DETERMINANTS OF SOCIOECONOMIC INEQUALITY IN UNDER-FIVE MORTALITY IN KENYA

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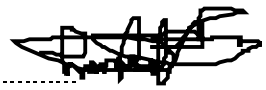
DECLARATION

This research project is my original work and has not been presented for a degree in any other university.

Signature 

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This research project has been submitted for examination with my approval as a university supervisor.

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ABSTRACT

Child mortality rate in Kenya has been declining overs the years. This is attributed to enactment of various initiatives by healthcare stakeholders. However, this decline in mortality has not been sufficient enough to enable the attainment of Millennium Development Goal 4. Previous studies in Kenya on child survival found that children from underprivileged households and places with poor access to sanitation facilities have a higher likelihood of dying before the age of five in comparison to children from rich households. Most of these deaths are from socioeconomic related factors which are avoidable through policy interventions and are therefore unnecessary. This study utilized the 2003, 2008/09 and 2014 KDHS datasets to analyze the magnitude and determinants of inequality in under five mortalities in Kenya. The Concentration Index (CI) was constructed to measure socioeconomic inequality in under-five mortality and was decomposed to identify the key factors underpinning the observed inequality in U-5 deaths. From the results, Concentration Index was -0.015, implying that under five mortality is moderately concentrated amongst the poor households. Sanitation facilities, age of the mother, birth interval, birth order and the size of child at birth were found to be key contributing factors influencing inequality in under-five mortality. Interventions such as promoting sanitation facilities and reducing risky birth interval among the poor and supporting health literacy programmes would contribute towards reducing the existing socioeconomic inequality in under-five mortality

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LIST OF ACRONYMS

CI	Concentration Index
DHS	Demographic and Health Survey
KDHS	Kenya Demographic and Health Survey
MCH	Maternal Child Health
MDG	Millennium Development Goals
NHSSP II	National Health Sector Strategic Plan II
PCA	Principle Component Analysis
SES	Socio Economic Status
U-5	Under-five
WHO	World Health Organization

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CHAPTER ONE: INTRODUCTION

1.1 Background

When a child is born, parents receive congratulatory messages from friends and relatives wishing them a trouble less world ahead. It's disheartening when a child dies below the age of five, while big number die before celebrating their first birthday. Governments, Non-Government organizations, civil society and other health sector actors have made significant progress towards reduction of U-5 (under-five) mortality. In the year 2015, World Health Organization (WHO) reported that 43 children for every 1000 live births died and this was a decrease from 91 deaths per 1000 live births in 1990 globally. Though this represented a 53% reduction in U-5 mortality, it was below the Millennium Development Goal (MDG) four that aimed at reduction of U-5 mortality by two thirds by the year 2015. Some regions lagged behind in embracing a good pace of achieving MDG 4, for instance Southern Asia, Oceania, Caucasus, Central Asia and Sub Saharan Africa. WHO report indicated that U-5 mortality was 81 deaths for every 1000 live births in Africa, U-5 mortality in Sub Saharan Africa is the highest with 1 in 12 children dying before reaching 5 years (United Nations, 2007; You et al., 2015).

In 2000-2015, Sub Saharan Africa reduced the annual U-5 mortality rate to approximately two and half times of the 1990-2000 levels. Infant mortality accounts for 45% of all U-5 deaths in the world. Despite significant progress in reduction of U-5 deaths, inequality in child mortality remains high. For instance, children from lower socioeconomic status households, rural areas and areas with poor access to sanitation facilities face lower chances of surviving to age five (Malderen et al., 2013).

Understanding disparities in health is challenging. The Commission on Social Determinants of Health (CSDH) acknowledged why it is important to understand health inequalities and subsequently provided a comprehensive explanation on how social determinants of health occur and the possible ways of handling them to enhance health equity (Marmot et al., 2008). You et al., (2015) found out that inequalities in child mortality between developed and less developed countries remain large.

Several partners have joined efforts to enhance child survival. For instance, in the year 2010 at the United Nations (UN) MDG summit, a global movement was launched to mobilize and strengthen national and international stakeholder's action towards improving child survival. Subsequently, Sustainable Development Goal 3 was launched with the aim of decreasing U-5 mortality to 25 deaths for every 1000 live births or below by the year 2030 (United Nations, 2015).

Kenya like other low income countries face environmental threats and upsurge in population among other challenges, which contribute significantly in increasing child mortality. Kenya slightly missed to attain the Millennium Development Goal 4. However, other low income countries like Eritrea, Ethiopia, Uganda, and Tanzania achieved the MDG 4 (You et al., 2015). The Kenya Demographic and Health Survey (KDHS) 2014 report indicates the level of U-5 mortality as 52 deaths per 1000 live births down from 74 in 2008/09 and the infant mortality as 39 deaths for every 1000 births down from 52 in 2008/09 (Fig 1). In general, the U-5 mortality trend in Kenya is reversing from the 1990-2000 levels. Residence, region, household wealth and mother's education contribute to disparities in U-5 mortality in Kenya (KDHS, 2015).

