPROVAL

"I confirm that the work in this thesis was carried out by the candidate under my supervision and submitted for examination with my approval"

Name of supervisor

..... 09/01/2017 .....

Signed Date

DEDICATION

I dedicate this thesis to my children and all the children residing in Africa.

LIST OF ABBREVIATIONS AND ACRONYMS

ARI	Acute Respiratory Infections
AIDS	Acquired Immune Deficiency Syndrome
EAS	Enumeration Areas.
HIV	Human Immune Virus
HSES	Household socio economic status.
IMR	Infant mortality rate
MDGs	Millennium Development Goals
NGO	Non-Governmental Organization
NBS	National Bureau of Statistics
GOSS	Government of South Sudan.
SSCCSE	South Sudan Centre for Census, Statistics and Evaluation
SSHHS 2	Second South Sudan household health survey.
UNICEF	United Nations International Children Emergence Fund
U5MR	Under Five Mortality Rate
UN	United Nations
WHO	World Health Organization

ABSTRACT

The main objective of this study was to examine factors associated with childhood mortality and morbidity in South Sudan. The specific objectives were to establish childhood mortality, examine the effect of childhood factors on morbidity as well as examining the contribution of mother factors on childhood mortality and morbidity. The study used both descriptive and inferential analysis using secondary data from Second South Sudan household health survey (SSHHS2). Using univariate, bivariate, logistic regression and nested logistic models, the study estimated the odds of dying and survivorship probabilities for under-five mortality. The results provided estimates of childhood mortality by bio-demographic, socio economic characteristics, residence and state level. The results showed unexpected pattern for infant and under five mortality rates across residence, mother education and wealth quintiles. Therefore, these childhood indicators are higher in urban areas (118), primary education (118) and richest household (117).

The proportion of children who received all vaccinations is very low (54.1%) compared with those who didn't receive any vaccinations. Children residing in urban areas (61.8) are more likely to be fully immunized compared to children in rural areas (38.2%). This is due to availability of health facilities in urban areas. The education of the mother has got a very poor relationship with the overall level of child mortality (Chi = 0.647, P-value < 0.05). Based on the results, it can be concluded that birth interval affects survival when there is an interval of less than two years between pregnancies, demonstrating the importance of spacing on child survival.

These factors were important in affecting child mortality. These factors may require to be taken into account in efforts that seek to address child mortality in South Sudan. The Childhood contributors to mortality and morbidity risk is diarrhea, because of large number of males and females that took part in the survey had diarrhea at least in the previous weeks prior to the study. Breast feeding, malaria infections were also great contributors to morbidity since they presented infection figures that were high in the study. In order to avoid prevalence of malaria, diarrhea and pneumonia in infants and under five years of age, the government of South Sudan in conjunction with NGOs should implement effective educational programs that aim at promoting and prolonging breastfeeding that may have a considerable effect on child survival.

CHAPTER ONE

INTRODUCTION

1.0 Background

One of the demographic variables that affect population trends and of interest to demographers, policy makers and researchers is mortality because it is an indicator of socio-economic development. World Health Organization (2005) reported that 10.8 million children under age five die every year (WHO, 2005). Four million of those children die within the neonatal period (1stmonth of life). In Kenya, studies on child health have focused on medical causes of infant and child mortality (McElroy *et al.*, 2001). In spite of improvements in the health and well-being of populations globally over the last few decades, factors such as infectious and parasitic diseases and malnutrition persist as the major obstacles to reduction in child mortality in many developing countries (Aguirre, 1995).

According to UNICEF (2006), the decline in child mortality in Africa has been slower since 1980 than in the 1960s and 1970s. Of the thirty countries with the world's highest child mortality rates, twenty-seven are in sub-Saharan Africa. Through the provision of better healthcare services, infant and under-five mortality rates have declined from 129.1 and 147.2 to 84.7 and 82.9 deaths per 1,000 live births, respectively over the decades. Although the situation is much better than it was a decade ago, the level of childhood mortality is still quite high. Therefore, disentangling the effects of environmental and socio demographic risk factors of mortality could lead to a better understanding of the forces underlying childhood mortality and help child survival intervention program managers to prioritize and target children who are at most risk (Binka *et al.*,2007).

Child mortality and morbidity both have a great impact on the development of any society.

Morbidity, which is the rate of incidence of a disease, or the number of times people suffer from a disease in a given locality, exerts a heavy price on families and communities.

From birth to two years, morbidity can have a long-term impact on a child's cognitive and physical development (World Vision, 2009). Morbidity is largely related to family size, socioeconomic status and birth interval. If a family is large, then there is a high possibility of diseases like Acute Respiratory Infections (ARI's) spreading to each member of the family and most especially if the ventilation in the home is not sufficient. This will be exacerbated in cases where the socio- economic status of the home is not good. Low socio-economic status may lead to poor nutrition in the home. This greatly affects the immunity of the children consequently increasing their vulnerability to the same contagious diseases within the same period hence the high incidence of morbidity as a result of family size.

This is also mentioned in a study carried out by Habib *et al.*(2009) in Pakistan, where birth spacing of less than 1-2 years showed an increase in infant morbidity. Vaccine-preventable diseases like measles, poliomyelitis, whooping cough, tetanus, tuberculosis, diphtheria as well as hepatitis Band (H) A and influenza contribute significantly to child mortality and morbidity in Uganda.

The prevalence of these diseases has been reduced as a result of high immunization coverage in the past five years (Uganda Bureau of Statistics, 2001). The mortality of children is of importance to demographers, policy makers and researchers as mentioned earlier; it is a sensitive indicator of social and economic development of a country and shows evidence of its priorities and values. Therefore, investing in the health of children and their mothers is not only human rights imperative, it is a sound economic decision and one of the surest ways for a country to set its course towards a better future. Impressive progress has been made in improving the survival rates and health of children even in some of the poorest countries since 19

This study thus focuses on determinants of child mortality and morbidity which include breastfeeding, age of mother at child's birth, vaccination, maternal education, Birth spacing and socio-economic conditions. The study used secondary datafrom2010south Sudan household survey second round (SSHHS2).

1.1. Statement of the Problem

In order to adjust and sharpen interventions, there is need to understand the dynamics and determinants of childhood mortality and morbidity among infant and under five children in South Sudan. The core drivers of childhood mortality and morbidity are not well understood largely due to limited structured monitoring and evaluations systems. Moreover, there are high levels of childhood mortality. The second South Sudan household health survey, 2010(SSHH 2) results shows that under-5 mortality is estimated at 118 deaths per 1,000 live births in urban areas, and 105 deaths per 1,000 live births in rural areas. For infant mortality, this is estimated at 90 deaths per 1,000 live births in urban areas, and 75 deaths per 1,000 live births in rural areas (Ministry of Health, and National Bureau of Statistics, 2010). Such a high level of childhood mortality among infants and under five-5 children makes this study very relevant.

1.2. Objectives of the Study

1.2.1. General objective

The main objective of this study was to examine factors associated with childhood mortality and morbidity in South Sudan.

1.2.2. Specific objectives

The objectives of the study were to:

Establish determinants of childhood mortality in South Sudan from 2006-2010

Examine effect of childhood factors on morbidity.

- Examine the contribution of mother factors on childhood morbidity and mortality.

1.3. Research Questions

The research questions for the study were:

- What were the determinants of childhood mortality in South Sudan from 2006-2010?
- Were there any Childhood mortality differentials by subgroups, for example female children against male children, rural and urban mortality variations, lower wealth quintile against higher wealth quintile?
- What is the effect of childhood factors on morbidity?
- Are there any contribution of mother factors on mortality and morbidity?

1.4. Hypotheses for the study

The hypotheses for the study were:

1. The mothers' age at birth of the child has no effect on childhood mortality.
2. The mothers' education level has no effect on childhood mortality.
3. The household wealth quintile has no effect on childhood mortality.
4. The previous birth interval has no effect on child mortality.
5. Breastfeeding has no association with childhood morbidity.

1.5. Significance of the Study

Determinants of childhood mortality inform interested parties such as health authorities and donor community. The results from this study are expected to contribute to already existing literature and hopefully highlight important determinants of childhood mortality in South Sudan, with the view of highlighting impediments to achieve MDG targets. Effort to reduce

childhood mortality and morbidity can only be given priority and a sense of urgency if the extent of the problem is well known together with issues that are hampering efforts to reduce childhood mortality are clearly defined. Furthermore, the results from study on childhood mortality and morbidity determinants could help in the planning and evaluation of health services in South Sudan.

1.6. Definition of Terms

Definitions of some terms used in this study are presented on this section.

Infant Mortality Rate (IMR):The probability of dying between 0-12 months of life and is expressed as deaths per 1000 live births.

Under-five mortality U5MR: The probability of dying between birth and exact age 5.

Determinants: Factors likely to have an influence on mortality.

Mortality: The condition of one day having to die or the rate of failure or loss.