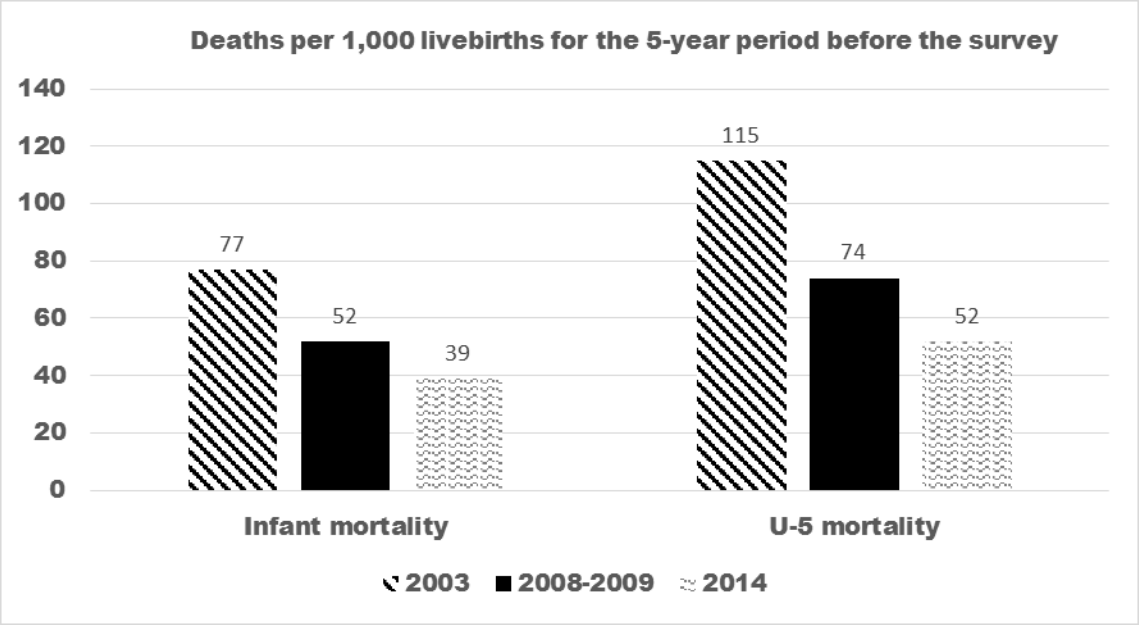

Figure 1.1. Trends in childhood mortality, 1999-2014

Source: Kenya National Bureau of Statistics and ICF International (2015).

The Government of Kenya has put effort on improving the health status of its people. A lot of initiatives have been established and some more are in progress towards strengthening the health system. Primary health care remain at the core for prosperity in improving access and equity in health care provision. The launch of vision 2030, implementation of Kenya's Constitution 2010 and the Kenya Health Policy 2014-2030 serves as evidence of Kenya's progress towards ensuring right to health for all. Kenya's Constitution 2010 provides for the right for every individual to highest attainable standards of health, and also devolved health to 47 counties with distinct functions being allocated to the County and the National Governments. The National Government mainly provides leadership in health policy formulation, training health practitioners and the management of national referral health facilities. The County Governments mainly provide County health services by managing ambulance services, pharmacies, primary health care, waste disposal, licensing and control of selling food to the public. Both the National and the County Government health administrators

set new strategies and initiatives to address the health needs of their populations (Kibui et al., 2015) .

The Government put in progress several initiatives towards protecting the health of children. One of the initiative that had profound impact was spearheaded by the National Health Sector Strategic Plan II launched by the Government to promote equity in child health. In addition, Malezi Bora, a strategy introduced in the year 2007 delivered integrated and comprehensive coverage services for the under-fives. Some of them were child immunization, treatment of childhood illness, de-worming and mosquito net use (Clohossey et al., 2014; Ministry of Health, 2005).

With the formation of a new Government in the year 2013, the Jubilee Government introduced free maternity services and removed user fee charges in all level two and three hospitals. The introduction of free maternal healthcare in public hospitals led to an increase in the number of women delivering at the public health facilities although the policy faced a number of challenges (Chuma & Maina, 2013). Equally, the office of the first lady through the "Beyond Zero" campaign has influenced resource mobilization and created awareness on Maternal Child Health (MCH) services for the marginalized populations in the country (Gakonyo et al., 2014).

Currently, there is a crisis in Kenya's health system. Even though devolution of health was a great idea, County Governments have experienced strikes from different cadres in the health sector thus affecting services delivery. Leadership in the health sector has not been effective in resolving the challenges. There is need to explore strategies of empowering community health workers in Kenya, more so given frequent strikes by medical personnel that leave many patients in distress. Spending for health in Kenya is often below the global average recommendations,

with investment in healthcare poor, thus hampering both research and treatment. These challenges tend to undermine past gains in the sector, and child health, especially for the most poor and vulnerable is seriously compromised.

1.2 Statement of Problem

Even though Kenya has made significant steps in reducing U-5 mortality rates, the existing rates are high and there is need to find innovative interventions to reduce the rates further down. There are several debates on finding appropriate strategies to reduce U-5 mortality rates, a concept that has over time proved to be problematic. To accelerate the decline in U-5 mortality, interventions that are proven and specific have to be implemented to target major causes of U-5 mortality (Darmstadt et al., 2005). No single factor influences U-5 mortality (Adhikari & Podhisita, 2010). Many public health programmes have addressed the biomedical causes in an attempt to improve child health, for instance, through immunization campaigns. There are also multiple causes of infant mortality, more so in developing countries, where there are great differentials among social, economic and demographical groups of people even inside one country. While addressing infant mortality, one must take into account this multiplicity (Black et al., 2003; Engmann et al., 2013).

Research on decomposition of socioeconomic inequality in U-5 mortality remains scanty even when under five mortality rates remains high in Kenya. Many studies have established how the biomedical determinants contribute significantly in reducing under five mortality (Hamel et al., 2011; O'Reilly et al., 2012). Previous studies on socioeconomic determinants of U-5 mortality (Ettarh and Kimani, 2012; Mutunga, 2007) focused on childhood mortality and its determinants, paying little attention to inequality in U-5 mortality. Kabubo-Mariara et al.

(2012) focused on asset inequality in households facing childhood mortality vs. not facing child death. The study did not explicitly analyze inequality in U-5 mortality and its determinants.

Health inequality arise due to differences in status of health from one person to another and among different groups of people. Previous studies have used health care utilization or self-assessed health variables to explain health inequality in Kenya. Few studies have employed U-5 deaths as a health outcome to explain inequalities in health. For instance, Egondi et al., (2015) examined determinants of immunization inequality while Malderen et al., (2013) explored the impact of socioeconomic factors in providing measles immunization and maternal health services. It is on this locus that our study unravels how the potential disparities in socioeconomic and demographic factors contribute to inequality in U-5 mortality.

1.3 Objectives of the Study

The general aim of the study is to analyze the magnitude and determinants of socioeconomic inequality in U-5 mortality in Kenya. The specific objectives are:

I. To measure socioeconomic inequality in U-5 mortality in Kenya.
II. To analyze the determinants of socioeconomic inequality in U-5 mortality.
III. To recommend policies for improving equity in child survival in Kenya.

1.4 Justification of the Study

Interplay between human development and child survival remains a crucial investment for a just society. For a better future generation, investing in child development is a necessity. Unhealthy children require attention and resources thus reducing productivity and passes economic hardships to the country and households. A number of studies have illustrated that

investment in child health is associated with good returns to the community (Bhalotra and Rawlings, 2011; Currie and Almond, 2011).

U-5 mortality levels is an indicator of the state of the community in a number of aspects; for instance, health equity and access, state of its public health and hygiene, and its environmental sanitation. Furthermore, it reveals the peoples cultural practices on clothing, nutrition, and their value for human life. Previous studies have identified an association between deprivation and U-5 mortality (Nandy & Minujin, 2012).

Children from households belonging to lower SES have high mortality rates (Victora et al., 2003). Most of these deaths are from socioeconomic related factors which are avoidable through policy interventions and are therefore unnecessary and inequitable (Arcaya et al., 2015). Reducing socioeconomic inequalities in health that lie behind uneven distribution of ill health, benefits all members of the society. Explaining disparities in health in Kenya is crucial in accelerating the decline of U-5 mortality in the most vulnerable children and marginalized sub-populations. Furthermore, this provide evidence base to inform and promote strategies for universal health coverage and allocation of health resources in Kenya. By outlining the underlying determinants of U-5 mortality and socioeconomic inequality in U-5 mortality in Kenya, we also provide useful information for advocacy, education and policy implications for improving child survival and equity-oriented health initiatives.

This study identifies determinants of inequality in U-5 mortality in Kenya. The results have important policy implications for the Government, Non-Governmental Organizations, Civil Society, Community Based Organizations and other health sector actors involved in fighting child related morbidities and mortalities.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter covers the theoretical literature, empirical literature and an overview of the reviewed literature.

2.2 Theoretical Literature

Studies on health inequality have analyzed and assessed many different perspectives of inequality. Previous studies identified different factors that affect U-5 mortality directly and indirectly. This review focuses on the main theories explaining socioeconomic, demographic and biological factors influencing child survival and theories explaining socioeconomic health inequalities.

Determinants of U-5 mortality are viewed through various analytical frameworks. Mosley and Chen (1984) and Schultz (1984) identified exogenous variables as socioeconomic variables i.e. community, social and economic variables. Endogenous variables were identified as biomedical factors i.e. breastfeeding patterns. Exogenous variables operate through biomedical factors thus their effects were indirect while the biomedical factors were considered proximate determinants. The proximate determinants were established on the assumption that the economic and social causes of under-five mortality work through a shared and fixed biological systems that are based on certain premises.

Previous studies revealed disagreement on causes of inequality in health. Grossman, (1972) explained the level and rate of change in health over the life cycle using the health capital model. Health was viewed as a durable capital stock over the individual's life cycle and it is influenced by education and socioeconomic status. The black report, published in 1980 identified three key theories explaining differences in health; artefact, selection and causation (Blane, 1985). Artefact theory proposed that socioeconomic health differences are the result artefact due to inappropriate consideration on how health and social class are measured. Social selection theory argues that people sort themselves into groups, neighborhoods and other clusters directly or indirectly. Direct selection occurs when a person's health status affect their social position. Indirect selection involves when indicators of good health affect SES. Causation theory explains that SES indirectly affects health through unequal sharing of factors influencing health across individuals/households with unfavorable factors affecting the poorest most.

Previous studies revealed transmission channels through which education, earnings and work affect health. Material, psychological, behavioral and health related factors influences health inequality. Material factors influences exposure to living in places that are not favorable to health, such as poor housing conditions, crowding, work-related risks, and criminality. Psychosocial factors contribute to health inequality in various ways such as through exposure to traumatic circumstances, adoption of effective surviving tactics, and access to effective community support. Behavioural factors determines the distribution of unhealthy ways of living, such as smoking, drug abuse, taking unbalanced foods, and inadequate exercise. Healthcare related factors condition access to preventive and curative services and access to health-related information. These four sets of pathway are interlinked, implying complex pathways through which various factors affect health status (Leigh, 1993).

Health variations between individuals and groups of a population may arise out of inevitable genetic and biological variations or random chance, however those which arise due to systematic, modifiable and avoidable processes are unjust and they are the main concern in promoting health equity. Health equity is concerned with how health outcomes match with people's need. Research has identified vertical equity as treating differently those having different needs as well as horizontal equity as giving the same those having similar needs (Peter & Evans, 2001).

Our study focuses on U-5 deaths as a health outcome to explain how difference in exogenous variables and demographic factors influences U-5 mortality inequality. The study employs Mosley and Chen (1984) and (Blane, 1985) to describe factors influencing the magnitude of socioeconomic inequality in U-5 mortality and how socioeconomic indicators and health interact. Causation theory forms the foundation of our approach in explaining socioeconomic inequalities in U-5 deaths.

2.3 Empirical Literature

Previous studies have analyzed health inequality through a number of perspectives. This study mainly focuses on how socioeconomic, demographic, and health related factors influence inequalities in health.

Most studies in Kenya have analyzed KDHS dataset by using either multivariate techniques or survival analysis to explain the determinants of U-5 mortality. Kabubo-Mariara et al., (2012) identified the following factors as the determinants of child survival, child's sex, ethnicity, maternal education, geographic location, premature delivery, birth order, birth interval and

socioeconomic status, similarly Kibet, (2010) examined how number of children below age five influences U-5 mortality. A study done by Mutunga (2007) revealed that children of twin birth, mother's age, access to sanitation and sources of cooking fuel influences child mortality. In addition, Ngigi (2013) found that infant's birth size, household wealth, and tetanus immunization affect infant mortality in Kenya. However, these studies do not explain the differences in U-5 deaths within various groups.