Morbidity: A term used to describe how often a disease occurs in a specific area or is a term used to describe a focus on death.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0. Introduction

Research on determinants of childhood mortality and morbidity has dominated the field of demography and population studies since the 1960s through to the 1990s as noted by (Kaldewei & Pitterle, 2011). Nevertheless, the 1980s and 1990s ushered in a new perspective towards the study of childhood mortality as it was a time to take seriously the intertwined nature of child mortality with other issues such as poverty, inequality and gender disparities (UN, 2011; Gakidou *et al.*, 2010). Stressing the significance of the relationship between child mortality and other socio-economic issues, Desai and Alva (1998) argue that it is often precarious to focus on maternal education alone as the dominant determinant of childhood mortality as was the tradition in the study of child mortality in the 1960s and the 1970s. Desai & Alva (1998) further argue that from the 1980s up to date there has been a transformation and efforts are constantly being made to acknowledge the important role played by other determinants of child mortality. To further support this argument Croghan *et al.*(2006) cite other important factors such as "strong economy, education, adequate nutrition, equity, and effective government; a functioning public health system that provides sanitation, clean water, and infection control; and a comprehensive primary health care delivery system" that are required to address Millennium development goals (MDGs) especially child mortality (Croghan *et al.*,2006).

The two rates of childhood mortality that are presented in this chapter are the Infant Mortality Rate (IMR), which is the probability of dying between birth and exactly age 1 and the Under-five mortality U5MR, which is the probability of dying between birth and exact age 5.

Both IMR and U5MR are good indicators of childhood mortality. IMR is a good indicator of both medical and public health conditions and initiatives, while U5MR is preferred to other indicators of child mortality because it represents collective mortality throughout childhood (Muhuri & Preston, 1991; Hill &Pebley, 1989).

2.1. Global Overview of Child Morbidity and Mortality

Since renewed global commitments in 2000 to reduce childhood mortality by two-thirds between 1990 and 2015 and to address other developmental goals, there has been another notable decrease in the levels of childhood mortality world-wide, although at a slower rate than anticipated (Walker *et al.*, 2002). According to *Black et al.* (2003) by the year 2000, the absolute number of children dying had come down to 10.8 million child deaths worldwide.

Rutherford *et al.*(2010) reported a global estimate of 9.7 million under-five deaths each year. Again, about 41% of these deaths occur in the sub-Saharan African countries. Recent estimates of the UNICEF (2012) put the 2011 global under-five deaths at around 7 million. Though childhood mortality seems to be declining, the figure still remains unacceptably high with sub-Saharan Africa remaining the major contributor to this figure.

Unfortunately, the vast majority of these childhood deaths are preventable by low-cost public health interventions (Jones *et al.*, 2007). Considering factors influencing child mortality, a study on maternal education and child survival in the developing countries by Cleland and others (1988) had long established the importance of maternal education in successful childrearing. That study established that maternal education has a strong effect on child mortality through the influence of intervening variables like reproductive health patterns and equitable care for sons and daughters. Also, emphasizing the importance of maternal education Whitworth and Stephenson (2002) study in India found that higher level of

maternal education has the advantage of weakening the effect of short birth interval because increased female autonomy and access to resources tend to remove the competition for resources that often characterize short birth interval. Kravdal *et al.* (2008) showed that apart from the effect of maternal education on child mortality in India, education of woman also has strong association with child mortality. A study by Diddy and Antai (2011) attributed ethnic differentials in the risk of under-five mortality to disparities in maternal level of education among various ethnic groups in Nigeria. Kravdal, (2008) also noted that equitable care for sons and daughters work to the advantage of children born to the educated mothers. Griffiths *et al.* (2008) opinioned that childhood malnutrition is not as prevalent as child mortality in sub-Saharan Africa; whereas, about half of the children in India alone are affected by malnutrition.

Griffiths *et al.*(2008)further suggested that homogenous nutritional outcomes are found among the children in the same community because of shared behavioral practices like cultural norms regarding food. Some of the identified covariates of child malnutrition are size of the child at birth, age of the child, maternal level of education, breastfeeding status, and last diarrhea episode. Furthermore, Subramanian *et al.* (2006) study provided evidence that socio-economic effect of mortality is substantial among the Indian and that the burden of poor health outcomes disproportionately affects the economically disadvantaged.

In a study by Frankenberg (1995) which examined the effects of access to health care on child mortality in Indonesia, it was shown that just an addition of one doctor could reduce the odds of child death by almost 2 percent while substantial reduction, that is 15 percent, could result from an addition of just one maternity clinic. The author confirmed the hypothesis that proximity to health facility significantly decreases child mortality. The study also goes on to

state that a slight increase in the distance to health facility would lead to a corresponding increase in mortality risk among the children.

Frankenberg (1995) also found that increase in health personnel tend to increase mortality risk among the study population. Antai *et al.*(2010) also stressed the need for community-level intervention to improve access to health care services in Nigeria.

Whitworth and Stephenson (2002) established that competition for resources between the newborn and the previous sibling is the pathway through which short birth intervals increase the mortality risk among the children. The authors conclude that children of young mothers, children of high parity and children whose previous sibling died or breastfed for short durations are at greatest risks of dying if their births follow a short birth interval.

2.2. Determinants of Mortality and Morbidity

A large body of literature focuses on the determinants of individual and household morbidity and mortality in order to inform policies designed to reduce the burden of disease. The majority of these studies examine the socioeconomic determinants of morbidity outcomes such as maternal education, household income and access to health (Schultz, 1983).

Mortality and fertility affect each other in many ways – both directly and indirectly. It is reasonable to assume that parents care about the number of surviving children and not how many that are born. Child mortality in a household, i.e. the probability of a child passing away, will therefore affect the number of births required to reach the desired number of surviving children. This can be said to be an indirect effect of mortality on fertility; the probability of a child dying affects the household demand for children (Becker, 1992)

2.3. Conceptual Framework

The conceptual framework was based primarily on one developed by Mosley and Chen (1984). This model provided for the measurement of mortality and morbidity and it organizes factors associated with infant and under five mortalities into bio demographic, socioeconomic, geographic and proximate determinants. The model allows for careful tracing of the pathways through which socioeconomic and bio-demographic factors impinge on child health and survival in the developing world.

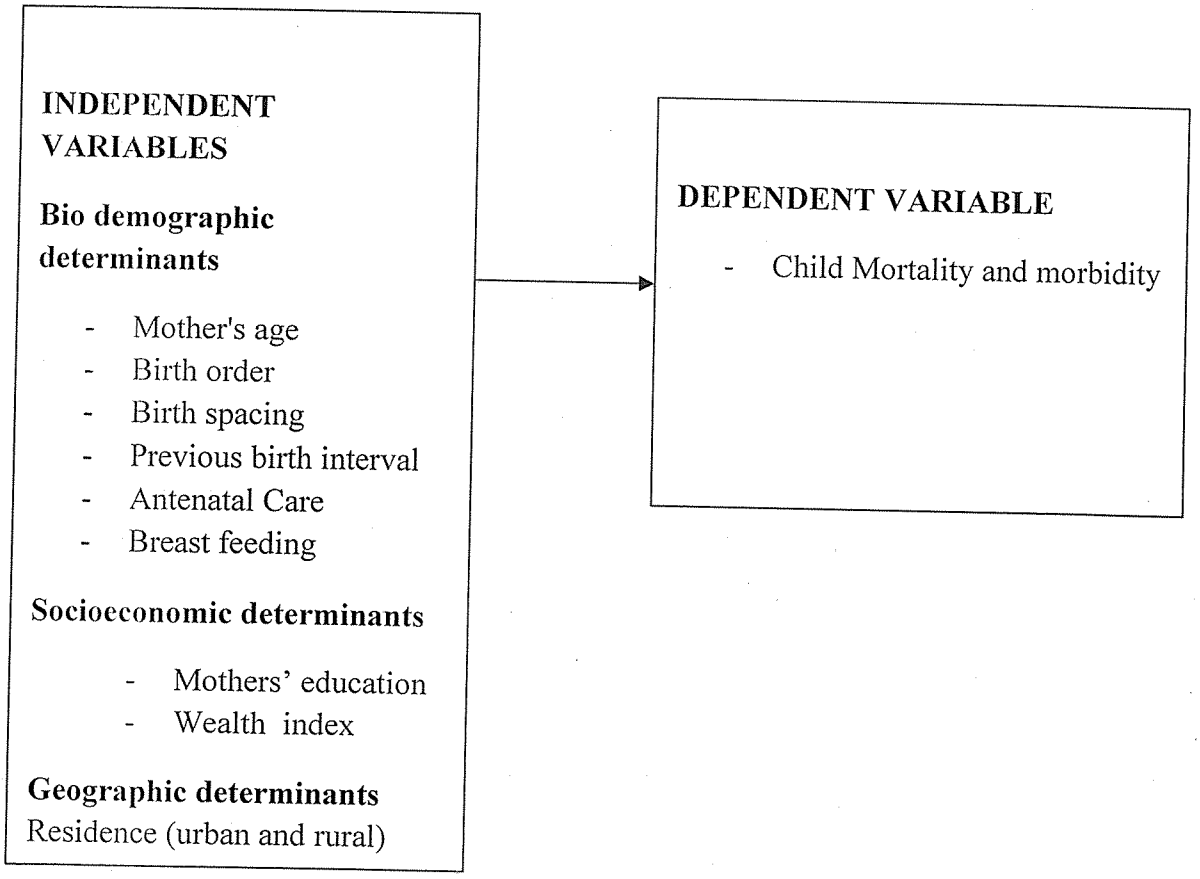


Figure 2.1: Conceptual framework for the variable relationships

Source: Modified from Mosley and Chen (1984).

Figure 2.1 is an illustrative example of how socioeconomic factors affect child health through proximate factors in a developing country is the education of women. Education is a social determinant that affects health through several of the proximate determinants. Educated

women tend to marry and give birth later in life than uneducated women. Delaying the first childbirth beyond the teenage years decreases the chance of complications during delivery, and thus increases the chance of survival of both mother and child. In this way, the education level of a child's mother as a social determinant affects a proximate determinant of child health, namely the mother's age at birth.

Because they start making family later in life and work outside the household to a larger extent, educated women have less time to both procreating and fostering children and consequently tend to have fewer children than women with less education. The number of children affects the individual child's health through the health of the mother (which is likely to be deteriorating in step with number and frequency of childbirths) and through the amount of resources (such as food) available to the fostering of the child. The mother's age at birth and the number of children fall into the maternal factors category in figure (2.1).

The mother's education also affects child health through knowledge. Both her ability to prevent herself and the children from getting ill and to take the appropriate measures if they do, is influenced by her level of education. Of course, women's education matter to child health in more developed countries too. However, the mechanism through which it works and the relative importance of the effects differs between the two settings, and the example was chosen because it is relevant to the subsequent analysis.

Macassa *et al.* (2011) acknowledges that the importance of Mosley's and Chen's work, but also criticized it for failing to incorporate more indirect factors affecting child health, such as national health, and health related, polices, institutions and macroeconomic variables. The consequence of this has been an over-emphasis on individual-level decision-making, while neglecting factors like the political, the geographical and the cultural environment which all affect child health.

2.4. Empirical work on Child Morbidity and Mortality

In this section, the researcher presents a brief overview of some of the empirical work done on child Morbidity and Mortality. The researcher focused attention to the factors in the economic model and the analytical framework and to those the data contain information about. The overview is not intended to be exhaustive.

Income/wealth

The empirical evidence shows a significant negative relationship between child mortality and wealth. The evidence is strong and the association is found at both the macro level and the micro level. Since this thesis deals with household characteristics and health service delivery, the studies focus on the micro evidence. In a review of international evidence on child mortality in low and middle income countries, Houweling and Kunst (2010) use a household asset index to measure wealth.

It was found that the child mortality is significantly higher in the poorest compared to the richest bracket of society in 55 developing countries. There were not only differences between the poorest group and the rest, but also across other income groups. Anyamele (2011) also finds a significant negative association between wealth quintile and child mortality in 20 countries in Sub-Saharan Africa and Ssewanyana *et al.*(2002) found a negative effect of wealth measured by household assets in South Sudan.

Explanations for this relationship are plentiful. In addition to its direct impact on purchasing power and the ability to buy health promoting goods and services, wealth is closely related to proximate determinants of child mortality; most of these factors show worse levels for the poorest (Houweling & Kunst, 2010). Wealthier households are likely to dwell in conditions with better sanitation, and display a higher level of education. Hence, they will probably have

more knowledge about disease prevention and treatment, and to have access to higher quality health service than the less wealthy.

Education

Education, and mother's education in particular, is one of the most frequently described social determinants of child mortality in developing countries, and empirical evidence strongly suggests that educated women have fewer and more healthy children than the less educated (Cleland &Ginneken, 1988) ,Studying the relationship between maternal education and child mortality in 17 developing countries, Bicegoand Boerma (1993) found a significantly higher mortality rate for children aged 0-23 months that had mothers with low levels of education.

They also found neonatal mortality to be significantly less sensitive to maternal education than mortality among children aged 1-23 months. This is consistent with Hobcraft *et al.* (1984) who found an increasing impact of mother's (and father's) education on child mortality as children grow older. In the same study, as well as in Caldwell (1979), it is also found that even for very low levels of education, positive effects on child survival are observed. While some of the effects of education on child mortality found in the literature are likely to be associated with household wealth (Houweling &Kunst, 2010), there are many plausible explanations for why education has additional direct effects on child mortality.

One is that educated women have better knowledge about prevention and treatment of illness. Hobcraft (1993) found that while the evidence is strong for higher prevalence of diseases among the children of uneducated mothers, the difference is much larger in treatment of diseases, when investigating data from 25 developing countries. In his study, educated

mothers proved to have better knowledge about illnesses and were more likely to take their children to a health facility when falling ill (Hobcraft, 1993).

Moreover, he found evidence that educated women were more likely to make sure that their children were fully vaccinated, to receive prenatal care and be vaccinated against tetanus during pregnancy, and to give birth in the presence of skilled personnel. Hobcraft also found evidence that children of educated mothers were less likely to be undernourished in terms of stunting. To what extent these differences translate into improved chances of survival for the children of educated mothers is not estimated in the article, but it is reasonable to assume that the two are positively related (Hobcraft, 1993).

Maternal factors

In addition to her education level, a number of other characteristics of a child's mother are found to have significant effects on survival. Age at childbirth is one of these. In a study of determinants of child mortality in Malawi, Manda (2006) found risk of child mortality to be considerably higher for relatively young and relatively old mothers. This could be explained by biological factors. While young women in their teenage years have increased risks of complications during delivery because they are not fully developed, older women have a higher risk of complications because their bodies and reproductive systems are "worn".
Fertility characteristics such as the number and frequency of child births and the number of the child in the succession of births are also found to have significant effects on child survival (Manda, 2006). These findings could also be accounted for by biological factors. If child births occur with brief intervals, this could drain the mother of nutritional and reproductive resources and give her weak children, more likely to succumb to infections. Under- and malnutrition is one of the largest direct causes of child deaths worldwide (World Health

Organization, 2009) and is closely related to another important maternal factor, namely breastfeeding.

Breastfeeding is found to have a significant bearing on child mortality (Manda,2006), and this can be explained by the fact that breast milk is very nutritious, contains antibodies that help protect the child from infection causing diseases like diarrhea and pneumonia (World Health Organization, 2011a) and is sterile (Palloni & Tienda, 1986). All of these properties make breastfeeding especially important in low income settings where good alternatives to breast milk are not readily available and households have limited access to clean water.

Like education, the maternal factors are generally worse for the least wealthy, with one exception: breastfeeding. Poor women with little or no education are usually breastfeeding their children for a longer period than the wealthier women (Houweling & Kunst, 2010).

Last, but not least, use of health services, especially those directly related to pregnancy and delivery are important maternal determinants of child health. Closely related to this, is access to and quality of health services which are also important determinants of child health.

Access to and quality of health services

In the literature, there seems to be a broad consensus on the significance of health services, especially antenatal, delivery, postpartum and immunizations services, to child health, but empirical evidence on the subject is scarce. Some studies do, however, exist. Lavy *et al.*, (1996) found a negative relationship between access to public child health services and child mortality in Ghana, and a recent study of neonatal mortality in China shows large positive effects of delivering in hospital compared to delivering at home. The reasons for why access to and quality of health services matter are obvious.

They play an important role in both prevention, for example, immunization and health education of patients and treatment of illness. Because most maternal and child deaths occur

during or shortly after delivery, antenatal care, which serves to discover and treat micro-nutrient deficiencies and assess other risk factors, is of crucial importance to survival of both mother and child. So is the attendance of skilled personnel that have access to necessary equipment and medicines needed if complications occur during delivery. Follow-up services in the period after delivery are also central to detect and treat infections and other conditions that are likely to occur to mother and child postpartum (WHO, 2009).

2.5 Geographic Variables

Many researchers have found significantly lower child mortality rates in urban compared to rural areas in developing countries (Pandey, 1998; Wang, 2007). This probably reflects differences in underlying socioeconomic factors (income, education level, household demography) that are often large between urban and rural areas. In a study of urban-rural differences in child mortality in Brazil (Sastry, 1997) finds that in addition to underlying socioeconomic differences, rural-urban differences are also explained by community characteristics such as the quality of social services including health service delivery, infrastructure and sanitation, education and geographic and epidemiological environment

2.6. Knowledge gap

The review of determinants of childhood mortality and morbidity remains a vital tool for policy re–evaluation purposes, implementation and for monitoring and evaluation of National health programs, including the donor funded projects. However, most studies reviewed above seem to lay a special focus on the main determinants of mortality yet morbidity is also known to be moving together with mortality. Therefore, this study has investigated the effect of childhood factors on both morbidity and mortality, the contribution of mother factors on mortality of children as well as further examined Childhood mortality differentials by subgroups, for example female children against male children, rural and urban mortality

variations, lower wealth quintile against higher wealth quintile. No study has ever been conducted to examine the above-mentioned determinants in South Sudan. Thus, this study aims at filling such a research gap.

CHAPTER THREE

METHODOLOGY

3.0. Introduction

Chapter 3 presents the methodology for the study. The main objectives were to examine factors associated with childhood mortality and morbidity in South Sudan. Using the most recent second South Sudan household health survey, 2010,the first part of this chapter described the research methodology, description of data sources used for the study, research design, Model specification and description of dependent and independent variables.

The dependent variable which is childhood mortality is measured against the well-known and well established independent variables that include bio- demographic parameters such as age of mother's age at birth, births order, previous birth interval, duration of breast feeding. Besides these bio- demographic parameters, the effects of socio-economic factors such as maternal education, household socio-economic status, area of residence rural and urban and state of residence.