Egondi et al., (2015) explored the factors contributing to inequality in immunization among poor urban children using the 2012 Nairobi Cross Sectional Slum Survey. Asset index was developed by utilizing the PCA approach and the Concentration Index was employed in quantifying extent of inequality and this was further decomposed into its determining factors. They found that inequality in immunization was concentrated among children from poor households and inequality was largely influenced by education of the mother.

Malderen et al., (2013b) determined the impact of socioeconomic factors on inequality in skilled birth attendance services and measles immunization in Kenya. Using data from KDHS 2008/09, they employed multivariate regression analysis to identify the key factors. In addition, the study employed decomposition analysis to explain the differences in coverage. They found that the differences were explained by SES of the household, order of birth, father's occupation and education of the parents.

Despite the efforts to understanding health inequalities, as noted from the past studies done in Kenya, few studies have utilized U-5 mortality as a health outcome to quantify health inequality. Most studies have identified the influence of socioeconomic, environmental and mother's behavioral characteristics on U-5 mortality and their associated inequalities. See for

instance (Kabubo-Mariara et al., 2012; Mustafa, 2008; Mutunga, 2007). There has been minimal attention to decompose the causes of health variation across different socioeconomic and demographic characteristics. This study addresses this gap by quantifying the contributions of the main identified socioeconomic determinants to inequality in U-5 mortality.

Due to persisting disparities in health, developing and developed nations have put efforts to promote equity in health, especially equity in child survival. Bado and Appunni (2015) explored the causes of inequality in U-5 mortality in West Africa. The study employed the Concentration Index approach and Generalized Linear Model technique to analyze socioeconomic inequality using Demographic and Health Survey (DHS) from six nations in West Africa. The study found that socioeconomic inequalities of U-5 are related to the gender of the child, the age of the mother, father's education and household's living standards. To quantify the effect of each variable to socioeconomic inequality, the study employed decomposition analysis. A number of previous studies employed decomposition analysis (Hosseinpoor et al., 2006; Poel, 2008; Quentin et al., 2014). Our study uses the decomposition approach to explain the causes of inequality in U-5 deaths in Kenya (see section 3.3.3).

Using DHS dataset, Malderen et al., (2013a) employed multivariate logistic regression to point out the significant factors affecting inequality in U-5 mortality in thirteen countries in Africa. The decomposition of Gini approach was employed to explain the existing inequality due to differences in wealth status. They found that the main contributors of inequality in U-5 mortality in overall were; the order of birth, birth spacing and region of residence. The primary causes of wealth-related inequality in U-5 deaths were, occupation of the father, SES of the household and the education of the mother. However, the results are not country specific thus one has to be cautious when prioritizing intervention aimed at reducing child health inequality.

Our study adds to literature the effect of size at birth and place of delivery in explaining disparities in under-5 deaths.

Novignon et al., (2015) investigated the relationship between social economic factors and child malnutrition inequality in Ghana. Using the 2011 Ghana's Multiple Indicator Cluster Survey, univariate and multivariate analysis approaches were applied to determine significant variables. To illustrate the extent of inequality and the main factors, concentration curves and concentration indices were employed. Results revealed that place of residence, maternal education, wealth status and ownership of health insurance contributed to inequality in childhood malnourishment. The strength of this study is that, it includes very important variables that were missing previously i.e. health insurance ownership which was crucial for Ghana to reduce inequality in childhood nutritional status. Novignon et al., (2015) employs child malnutrition as a health outcome to explain health inequality while our study employs U-5 deaths as a health outcome to explain the socioeconomic inequality in the health of children below age five.

A study done by Emamgholipour et al., (2015) while using the World Bank and the WHO data for 20 countries, employed random effects technique to decompose socioeconomic inequality in infant deaths in Eastern Mediterranean Regional Office (EMRO) Countries for 2000 to 2013. They found that inequality in infant deaths is determined by education system, health expenditures, economic variables and access to health facilities. The strength of the study is that it utilized both income and expenditure data which give most reliable socioeconomic information and are often unavailable in most DHS surveys. Emamgholipour et al., (2015) utilized infant mortality data to explain the impact of education system and other economic variables on socioeconomic inequality in infant deaths in EMRO Countries while our study

employs KDHS U-5 mortality data to explore socioeconomic determinants on inequality in under five mortality.

Using Urban Health Equity Assessment and Response Tool (Urban HEART) survey, Morasae et al., (2012) carried out a cross-sectional observational study where they employed the Principle Component Analysis and the Concentration Index to estimate the disparities in mental health in Iran. Findings revealed that residence, economic status, educational status, age group and occupation contributed most to the observed socioeconomic inequality. However, the study did not cater for missing data yet non-response cases were more likely from mentally ill respondents even though they were identified to be low. Our study adds to the literature by employing U-5 five deaths as a health outcome to explain child health inequality.

Doherty et al., (2014) examined childhood immunization disparity in the Republic of Ireland. The study utilized the Growing Up in Ireland survey 2008/09, they employed the concentration index and multivariate techniques in the analysis. The results indicated that SES, income, structure of the household and publically financed care influenced inequality in childhood vaccination. The strength of the study is that they employed a General Linear Model (GLM) and binary variable model that is suited for dummy variables irrespective of the selected reference category. Our study adds to the literature by utilizing U-5 mortality to explain the existing inequality in U-5 mortality across various groups.

Using Philippines 1998-2007 DHS, Kraft et al., (2013) employed a multivariate regression and the concentration index while assessing the prevalence of U-5 mortality trend and the distribution of U-5 mortality with the aim of understanding child health inequality in Philippines. The study found that facility based delivery, region, mother's education, tetanus

injection and birth order influence child health inequality. However, the results cannot be generalized to subnational units due to lack of the necessary data. Our study uses the concentration index to study U-5 mortality inequality in Kenya.

Gonzalo & Urbanos, (2016) examined the income related inequality about physical inactivity in children from Spain. The study employed the concentration index to analyze physical inactivity by using Spanish National Health Survey for 2011/12. The found that gender, age, education, income and the place of residence were related with variation in free time physical inactivity among Spain children. However, the study did not include all the most relevant determinants of physical inactivity factors. Our study employs U-5 mortality as a health outcome to explain child health inequality in Kenya.