3.1. Research design

The Second South Sudan Household Health Survey (SSHHS 2) was one of descriptive surveys that generate cross-sectional data which allows to deduce certain characteristics about the entire population. Vogt (1993) defines descriptive research as "research that describes phenomena as they exist". Williams (2003) further acknowledges that although the design of descriptive surveys is simple by nature, the surveys have the capacity to collect as much information as possible about the study population. Descriptive surveys make it possible to describe populations over time and also to make inter-country comparisons with countries that have conducted similar studies (Williams, 2003).The study is a quantitative

research design, which allows putting numerical values to social observable issues (Basu, 1989).Antonius (2002) also mentioned that it is possible to describe occurrences accurately and to establish links between issues or variables being investigated in this case the relationship between childhood mortality and age of mother, child's gender, maternal education, areas of residence, household wealth status and province of residence not necessarily in that order. One advantage of descriptive surveys identified by Williams (2003) is that it is economically viable in the long run as there is no need to conduct several studies about different variables of interest.

Cross-sectional data captured by descriptive studies such as South Sudan Household Health survey (SSHHS) makes it possible for researchers to study many phenomena such as mortality, morbidity, fertility, migration and general behaviors of the population being investigated. This makes descriptive research the most appropriate method to use for this kind of study, since mortality data is captured in detail in this research method. In the SSHHS2, 2010, women were asked to provide a detailed account of birth history capturing children ever born and the number that has died and the exact date of the event.

SSHHS make use of questionnaires to get the necessary information from the respondents. Several questions related to fertility, mortality, household characteristics, socio-economic status, nutritional status and behaviors are answered by those who take part in the survey. The SSHHS, 2010 had three questionnaires, one was for men, and the other one was for women and the household questionnaire. This study uses only answers provided by women on reproductive issues in-order to estimate childhood mortality and determinants, hence the use of data generated from the women's questionnaire. Some of the questions that women were asked include the following: Now I would like to ask about all the births you have had during

your life. Have you ever given birth? Have you ever given birth to a boy or girl who was born alive but later died?

3.2. Data source

This study is fixed in cross-sectional data emanating from the South Sudan Household Health Survey conducted in 2010. According to ministry of Health and National bureau of Statistics (2010), the SSHHS, provide answers to some of the questions such as how many people have particular characteristics and how many have experience certain events such as mortality. The Household Health Survey usually have a large sample size and this improves confidence interval of the studies and reduces the chances of making Type 11 (β) error of reporting a false negative result based on a small sample size (Bryman & Cramer, 1990). Surveys such as Demographic and Health survey (DHS) and World Fertility Surveys have become a source of reliable data especially for developing countries as they produce cross-sectional data making it possible to understand health and social issues on populations being studied. The Household Health surveys (HHS) are financially and technically supported by US Agency for International Development (USAID) and Macro International. In South Sudan, Household health surveys are conducted in partnership with the National Bureau of Statistics (NBS) a governmental department which is responsible for producing and keeping of data related to fertility, mortality, migration and health surveillance. The SSHHS have been conducted in South Sudan after every five years since 2006 making the SSHHS 2010 the Second SSHHS to be conducted in South Sudan since 2006. Data from the SSHHS of 2010is stored in different files that are the women Recode file, Household Recode, file Individual Recode, Under -5 years Children's Recode, Male Recode and Household Member Recode. For this study, analysis of determinants of childhood mortality is limited to the five years period

preceding the survey. The main objectives of the study were to see the impact of well-established determinants in the country.

3.3. Data Analysis

Data analysis process and extraction process was intertwined and the study made use of **SPSS** version 20, a statistical computer program that allows for extraction and analysis of relevant data from the dataset. As already highlighted earlier, South Sudan household health survey, 2010 data was stored in different formats and in SPSS the data for this study used three files ,namely the women Recode file, Children's' Record file and Household Recode, the women's' Record file contain the status of women age 15-49 years and that of Children's recode file contains status of under 5 children. For this study data was analyzed using three stages of analysis. The first phase of analysis involved using univariate and Bivariate analysis. The second stage involved the use of logistic regression analysis.

Univariate analysis was used to study the distribution of background characteristics such as bio-demographic and household socio -economic, status. Frequency distributions and percentages were used in establishing the proportion of respondents in each category.

Bivariate analysis was performed to determine the differentials of morbidity and mortality among under-5 children according to any prevailing risk factors. Pearson's chi square test of independence was performed to test the existence of any significant association between child mortality and selected risk factors. The formula used is as below.

$$X^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \left[\frac{(O_{ij} - E_{ij})^2}{E_{ij}} \right] \text{----------(3.1)}$$

Where; j=1, 2... c.,

i=1, 2... r

O_{ij}= the observed frequency (observed number of children)

E_{ij} = the expected number of death.

c = Number of categories of the dependent variable.

r = Number of categories of the independent variable.

3.4. Model Specification

Logistic regression model

Logistic regression analysis belongs to a family of multivariate regression methods that are used to establish existing relationships between and among variables. According to (Reid, 1987) measuring of existing relationships or associations between and among variables is important in the field of social statistics as it helps with the formulation of theories and hypotheses. Logistic regression measure association between variables and it is methods which accommodate dependent variables with categorical outcomes (Rutherford *et al.*, 2010). Logistic regression can be used to estimate likelihoods, probabilities, odds and log-odds of an event occurring (Rutherford *et al.,* 2010).

For this study logistic regression was used to estimate the odds of an event happening and was presented as odds ratios. These odds ratios produced with logistic regression analysis indicated the association that is likely to occur with dichotomous outcomes, in case of this study whether the child was still alive or dead at the time of the survey. Since the outcome variable was a two-category dependent variable, binary logistic regression was the most appropriate method for this study (Rutherford *et al.,* 2010, Marsh and Elliott, 2008). Where 0 was children alive and children dead were coded 1. The purpose of the analysis using logistic regression analysis is to assess the effects of multiple explanatory variables on the outcome variable.

Logistic regression method of analysis involves the construction of models or logits that

predict the odds of an event occurring. In this analysis the dependent variable is binary of nature since there are two different outcomes; a child either survives or dies as mentioned earlier. Thus, a logistic regression model was applied for the statistical analysis. It was used in the study to estimate the likelihood of child survival in view of the prevailing socio-economic and demographic as well as biological factors in the mortality regions. It was used to determine the relationship between selected independent variables and child death.

The P-value selected is 0.05 implying that any observed significance which was less than P-value implied an association between the dependence and independent variables, while P-value above 0.05 was taken as indicating no association between the variables.

The equation for predicting the probability of an event occurring using logistic regression analysis when investigating the effects of one independent variable is as follow.

$$\text{Log}\left[\frac{Pi}{1-Pi}\right] \quad logoi = \alpha + \beta X \text{----------} (3.2)$$

Where 1 is the probability of being alive and Pi is the proportion of dying, $log0i$ is the odds of an event occurring and $\boldsymbol{\alpha}+\boldsymbol{\beta X}$ is the effects of one independent variable before controlling for other factors

The formula that involves independent variables therefore becomes

$$\log\left[\frac{\text{Pi}}{1-\text{Pi}}\right] = \alpha + \beta_1 \text{X}_{i1} + \beta_2 \text{X}_{i2} + \cdots + \beta_p X_{\text{ip}} \text{----------} (3.3)$$

Where $1-Pi$ represent the conditional probability of being alive; Pi is the proportion dying.x_{i1} , X_{i2}+.....X_{ip}, are the independent variables, β_1 , β_2....$\beta_3$are the slope coefficients. In order for interpretation of logistic regression using odds, antilogs were applied to equation (3.2) to have the model as;

$$\frac{\text{Pi}}{1-\text{Pi}} = \text{e}^{\alpha+\beta} = e^{\alpha}\left(e^{\beta}\right)^{X} \text{----------} (3.4)$$

Where the two constants multiplied by each other raised to the power X imply that an

additional explanatory variable added on to the regression has a multiplicative effect on the odds of dying.

For this study three models were nested. The models were labeled as model I, which investigated the effects of bio- demographic factors which are age of mother and gender of child. In model II socio-economic factors that have been known to impact on the survival of children that include maternal education and household socio-economic status are introduced. And model III introduced geographical variables which are area of residence (rural or urban and state of residence to the equation.

3.5. Description of Variables

Selected variables from the South Sudan household health survey second round (SSHHS 2) dataset were used to establish the model for socio-economic, proximate and bio-demographic variables can be found in the dataset. From the back drop of the theoretical framework the following variables were created.

Dependent variable

The dependent variable has been described as that factor which the researcher observes and measures to determine how it was affected by the independent variable (Welman *et al., 2005.)*For this study the dependent variable was status of child whether dead or alive at the time preceding the survey, indicating that the dependent variable had binary outcome.

Independent variables

The independent variable is the factor that can be used by the researcher in-order to observe its effects on the dependent variable (Welman *et al.,* 2005). For this study a number of independent variables were of interest and they included bio demographic factors, socio-economic factors and Geographical factors such as Residence.

3.6. Bio-demographic factors

Included age of mother at birth, child's gender, Birth order previous birth interval, antenatal care, Diarrhea, phumonia and duration of breastfeeding.

Childhood factors associated with morbidity

Some of the determinants of childhood morbidity include breastfeeding, age, child's sex, and plurality, mode of delivery, gestational age, and birth weight, parity of mother, vaccination, maternal education, birth spacing and household socio-economic status. Breast feeding is a key determinant that lowers the rate of infection related morbidities (Habib *et al.,* 2009).

3.7. Socio-economic factors

The SSHHS 2 collect information on socio-economic factors and these include education attainment for the women, education attainment for the head of the household, household toilet facility, source of drinking water, source of energy, ownership of household electrical goods, rooms in the households used for sleeping purposes alone, floor material, ownership of automobiles among other factors all these refer to wealth index. Results of which were then used to estimate and classify households by wealth index quintile.

Maternal education

In second South Sudan household health survey (SSHHS 2), household members were asked to provide level of education of all members of the household before selection of one eligible woman respondent from the household to answer ensuing questions. Levels of education were classified as No education, Primary and Secondary (Ministry of Health and National Bureau of Statistics, 20010). Different studies have acknowledged the importance of maternal education to overall child survival and some have suggested that education of

women is likely to contribute significantly to the decrease in the number of children who die before reaching 5 years (Caldwell, 1986).

3.8. Geographical factors (area of residence-rural/urban)

According to Basha (2004), geographical factors are factors that relate to a place, a specific area or environment where a particular individual spends a proportion of their time. These include the environmental factors, climate factors, political and economic factors prevailing in that particular area.

State of residence.

Bangha and Simelane (2007) in South Africa found that child mortality was not uniform among different provinces in the country suggesting that there could be other factors that are at play in other provinces that are missing in others. The factors could range from quality of air, waste management and waste disposal to climate conditions.

CHAPTER FOUR

ANALYSIS AND INTERPRETATION OF RESULTS

4.0. Introduction

This chapter presents results of the study which sought to investigate the determinants of child mortality and morbidity using data from second South Sudan household health survey 2010. Factors were grouped into three main determinants that are bio-demographic, socio-economic and geographical factors that impact on child survival. Under bio-demographic factors, age of mother at birth of the child, Birth order, and previous birth interval, duration of breastfeeding, Pneumonia, diarrhea and antenatal care were investigated. Under the socio-economic factors, the concepts that were investigated include mothers' education and household socio-economic status. The last group looked at geographical factors that impact on childhood mortality and in this group the study looked at mortality differentials by area of residence whether urban or rural area and state of residence.

4.1.Determinants of Childhood Mortality

Table 4.1: Early Childhood mortality rates by Bio-demographic characteristics

	Neonatal mortality rate	Post neonatal mortality rate	Infant mortality rate	Child mortality rate	Under five mortality rate
Sex of child					
Male	46	38	84	36	117
Female	39	34	73	29	99
Mothers age at birth					
< 20 years	34	38	72	20	91
20 - 34 years	37	30	67	31	96
35 - 49 years	75	59	134	56	188
Birth order					
1	31	31	63	22	83
2-3	26	26	52	26	76
4-6	44	42	86	34	117
7+	107	54	161	91	238
Previous birth interval					
< 2 years	87	60	147	49	188
2 years	34	26	60	31	89
3 years	21	26	47	27	72
4 + years	29	31	60	26	84

Source: Ministry of Health and National Bureau of Statistic, 2010.

Distribution of Early Childhood Mortality rates by Bio-demographic characteristics.

The results from table 4.1 show that all childhood mortality indicators, early childhood mortality rates are higher more males than females. For example, under-five mortality rate is estimated at 117 deaths per1,000 live births for boys, and 99 deaths per 1,000 live births for girls. This means that male children are 1.18 times more likely to die before the fifth birthday than females.

Table 4.1, also show that for mothers aged below 20 years, the infant mortality rate is estimated at 72 deaths per 1,000 live births, compared to 67 deaths per 1,000 live births for mothers aged 20-34 years. The under-five mortality rate is estimated at 91 deaths per1,000 live births for women below the age of 20 years, and at 96 deaths per 1,000 live births for women aged 20-34 years. Infant and under-five mortality rates are higher for children born to women aged 35-49 years, with 134 deaths per 1,000 live births and 188 deaths per 1,000 live births, respectively.

Results in table 4.1shows that birth order 4-6, face a higher risk of Under-five mortality. Births order seven and higher experience the highest levels of childhood mortality, while mortality is lowest for second and third order births. For example, under-5 mortality rate is estimated at 238 deaths per 1,000 live births for birth order seven and higher, 76 deaths per 1,000 live births for birth orders 2-3, and 117 deaths per 1,000 live births for birth order 4-6. The birth interval also affects survival when there is an interval of less than two years between pregnancies, demonstrating the importance of spacing on child survival. This is fairly consistent in all childhood mortality indicators.

For example, infant mortality rate for children born at less than a two-year interval is 147 deaths per 1,000 live births and 47 deaths per 1,000 live births when the birth interval is 3 years. This means that the children born at less than a two-year interval are more than three times likely to die before their first birthday compared to the ones born at 3 years' interval.

Under-five mortality rate is 188 deaths per 1,000 live births for birth intervals of less than 2 years and 72 deaths per 1,000 live births when a birth occurs 3 years after a previous birth. Children born at less than a two-year interval are more likely to die before their fifth birthday compared to the ones born at 3 years' interval.

Table 4.2: Early Childhood Mortality rates by Socio economic characteristics

	Neonatal mortality rate	Post neonatal mortality rate	Infant mortality rate	Child mortality rate	Under five mortality rate
State					
Upper Nile	29	44	74	26	98
Jonglei	14	17	31	17	48
Unity	15	16	31	20	51
Warap	31	40	71	50	117
Northern Bahr El Ghazal	78	42	120	42	157
Western Bahr El Ghazal	35	56	91	27	115
Lakes	29	23	52	22	73
Western Equatoria	53	43	95	38	130
Central Equatoria	76	39	115	42	152
Eastern Equatoria	59	47	106	35	137
Residence					
Urban	47	44	90	31	118
Rural	41	33	75	33	105
Mother's Education					
None	42	36	78	31	107
Primary	47	35	82	39	118
Secondary +	43	40	83	35	115
Wealth index quintile					
Poorest	48	31	79	31	108
Second	43	37	80	35	112
Middle	40	31	71	30	99
Fourth	38	35	73	35	106
Richest	44	46	90	29	117

Source: Ministry of Health and National Bureau of Statistics, 2010.

Early Childhood Mortality rates by Socio economic characteristics.

The results in table 4.2 provide estimates of childhood mortality by state, residence and two socio-economic characteristics. The early childhood mortality estimates for the state level show that Northern Bahr El Ghazal and Central Equatoria have the highest under-five

mortality rate with 157 deaths per 1,000 live births and 152 deaths per 1,000 live births, respectively; and the lowest proportions are reported in Jonglei (48 percent) and Unity (51 deaths per 1,000 live births). Northern Bahr El Ghazal state has also the highest infant mortality rate (120 deaths per 1,000 live births) and the lowest infant mortality rates are in Jonglei and Unity (31 deaths per 1,000 live births each).

The results show an unexpected pattern for infant and under-five mortality rates across residence, mother's education and economic status. The two childhood mortality indicators are higher in urban areas, primary education and richest households. A close look at the data also reveals that under-5-mortality is estimated at 118 deaths per 1,000 live births in urban areas, and 105 deaths per 1,000 live births in rural areas.

For infant mortality, this is estimated at 90 deaths per 1,000 live births in urban areas, and 75 deaths per 1,000 live births in rural areas. The findings further reveal that under-five mortality rate is estimated at 107 deaths per 1000 live births for children whose mothers have no education and at 118 deaths per 1,000 live births for mothers with primary education. For children whose mothers have no education, infant mortality rate is estimated at 78 deaths per 1000 live births, and at 82 deaths per 1000 live births for children whose mothers have primary education.

As already mentioned above, the infant and under-five mortality rates are higher in the richest households compared to the remaining four and lower quintiles. Significant variations are also noted between middle and richest quintiles. In other words, the children from the richest households have higher mortality rates, compared to those from the middle households.

Under-5-mortality is estimated at 117 deaths per 1,000 live births for children from the richest households, compared to 99 deaths per 1,000 live births for children belonging to the middle households. This means that the children from the richest households are more (1.18 times) likely to die before their fifth birthday as those from the middle households.

Results of Logistics regression analysis

Table 4.3: Percentage distribution and odds for children dead by selected variables

Back ground characteristics	Lost Child (Mortality)				Binary Logistic		
	Yes		No				
State	Number	Percentage	Number	Percentage	Odds Ratio	ME (OLS)	Sig
Upper Nile	187	9.51	589	11.00	1.58	0.46	0.02
Jonglei	108	5.49	635	11.86	3.52	1.26	0.00
Unity	84	4.27	594	11.09	3.31	1.20	0.00
Warap	245	12.46	562	10.49	1.34	0.29	0.13
Northern Bahr El Ghazal	308	15.66	464	8.66	0.83	-0.19	0.29
Western Bahr El Ghazal	204	10.37	462	8.63	1.51	0.41	0.05
Lakes	156	7.93	625	11.67	2.41	0.88	0.00
Western Equatoria	213	10.83	504	9.41	1.46	0.38	0.09
Central Equatoria	243	12.35	472	8.81	0.93	-0.08	0.71
Eastern Equatoria	219	11.13	448	8.37	Omitted		
Residence							
Urban	615	31.27	1319	24.63	0.889	1.667	0.57
Mother's age							
15-19	34	1.73	324	6.05	3.50	0.00	1.25
20-24	220	11.18	1063	19.85	1.98	0.06	0.68
25-29	431	21.91	1510	28.20	1.21	0.59	0.19
30-34	403	20.49	976	18.23	0.92	0.81	-0.08
35-39	441	22.42	851	15.89	0.64	0.22	-0.45
40-44	237	12.05	339	6.33	0.59	0.19	-0.54
45-49	201	10.22	292	5.45	Omitted		
Wealth Index							
Poorest	369	18.76	1017	18.99	1.09	0.61	0.09
Second	392	19.93	1044	19.50	1.02	0.93	0.02
Middle	337	17.13	1149	21.46	1.44	0.03	0.36
Fourth	412	20.95	1118	20.88	1.10	0.54	0.09
Richest	457	23.23	1027	19.18	Omitted		Omitted
Mother's Education							
None	1621	82.41	4463	83.34	1.71	0.55	0.54
Primary	292	14.84	706	13.18	2.04	0.44	0.71
Secondary +	51	2.59	170	3.17	4.32	0.13	1.46
Adult education/Khalwa/Sunday eductation	3	0.15	16	0.30			
Antenatal Care							
Yes	548	54.75	1404	46.08	0.82	0.56	0.82

Source: Ministry of Health and National Bureau of Statistics, 2010.