Using Turkish 2003 World Health Survey, Sözmen et al., (2012) employed the concentration index and multivariate analysis technique to examine socioeconomic disparities in Self Assessed Health (SAH) and to explain the causes of such disparities among the Turkish people. The study show that the wealth of the household and education of the household contributed most in the prevailing disparities in SAH. In addition, geographical area, gender and marital status were associated with SAH inequality. However, the study design was cross-sectional thus ought to be careful in assuming causality in the included factors.

Most of the reviewed studies utilized secondary data. Since death is a rare event, a number of studies employed more than one round DHS. In developing a living standards measure, most studies did not contain income, consumption or expenditure data thus the asset index developed using the PCA approach has been used as a proxy measure. Survival analysis has been

employed to estimate child survival, for instance Mutunga (2007). Other studies utilized bivariate and multivariate models (Ettarh & Kimani, 2012; Mustafa, 2008; Ngigi, 2013). In assessing health inequality, majority of the studies employed the Concentration Index (CI) and decomposition analysis approach. A summary of some of the reviewed literature is shown in appendix 1.

2.4 Overview of Literature

There is a common agreement in the literature that a child's personal and biological characteristics, behavioral characteristics of the child's mother and socioeconomic household and community variables have significant effects on inequality in U-5 mortality.

From the reviewed literature, child sex, multiple delivery, premature delivery and birth interval affects U-5 mortality. U-5 mortality is higher among children of multiple births, short birth intervals and premature deliveries. Kabubo-Mariara et al., (2012) revealed that mother's education level, ethnicity, geographical location and SES influences U-5 mortality. Bado & Appunni, (2015) found that the gender of the child, father's education, age of the mother and household SES influenced inequalities in U-5 mortality. However, most of the reviewed studies focused on identifying the impact of the determinant's contribution to U-5 mortality without computing the contribution of various characteristics to the existing inequality in U-5 mortality. In Kenya, most studies have used immunization, malnutrition and skilled birth attendance to explain inequalities in child health.

Various factors have been identified as the determinants of inequality in U-5 mortality. Guided by the reviewed literature and the availability of data, this study investigates how region, ethnicity, child sex, mother's education, birth interval, socioeconomic status, place of

residence, age of the mother, availability of sanitation facilities and place of deliver influences inequality in U-5 mortality. This study uses the Concentration Index, decomposition analysis and Generalized Linear models which have been considered to be the most appropriate methods for analyzing health inequality. We use a model that includes health services utilization, maternal, child and household characteristics so as to establish the main determinants of inequality in U-5 mortality. Our study contributes by explaining how the disparities in distribution of the aforementioned determinants contribute to inequality in U-5 mortality in Kenya. This study has the potential to guide policy makers involved in improving child survival through resource allocation, universal health coverage and other interventions promoting health equity.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter presents a description of the data sources, research design, data management and analytical tools applied to come up with the factors influencing socioeconomic inequality in U-5 deaths in Kenya.

3.2 Conceptual Framework

From Mosley & Chen, (1984) and Blane, (1985) the magnitude of socioeconomic inequality in U-5 mortality is influenced by the following factors: the extent and interrelationship of social and geographic stratification (A); the relationship between social stratification and inequality in proximate determinants (B); the relationship between inequality in specific proximate determinants and mortality inequality (C); a reverse impact of ill-health on socioeconomic position (D); and extent to which these relationships are modified by the wider context,

including country (E, F, G, H) and global (I) level determinants. This can be summarized as shown in figure 2.

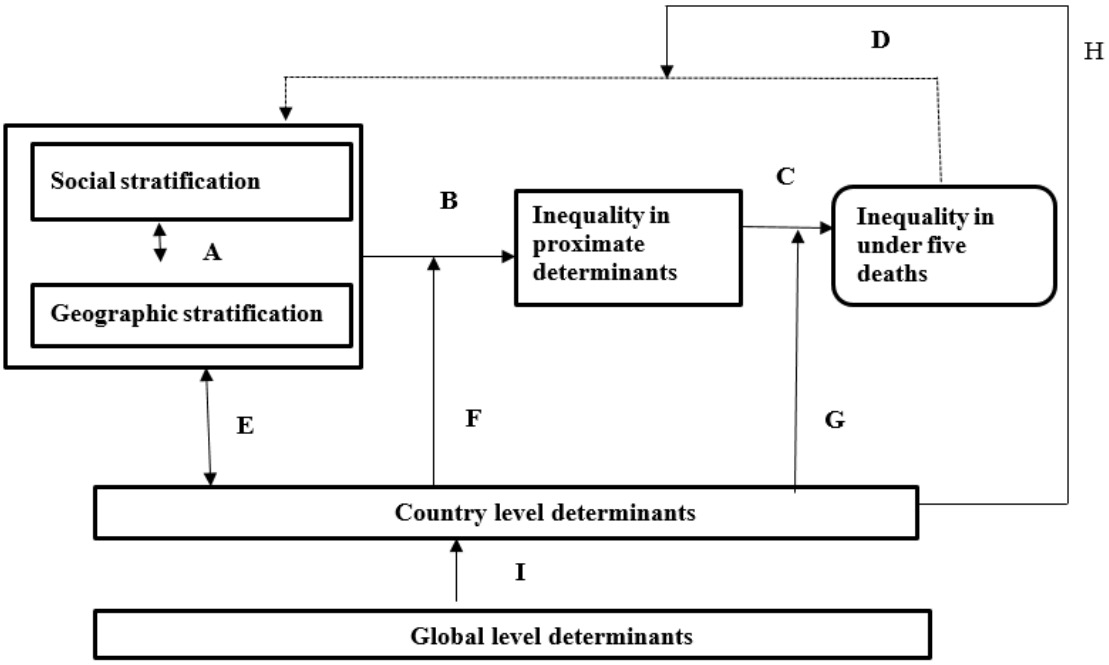

Figure 3.2. Conceptual framework, relationship between social and geographic stratification and inequality in U-5 mortality.

Source: Houweling & Kunst, (2010).

Through social and geographic stratification (A), individuals consciously decide whom to live close to, thus the poor end up living in more deprived regions. Social and geographic stratification also influences the distribution of direct mortality determinants (B) leading to inequality in U-5 deaths (C). When a child is sick, a household may incur expense or sell some of the assets to meet healthcare cost hence affecting the household's SES (D).

Features at the country level (E-I) can have influence on the extent of mortality inequalities through several ways. First, social stratification (E) is under the influence of the government through, for example, taxation and education policies. Conversely, the extent of social stratification (e.g. size of income inequalities, extent of ethnic fragmentations) can affect health sector performance. Second, country level variables can modify the relationship between social stratification and inequality in proximate determinants (F). For instance, health care financing arrangements can alter the effect of economic status on how one accesses health care. Third, characteristics at the country level can alter the impact of inequalities in proximate determinants on mortality inequality (G). For example, the quality of care may influence the extent to which inequalities in healthcare use cause inequalities in childhood mortality. Finally, the extent to which ill-health has impoverishing effects can also be influenced by public policies (H). The proportion of households making catastrophic health care expenditures varies with health system reliance on out of pocket expenditures.

Country level issues are often strongly influenced by the international context (I); international aid and debt service flows, and structural adjustment programmes, for example, may impact on mortality inequalities. Trade negotiations and the associated commercialization of health care, may influence inequalities in access to care. Trade agreements that reduce tariff obstacles, can impact on public spending (Houweling et al., 2003).

3.3 Analytical Framework

Atkinson, (1970) contributions guided the approach of inequality measures through the identification of the relationship between social evaluation orderings, value judgment distribution and income distribution. Previous studies have used simple estimates of inequality like the range while other studies have employed complex measures like the Gini Coefficient

and the concentration index. Bleichrodt & Doorslaer, (2006) study expounded the foundation of the regularly used estimators of health inequality by highlighting a number of assumptions.

Health equity analysis is primarily involved in estimating disparities between socioeconomic or demographic groups in outcomes in health, health care services use, payments in health care and receiving of subsidies through the use of health care services. This study mainly focuses on the health outcomes dimension.

3.3.1. Estimating socioeconomic status

This study employs the asset index as a measure for SES. Various studies have applied the asset index to estimate socioeconomic position for explaining inequalities in various health outcomes (Emamgholipour et al., 2015; Lindelow, 2006; Poel, 2008). The KDHS creates a wealth index (Filmer & Pritchett, 2001) utilizing data on household assets and dwelling characteristics.

3.3.2 Measuring socioeconomic related health inequality

To measure the extent of socioeconomic-related inequality in under-5 mortality, the study employed the concentration index, an approach developed by (Wagstaff et al., 1991). The concentration index measures the level to which under-5 mortality differs between different children from households of different socioeconomic status.

The Concentration Index offers a measure of the degree of disparities in health that are systematically related with SES. By plotting cumulative proportions U-5s ranked by household's SES against the cumulative proportions of U-5 deaths, a mortality concentration

curve is determined which presents the extent of socioeconomic inequality in mortality. If U-5 mortality is equally spread across the wealth groups, the concentration curve eventually coincide with the diagonal. If U-5 mortality is higher among the lower SES, the concentration curve lies above the diagonal and the further it lies directly above the diagonal, the bigger the amount of inequality in U-5 mortality.

The general formula for the concentration index (CI) is:

$$\boldsymbol{CI = \frac{2}{\bar{y}} cov(y_i r_i)} \quad \textbf{[1]}$$

Where $\bar{y}_i$ is the mean U-5 mortality, and r_i is the cumulative percentage that each U-5 child represents over the total population after ranking U-5 mortality by wealth index.

For an unbound variable, the index ranges between -1 and 1. For bound variables, like U-5 mortality, the index ranges from $\bar{y} - 1$ to $1 - \bar{y}$ thus the values of the index depends on the mean of the distribution and the sample size (Kakwani et al., 1997). This overdependence of the mean is a shortcoming if one is interested in comparing children with different average mortality levels. Further, the standard concentration index could be outside the (-1,+1) interval (Wagstaff, 2005). Furthermore, the standard concentration index also violates the "mirror property", that is inequalities in health do not always "mirror" inequalities in ill-health. As a result, there has been broad discussion on correcting the problem when the health variable is bound (Erreygers, 2009; Erreygers et al., 2012; Wagstaff, 2011).

In the case of binary health variables, Erreygers, (2009) recommended adjustment of the Concentration Index to allow comparison of groups of individuals with different levels of poor health:

$$E_y = \frac{4\bar{y}}{y^{max} - y^{min}} \times CI \quad \text{.....[2]}$$

Where y^{max} and y^{min} represents the extremes of the health.

The Erreygers's CI ranges from -1 to 1. A CI of 0, implies equity in health. A negative CI implies that poor health is more prevalent among the poor, while a positive value implies that poor health is concentrated among the rich people. The magnitude of the concentration index show the strength of the relationship between SES and health variable.

3.3.3 Decomposition of the concentration index

The decomposition analysis makes it possible for inequality to be apportioned into explicit effects to show how much each explanatory variable determines the overall inequality.

Following Wagstaff et al., (2003), for continuous health outcome with a linear relationship between health (y) and a set of k independent variables x, the CI can be written as a weighted sum of partial CIs for the independent variables of inequality:

$$y_i = \propto + \sum_k^{\infty} \beta_k \, x_{k_i} + \varepsilon_i \quad \text{.....[3]}$$

Where ε represents the residual. From equation (3), the Concentration Index for y (CI) can as well be written as:

$$CI = \sum_k \left(\frac{\beta_k \bar{x}_k}{\bar{y}}\right) CI_k + \frac{GCI_\varepsilon}{\bar{y}} \quad \text{.....[4]}$$

Where $\bar{x}_k$ and CI_k are the mean and concentration index for x_k respectively. GCl_ε denotes the generalized concentration index for the error term (Wagstaff et al., 2003). The CI in equation (4) is made up of two components. The first is the explained component which is equal to a weighted sum of the CIs of the independent variables, where the weights are the elasticities. The second is the unexplained component which shows the inequality in health that cannot be explained by the disparity in the x_k across socioeconomic groups.