Percentage and odds ratios of children dead by state.

Results in table 4.3 showed that for the children born in Upper Nile, the odds against dying were 1.583 compared to the reference state, Central Equatoria. For the children born in Jonglei, the odds against dying were 3.521 compared to the reference state. For the children born in Unity, the odds against dying were 3.309 compared to the reference state. For the children born in Warap, the odds against dying were 1.338 compared to the reference state. For the children born in Northern Bahr El Ghazal, the odds against dying were 0.829 compared to the reference state. For the children born in Western Bahr El Ghazal, the odds against dying were 1.511 compared to the reference state. For the children born in Lakes, the odds against dying were 2.409 compared to the reference state. For the children born in Western Equatoria, the odds against dying were 1.462 compared to the reference state. For the children born in Central Equatoria, the odds against dying were 0.927 compared to the reference state.

Percentage and odds ratios of children dead by Residence.

The results further show that for the children born in Urban, the odds against dying were 0.89 compared to those in the rural region. However, the probability was not significant since it was associated with a very low P-value.

Percentage and odds ratios of children dead by Mother's age.

Furthermore, from Table 4.3, the data shows that for the children born in 15-19, the odds against dying were 3.497 (p-value <0.05) compared to those in the 45-49 age bracket. For the children born in 20-24, the odds against dying were 1.978 (p-value > 0.05) compared to those in the 45-49 age bracket. For the children born in 25-29, the odds against dying were 1.209 (p-value > 0.05) compared to those in the 45-49 age bracket. For the children born in 30-34, the odds against dying were 0.919 (p-value > 0.05) compared to those in the 45-49 age

bracket. For the children born in 35-39, the odds against dying were 0.639 (p-value > 0.05) compared to those in the 45-49 age bracket. For the children born in 40-44, the odds against dying were 0.585 (p-value > 0.05) compared to those in the 45-49 age bracket.

Percentage and odds ratios of children dead by wealth index quintile

The data shows that for the children born in the households with the Poorest, the odds against dying were 1.092 (p-value > 0.05) compared to the reference group. For the children born in the households with the second wealth quintile, the odds against dying were 1.015 (p-value > 0.05) compared to the reference group. For the children born in the fourth wealth quintile households, the odds against dying were 1.099 (p-value > 0.05) compared to reference group.

Percentage and odds ratios of children dead by Mother's education

The data shows that for the children born to the mothers that did not go to school, the odds against dying were 1.71 (p-value > 0.05) compared to those in reference group. For the children born to the mothers that stopped at Primary level, the odds against dying were 2.04 (p-value > 0.05) compared to those in reference group. For the children born to the mothers that studied beyond secondary level, the odds against dying were 4.32 (p-value > 0.05) compared to those in reference group. None of these probabilities were significant in the model implying that the mothers' education level has nothing or little to do with the level of mortality.

Percentage and odds ratios of children dead by Antenatal Care attendance during pregnancy

The data shows that for the mothers who attended antenatal care while pregnant, the odd against dying were 0.82 (P-value > 0.05). Similarly, for the mothers who did not attend antenatal care while pregnant, the odds against dying were 1.14 (p-value > 0.05) compared to reference group.

Results of Multivariate Logistic Regression Analysis

Table 4.4:Multivariate Nested logistic model using selected variables of interest

Back ground characteristics	Model I		Model II		Model III	
	Odds Ratio	Sig	Odds Ratio	Sig	Odds Ratio	Sig
Mother's age						
15-19	6.560	.000	7.169	.000	7.229	.000
20-24	3.326	.000	3.442	.000	3.567	.000
25-29	2.412	.000	2.444	.000	2.506	.000
30-34	1.667	.000	1.669	.000	1.696	.000
35-39	1.328	.009	1.326	.010	1.297	.021
40-44	.985	.901	.988	.924	.974	.836
45-49	Omitted	Omitted				
Mother's Education						
None			.544	.339	.335	.539
Primary			.389	.140	.276	.496
Secondary +			.585	.414	.749	.810
Adult education			1.00	1.00	1.00	1.00
Antenatal Care						
Yes					1.145	.037
No					Omitted	Omitted
Wealth Index						
Poorest					1.210	.061
Second					1.143	.174
Middle					1.507	.000
Fourth					1.160	.095
Richest					Omitted	Omitted
State						
Upper Nile					1.520	.001
Jonglei					3.084	.000
Unity					3.319	.000
Warap					1.042	.721
Northern Bahr El Ghazal					.700	.002
Western Bahr El Ghazal					1.086	.498
Lakes					1.923	.000
Western Equatoria					1.139	.281
Central Equatoria					.943	.627
Eastern Equatoria					Omitted	Omitted
Residence						
Urban					.721	.000
Rural					Omitted	Omitted
Log likelihood	4421.36		4411.947		4222.263	
Nagelkerke R Square	.046		.050		.115	

Source : Ministry of Health and National Bureau of Statistics, 2010.

Table 4.4, model I, presents the odds ratios of being reported dead by selected variables. In model I, the study controls for age of mother. The results show that the odds of being reported dead for children born to mothers in the age groups 15-19 were 6.560times compared to children born to mothers in the age group 45-49, which was the reference group. For children to mothers in the age groups 20-24, 25-29, 30-34, 35-39, were 3.326, 2.412, 1.667 1.328 respectively, indicating higher chances of dying compared to children born to mothers in the reference group. The odds ratio of being reported dead for children born to mothers in the age category 40-44 was 0.985. This indicates that children born to mothers in the age category40-44 were more likely to die than children born to mothers in the reference group.

Model II, introduces mother education in the model that controls for age of mother. This changes the values of the odds ratios for age of mother. The odds of being reported dead for children born to mothers in the age group 15-19, increases from 6.560 to 7.169. The odds ratios for age groups 20-24 and 25-29 increases from 3.326 to 3.442 and from 2.412 to 2.444 respectively. The odds for age group 30-34 remain the same at 1.667. For the age group 35-39, the odds of being reported dead decreases to 1.328 to 1.326. Since, the odds ratios are still positive it means the relationship between ages of mothers and being reported dead intensifies with the introduction of mother education.

For the None, Primary, Secondary level of education, the odds of reporting a dead child were 0.544, 0.389, and 0.585, compared to those in the reference group which was Adult education. All these values were not statistically significance.

In model III, four more variables, Antenatal Care, Wealth Index, State and Residence were introduced in the model to predict the likelihood of a child being reported not dead. The results of the analysis indicate that for the women in the 15-19, 20-24, 25-29, 30-34, 35-

39,40-44 age brackets, the odds ratio of reporting a child dead change to 7.229, 3.567, 2.506, 1.696, 1.297, .974 compared to the reference group 45-49. For mothers that received antenatal care, the odds of reporting a dead child were 1.145 times compare to reference group which was those that did not receive antenatal care. For the women in the Poorest, Second, Middle, fourth wealth quintile, the odds of reporting a dead child were 1.210, 1.143, 1.507 times respectively, compared to those in the reference group which was the richest wealth quintile.

Similarly, for the women living in Upper Nile, Jonglei, Unity, Warap, Northern Bahr El-Ghazal, the odds of reporting a dead child were 1.520, 3.084, 3.319, 1.042, and 0.700, respectively, compared to reference group that is Eastern Equatorial state. For Western Bahr, El Ghazal state, the odd reported of being dead were1.086, compared to those in reference group. For Lakes, Western Equatoria, Central Equatoria, the odds of reporting a child dead were 1.139, and 0.943 compared to reference state. Lastly, for the women that live in the urban area, the odds of reporting a dead child were 0.721 compared to rural area reference group.

4.2. Effect of Childhood Factors on Morbidity.

Table 4.5: Prevalence of Vaccinations in first year of life

Type of vaccination	Vaccinated by 12 months of age
BCG[1]	31.4
Polio 0	18.4
Polio 1	34.7
Polio 2	20.9
Polio 3 [2]	12.7
DPT/HepB/INL1	24.9
DPT/HEPB/INFL2	20.4
DPT/HepB/INF3[3]	13.1
Measles [4]	20.4
All Vaccinations	6
No Vaccinations	45.9

Source: Ministry of Health and National Bureau of Statistics, 2010

The results indicate that the vaccination schedule followed by the South Sudan National Immunization Programme provides only BCG and DPT (against Diphtheria, tetanus and whooping cough). Oral polio vaccine and measles are used for routine infant immunization schedule. Taking into consideration this vaccination schedule, the estimates for full immunization coverage from the South Sudan Household Health Survey are based on children aged 12-23 months. The percentage of children aged 12 to 23 months who have received each of the specific vaccinations by source of information (vaccination card and mother's recall)

Approximately 31 percent of children aged 12-23 months received a BCG vaccination by the age of 12 months and the first dose of DPT was given to 25 percent. The percentage declines for subsequent doses of DPT to 20 percent for the second dose and the 13 percent for the third dose. Similarly, 35 percent of children received Polio 1 by age 12 months, and this declines to 13 percent for the third dose. The coverage for measles vaccine by 12 months is 20 percent. The proportion of children who received all vaccinations is very low at 6 percent, while those who didn't receive any vaccinations is 46 percent.

Table 4.6: Childhood Factors associated with Morbidity.

	Diarrhea	Vaccinated children	Suspected Pneumonia	Suspected Malaria	Minimum Meals a day	Percentage Breast-fed	Under Five Mortality
Sex							
Male	34.9	5.6	19.1	33.1	10.4	37.6	117
Female	33.1	7	18.8	31.7	12.7	38.5	99
State							
Upper Nile	32.3	6.7	15.9	27.6	15.6	31.8	98
Jonglei	28.5	1.8	13.5	28.7	9.8	34	48
Unity	38.9	7.8	18	25.4	7.9	33.3	51
Warap	32.3	4.2	28	27.4	4.7	38.2	117
Northern Bahr El Ghazal	37.4	4.3	32	30.7	5.4	23.2	157
Western Bahr El Ghazal	42.2	12	19.5	27.6	15	34.1	115
Lakes	30	5.6	28	35.4	8.5	21.2	73
Western Equatoria	33	9.3	18.1	35.9	16.8	53.9	130
Central Equatoria	31.2	26	6.4	39.1	15.5	54.5	152
Eastern Equatoria	43.7	13.9	24.4	45.8	16.3	44.2	137
Residence							
Urban	33.6	13.9	59	33	17	42.9	118
Rural	34.2	8.6	44	32.2	9.5	36.4	105
Mother's Education							
None	33.9	4.5	18.3	31.8	9.9	35.8	107
Primary	36.8	13.6	23	36.6	17.2	48.4	118
Secondary +	26.2	15.7	21.4	32.2	21.9		115
Wealth index Quintiles							
Poorest	35.9	2.3	18.6	31.2	7.8	39.4	108
Second	33.9	3.2	18.6	32.5	7	37.2	112
Middle	35.2	5.1	21	34.3	9.1	37	99
Fourth	33.3	6.2	18.2	33.1	13.5	38.9	106
Richest	31.7	14.6	18.5	30.9	19.5	37.5	117

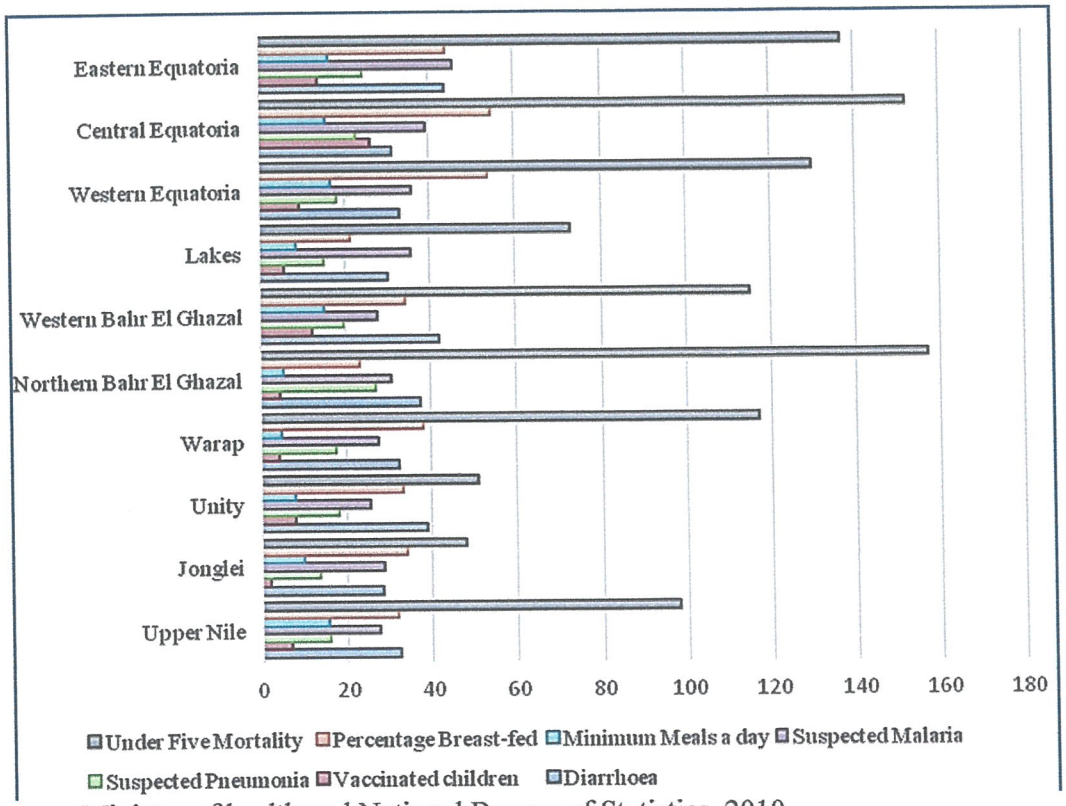
Source: Ministry of health and National Bureau of Statistics, 2010

Results in table 4.6 presents the prevalence of suspected pneumonia and, if care was sought outside the home, the site of care. Overall, 19 percent of children aged 0-59 months were reported to have had symptoms of pneumonia during the two weeks preceding the survey. Of these children, 48 percent were taken to an appropriate provider.

The results also indicate the greatest childhood contributor to morbidity is diarrhea because the data indicates that 34.9 percent and 33.1 percent of the male and female that took part in the study had diarrhea at least in the previous weeks prior to the study. Breast feeding, malaria infection were also great contributors to morbidity since they presented infection figures that were significant enough in the study. The results also indicate that the children from the second, fourth and poorest wealth quintile recorded had the highest levels of mortality

However, 5.9 percent of urban children with suspected pneumonia were taken to an appropriate provider compared to 4.4 percent for rural children. The State with the highest proportion of children aged 0-59 months reported to have had symptoms of pneumonia during the two weeks preceding the survey and were taken to an appropriate provider is Central Equatoria (64 percent). The lowest proportions are in Lakes State (28 percent), Warap (28 percent) and Northern Bahr El Ghazal (32 percent).

Figure 4.2: The level of morbidity and mortality in South Sudan.



Source: Ministry of health and National Bureau of Statistics, 2010

4.3. Contribution of mother factors on child mortality and morbidity in South Sudan

Table 4.7. The relationship between mother factors on the level of child mortality in Sudan

	Chi-square	two-sided P-value	Cramer's V	Phi
Mothers age at birth	4.677621027	0.791410893	0.047837896	0.067653001
Birth order	11.34676708	0.056094878	0.097159179	83
Previous birth interval	5.495320923	0.78917131	0.042315364	0.073292361
State	31.39130961	0.255377029	0.064058092	0.11095187
Residence	1.173250383	0.759426862	0.04709421	0.04709421
Education	0.647127954	0.885563715	0.035075366	0.035075366
Wealth index quintile	3.783578011	0.987032538	0.031451085	0.054474876

Source: Ministry of health and National Bureau of Statistics, 2010

Table 4.8 presents a summary of the main mother factors that have got an effect on the overall level of child mortality in Sudan. The data shows mother's age at birth of the child, Birth order of the children, previous birth interval, and state of the mother, residence of the mother, education and wealth index quintile as the major determinants of child mortality.

Each of these mother factors produced values that indicate that there is a positive relationship between the variation in the mother factors and the level of infant mortality in South Sudan. The data shows that the States from which the mother produces the child has got a very strong relationship with the level of child mortality judging by the size of it Pearson Chi-square figures.

A closer look at the data reveals that there exists a relatively strong positive relationship between birth order and the overall level of child mortality in South Sudan. A birth order of 7+ is linked with relatively high infant mortality rate recording the highest figure for the under-five mortality rate category. The results also indicate that as the birth order increases, the rate of infant mortality increases as well. The education of the mother has got a very poor

relationship with the level of child mortality in the country since it was associated with a very negligible Pearson Chi-square value.

The previous birth interval variable produced a relatively strong relationship with the overall rate of mortality in the country. The results indicate that lower birth intervals are associated with lower infant mortality rates and the figure for infant mortality rate reduces as the birth interval increases recording the lowest figure for 4+ years' category of birth interval. Furthermore, the states where the mothers of these children live have also got a positive impact on the overall level of infant mortality.

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.0. Introduction

This study sought to examine the factors associated with childhood mortality and morbidity in South Sudan. Among the objectives discussed were 1) determinants of childhood mortality in South Sudan; 2) the effects of childhood factors on morbidity; 3) the contribution of mother factors on mortality and morbidity. Are there any child mortality differentials by subgroups, for example urban and rural mortality variations, lower household socio economic status against higher household socioeconomic status and Mothers with no education against mothers with higher education. In seeking to establish these objectives, the study also referred to proximate determinants framework as proposed by Mosley and Chen (1984)

5.1. Discussion of Findings

The study examined the effect of childhood factors and contribution of mother characteristics on childhood survivorship in South Sudan. The study used secondary data from South Sudan Household Health Survey (SSHHS, 2010). The analysis was done at three different levels of analysis. Univariate, bivariate and Logistics regression analysis were used for analysis of the data in this study. The discussion of the findings was done objective per objective.