When the dependent variable is a dummy, maximum likelihood approach can be used to estimate the weights. To apply decomposition analysis, a non-linear model requires a linear approximation and a Generalized Linear Model (GLM) approach is the most suited for dummy outcomes i.e. Yiengprugsawan et al., (2010). Thus the CI can be rewritten as;

$$\boldsymbol{CI} = \sum_{\boldsymbol{k}} \left(\frac{\boldsymbol{\beta_k^m \bar{x}_k}}{\bar{\boldsymbol{y}}} \right) \boldsymbol{CI_k} + \frac{\boldsymbol{GCI_\varepsilon}}{\bar{\boldsymbol{y}}} \quad \text{.....[5]}$$

Where β_k^m are the partial effects (dy/dx_k) evaluated at sample means and GCIε is the error term. Erreygers's corrected Concentration Index produces similar results when used. It can be expressed as;

$$\boldsymbol{C_E = \sum_{k=1}^{K} \beta_k^m 4 \bar{x}_k CI_k + 4GCI_\varepsilon} \text{.....[6]}$$

From equation 3, the set of k independent variables of x represented as x_k consists of the selected maternal characteristics, household characteristics, child characteristics and health services variables as shown in table 3.1.

3.4 Variable Definitions

The variables used in this study are drawn from the KDHS dataset. From the literature review and the theoretical framework, several variables are hypothesized to influence inequality in U-5 mortality. The contributing factors of inequality in U-5 mortality, how they are categorized and the expected effects are presented in table 3.1.

Table 3.1: Variable definition and hypothesized relationships

Variable	Measure	Expected sign and literature source
Household characteristics		
Socioeconomic status (SES)	1- Poorest(Reference category), 2- Poor, 3- middle, 4- rich, 5- Richest	Poorest quintiles expected to be associated with higher inequality in U-5 deaths (Bado & Appunni, 2015; Hosseinpoor et al., 2006; Quentin et al., 2014)
Source of drinking water (DW)	1-Unprotected well / River/ surface water/ Spring- (Reference category) 2-Protected Spring/Well/Rain water 3- Piped/ Bottle water	Availability of safe drinking water expected to reduce inequality in U-5 deaths (Source: own tabulation)
Toilet facility (ATS)	1- No facility-(Reference category) 2- Ventilated Improved Pit /Pit Toilet 3- Flush	Access to sanitation facilities is expected to reduce inequality in U-5 deaths (Hosseinpoor et al., 2006; Emamgholipour et al., 2015)
Residence type (RT)	0- Urban 1- Rural	Rural residence expected to have higher inequality in U-5 deaths than urban residence (Hosseinpoor et al., 2006; Malderen et al., (2013a)
Region (RON)	1-Nairobi 2-Central 3-Coast 4-Eastern 5-Nyanza (reference category) 6-Rift Valley 7-Western 8-North Eastern 9- Other	Regional socioeconomic differences are expected to influence inequality in U-5 mortality (Hosseinpoor et al., 2006; Malderen et al., 2013a)
Ethnicity (ET)	1-Luo (reference category) 2-Kamba 3-Kikuyu 4-Luhya 5-Kalenjin 6-Somali 7- Kisii 8-Mijikenda/Swahili 9- Maasai 10-Meru 11-Others	Marginalized tribes expected to have higher inequality in U-5 deaths (Source: own tabulation)
Maternal Characteristics		
Mother's education (MED)	0 -No education -(Reference category) 1 -Primary 2 -Secondary 3 -Higher	Child born of uneducated mothers likely to face higher U-5 mortality inequality than those born of educated mothers Hosseinpoor et al., (2006)

Mother's age (MAGE)	1- (15-24) 2- (25-29)-(Reference category) 3- (30-34) 4- (35-49)	High inequality in U-5 mortality expected from children born by very young/old mothers (Bado & Appunni, 2015; Malderen et al., 2013a)
Characteristics of the child		
Sex of the child (G)	Male (1) Female (0)	Male children are expected to contribute more to inequality in U-5 mortality than female children (Bado & Appunni, 2015; Malderen et al., 2013a)
Birth Spacing (BSP)	1- Below 24 months 0- Above 24 months	Wider birth spacing of above 24 months is likely to decrease inequality in U-5 mortality (Bado & Appunni, 2015; Hosseinpoor et al., 2006)
Birth order (BO)	0- first order- (Reference category) 1- 2-3 birth order 2- above 3 birth order	Inequality in U-5 deaths expected to be higher for high birth orders (Bado & Appunni, 2015; Malderen et al., 2013a)
Size at birth (Z)	0- small- (Reference category) 1- average 2- large	Inequality in U-5 mortality is expected to be higher when birth size is small compared when it is large (Source: own tabulation)
Health service factors		
Place of delivery (PD)	1-Health facility 0-Home	Inequality in U-5 mortality is expected to be lower with the availability of basic health services and delivery at hospitals (Kraft et al., 2013)

3.5 Data Source

The study utilized the 2003, 2008/09 and 2014 KDHS datasets. The KDHS contains representative data on family planning, fertility, maternal health and child health for women aged 15 to 49 years. The study utilized information on all child born in the 5-years prior to the survey for every women interviewed. The KDHS sample is based on a stratified 2-stage cluster design to produce representative estimates for most of the survey indicators. KDHS 2003 comprised of 8195 women, KDHS 2008 had 8444 women and KDHS 2014 had 31079 women.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the study findings. Section 4.2 presents the descriptive statistics, section 4.3 presents the concentration index and section 4.4 the decomposition of the concentration index.