Determinants of Childhood Mortality

The result from the study, indicate that births order seven and over experience the highest levels of childhood mortality, while childhood mortality is lowest for second and third order births. The birth interval also affects survival when there is an interval of less than two years between pregnancies, demonstrating the importance of spacing on child survival. This is

fairly consistent in all childhood mortality indicators. The results further provided estimates of childhood mortality by state, residence and socio economic characteristics. The result showed that state levels such as Northern Bahr ElGhazal and Central Equatoria have the highest infant and under–five mortality rate. The lowest proportion is reported in Jonglei and Unity states. The results showed unexpected pattern for infant and under five mortality rates across residence, mother education and wealth quintiles.

State of residence played an important role in the survival of children under age of 5. Children residing in 7 of the country's 10 states were less likely to die compared to the Eastern Equatoria reference state. The only states which showed the highest chances of dying were Northern Bahr El Ghazal, and Central Equatoria. These results showed that childhood mortality was not uniform in South Sudan.

The results showed that the odds against dying for children born in the household with poorest second, middle, and Fourth wealth quintiles compared to the richest wealth quintiles. It was observed from the results that all the probabilities were not significant as they were associated with very high P- value.

The finding showed that the odds against dying for children born to mothers with no education, primary education, and secondary education and beyond. The results showed that none of these probabilities were significant in the model implying that the mother's education levels have no or little to do with the level of child mortality.

The findings further showed no significance association in the odds of dying for mothers who attend Antenatal care while pregnant compared to mothers who did not attend Antenatal while pregnant.

The findings further showed that the odds ratios of being reported not dead by selected variables. In model I, the study controls for age of mother. The results show that the odds of

being reported not dead for children born to mothers in the age groups 15-19 were higher than those in the reference group of 45-49. For the children born to mothers in the 20-24, 25-29, 30-34, 35-39, 40-44 respectively all these were significant at 0.05 level besides the 40-44 indicating that older women tend to reported more deaths compared to the young women

In model II, mother's education was introduced in the equation. The resulting odds imply that the odd of being reported not dead for mothers in the 20-24, 25-29, 30-34, 35-39, 40-44 age brackets increase. Furthermore, for the None, Primary, Secondary +, and Adult education levels the odds of reporting a dead child were lower than those that received Adult education of any form.

In the last model III, Antenatal Care, Wealth Index, State and Residence were introduced in the model to predict the likelihood of a child being reported not dead. The results further indicated that for15-19, 20-24, 25-29, 30-34, 35-39, 40-44 age brackets, the odds ratio of reporting a child dead greatly changed compared to the reference group when Antenatal Care, Wealth Index, State and Residence were introduced in the model. For instance, for mothers that received antenatal care, the odds of reporting a dead child were lower than those that did not receive antenatal care.

For the women in the Poorest, Second, Middle and fourth wealth quintile, the odds of reporting a dead child were lower than those in the richest wealth quintile. Similarly, for the women living in Upper Nile, Jonglei, Unity, Warap and Northern Bahr El-Ghazal, the odds of reporting a dead child were higher than those in Eastern Equatoria state respectively. For Western Bahr, El Ghazal state, the probability would be lower than those in Eastern Equatoria states. For Lakes, Western Equatoria, Central Equatoria, these probabilities were significantly higher than those in reference state. For the women that live in the urban center, the probability of reporting a dead child was lower than those in the rural areas.

Effect of Childhood Factors on Morbidity

The findings further indicated vaccination schedule followed by the South Sudan National Immunization Programme provided only BCG and DPT (against Diphtheria, tetanus and whooping cough). Oral polio vaccine and measles are used for routine infant immunization schedule. Taking into consideration this vaccination schedule, the estimates for full immunization coverage from the South Sudan Household Health Survey are based on children aged 12-23 months. The percentage of children aged 12 to 23 months who have received each of the specific vaccinations by source of information (vaccination card and mother's call).

The proportion of children who received all vaccinations is very low than those who didn't receive any vaccinations. There were differences in coverage of vaccination across States. The percentage of children fully immunized was highest in Central Equatoria and lowest across Northern Bahr El Ghazal, Jonglei and Warap states. Furthermore, there are urban-rural differences in vaccination coverage. Children residing in urban areas are more likely to be fully immunized compared to children in rural areas. The findings were also consistent with the under-five mortality rates indicate that states with a low prevalence of immunization have the largest proportion of child mortality. The trend was also similar in the Urban-Rural areas since, the results indicate that rural areas have got relatively higher infant mortality. The under five children were ill with fever in the two weeks prior to the survey. State level differences in fever prevalence were large, in Unity and Eastern Equatoria.

The results further showed the prevalence of suspected pneumonia. Children aged 0-59 months were reported to have had symptoms of pneumonia during the two weeks preceding the survey. The results also showed that the greatest childhood contributor to mortality and morbidity is diarrhea because of large number of males and females that took part in the study had diarrhea at least in the previous weeks prior to the study.

Breast feeding, malaria infection were also great contributors to morbidity since they presented infection figures that were significant enough in the study. The children from the second, fourth and poorest wealth quintile recorded had the highest levels of mortality. These findings indicated that such children had the highest prevalence of Malaria, diarrhea and were poorly breast fed. The result showed that urban children with suspected pneumonia were taken to an appropriate provider compared to rural children. The State with the highest proportion of children aged 0-59 months reported to have had symptoms of pneumonia during the two weeks preceding the survey and were taken to an appropriate provider was Central Equatoria while, The lowest proportions were reported in Lakes, Warap and Northern Bahr El Ghazal states.

Contribution of Mother Factors on Child Morbidity and Mortality

The results revealed that there existed a relatively strong positive relationship between birth order and the overall level of child mortality in South Sudan. A birth order 7+ is linked with relatively high infant mortality rate recording the highest figure for the under-five mortality rate category. The results also indicate that as the birth order increases, the rate of infant mortality increases as well. Additionally, the education of the mother has got a very poor relationship with the overall level of child mortality in the country since it was associated with a very negligible Pearson Chi-square value.

The previous birth interval produced a relatively strong relationship with the overall rate of mortality in the country. The findings indicated that lower birth intervals are associated with lower infant mortality rates and the figure for infant mortality rate reduces as the birth interval increases recording the lowest figure for 4+ years' category of birth interval. Furthermore, the states where the mothers of these children live have also got a positive impact on the overall level of infant mortality.

5.2 Conclusions

In conclusion, the study used data from South Sudan household health survey, 2010to establish determinants of childhood mortality and morbidity in South Sudan. Univariate, bivariate, logistic regression and multivariate nested regression models were applied. The findings suggested that childhood mortality was not associated with age of the mother, mother's education, wealth index quintiles, residence and state of residence. There may be other factors which affect childhood mortality. Births order 7+ experience the highest levels of childhood mortality, while childhood mortality is lowest for second and third order births. The birth interval also affects survival when there is an interval of less than two years between pregnancies, demonstrating the importance of spacing on child survival. These factors were important in affecting child mortality. These factors may require to be taken into account in efforts that seek to address child mortality in South Sudan.

The greatest childhood contributor to mortality and morbidity risk is diarrhea because a large number of males and females that took part in the survey had diarrhea at least in the previous weeks prior to the study. Breast feeding, malaria infections were also great contributors to morbidity since they presented infection figures that were significant enough in the study. Hence, we can conclude that these factors influence child morbidity and mortality thus required to be considered. The results concluded that previous birth interval produced a relatively strong relationship with the overall rate of mortality in the country. The findings further indicated that lower birth intervals were associated with lower infant mortality rates. Birth interval remains an issue that deserves urgent attention in South Sudan.

5.3. Recommendations

Further study should be conducted to look into causal pathways as well as strategies to improve spacing between pregnancies whilst efforts to prevent adverse pregnancy outcomes,

an important determinant of birth spacing, should be identified. In order to avoid prevalence of malaria, diarrhea and pneumonia in infants and under 5, the government of South Sudan in conjunction with NGOs should implement effective educational programmes that aim at promoting and prolonging breastfeeding that may have a considerable effect on child survival as well as to carry out full immunization programmes that cover

both urban and rural areas in South Sudan.Mother needed to be exposed in order to alleviate the health of their young ones and themselves.

5.4. Limitation of the Study

The analysis of determinants of childhood mortality and morbidity was restricted to the five years' period preceding the survey (2005-2010). As a result of this limitation factors such as death certificate that may indicate the cause of death and birth registration to show number of births for Children Under -Five was not included in questionnaire for children under five that was administered to mothers or caretakers of children under 5 years of age1 living in the households. Therefore, a further study is required to use vital registration records involving death certificate and birth registration certificate from which number of births and the causes of child mortality and morbidity would be established in South Sudan.

5.5. Suggestion for Further Study

A large proportion of the children included in this survey had never received any form of vaccination. That could be linked to the low levels of education of their parents or the unavailability of the vaccination centers or deliveries outside health facilities. A further study may examine the impact of National Immunization Programme, education of Parents on infants and under-five mortality within urban and rural areas.

Second, further study could focus on the key determinants of under-five mortality and would possibly investigate the sources of health in equalities. The most likely factor that may have

caused a slower decline in the child mortality rate in South Sudan is increased health inequality. A study that tries to identify the key determinants of under-five mortality among the poor in South Sudan would provide more information of relevance to policy recommendations in this area.

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