4.2 Descriptive Statistics

Table 4.1 shows the descriptive statistics. The summary statistics indicate differences between the poorest children to the least poor. The table shows how the variable are distributed across the five socioeconomic groups. We observe that the poorest children are more likely to face U-5 deaths than children from better off households. These children are also more likely to drink water from unprotected water sources (88%) than those from the upper quintile (6%), and are also more likely to lack a toilet facility (77%) than those from the wealthiest households (1%).

Children from the poorest quintile are also more likely to reside in rural areas (99%) when compared with children from the wealthiest quintile (17%). The summary statistics show that 55% of mothers from the poorest quintile have no primary education, compared with 6% of mothers from the wealthiest households. Children from the poorest quintile are more likely to have short birth intervals relative to children from least poor households. Poorest households are more likely to have higher birth order (hence more children) than the less poor households. Also, children from the poorest quintile are more likely to be delivered at home (82%) than children from the least poor households (14%).

Table 4.2: Descriptive statistics (2003, 2008/09 and 2014 KDHS datasets).

Variable	**1(Poorest)**	**2**	**3**	**4**	**5(Least poor)**
U5deaths	0.0547	0.0617	0.0503	0.0526	0.0452
Household characteristics					
Drinking water source					
Unprotected sources / River	0.8780	0.7275	0.3628	0.3468	0.0680
Protected Spring/Well/Rain water	0.1220	0.2165	0.3463	0.2521	0.1283
Piped water/Bottle water	0	0	0.2909	0.4011	0.8037
Toilet facility (ATS)					
No facility	0.7748	0.2060	0.1542	0.0433	0.0130
Ventilated Improved Pit/Toilet	0.0130	0.7940	0.8428	0.9437	0.5695
Flush	0	0	0.0030	0.0130	0.4175
Residence type (Rural)	0.9934	0.9508	0.8006	0.5969	0.1674
Maternal Characteristics					
Mother's education					
No education -(Reference category)	0.5484	0.2110	0.1318	0.0952	0.0641
Primary	0.4516	0.7508	0.6327	0.5607	0.3499
Secondary	0	0.0382	0.2228	0.2987	0.3597
Higher	0	0	0.0128	0.0455	0.2263
Mother's age	29.08	28.83	28.68	28.05	28.34
Characteristics of the child					
Sex of the child (Male)	0.5064	0.5049	0.5160	0.5102	0.5085
Birth interval (less than 2 yrs.)	0.2320	0.2196	0.1894	0.1635	0.1242
Birth order (BO)					
First order- (Reference category)	0.1428	0.1669	0.2038	0.2606	0.3712
2-3 birth order	0.3098	0.3399	0.3658	0.3994	0.4456
Above 3 birth order	0.5474	0.4932	0.4304	0.3400	0.1833
Size at birth (Z)					

Small- (Reference category)	0.1565	0.1889	0.1628	0.1768	0.1809
Average	0.1350	0.1185	0.1020	0.1082	0.0986
Large	0.7084	0.6926	0.7352	0.7150	0.7205
Place of delivery (Home)	0.8193	0.6719	0.5329	0.3708	0.1373
N	7117	5787	6419	6442	6439

4.3 Inequality in Under Five Mortality

Using 2003, 2008/09 and 2014, the results show that across the five socioeconomic groups, U5 mortality is lowest among the 4th quintile and highest among the 1st quintile (poorest).

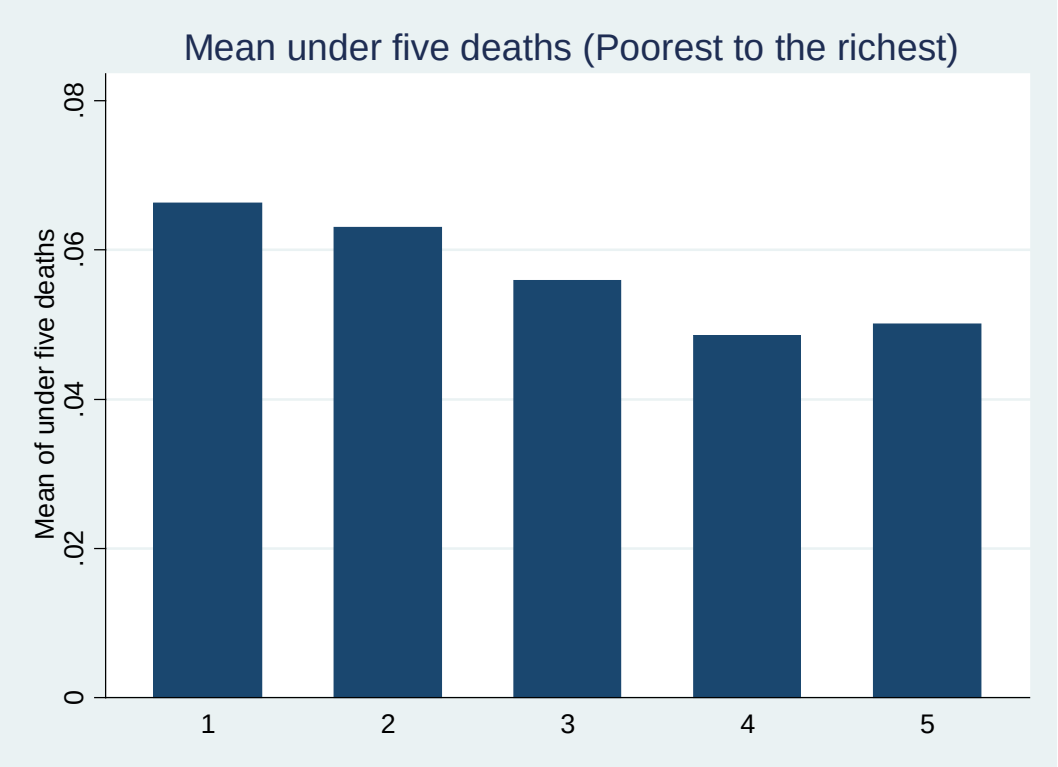

Figure 4.3 : **Differences in U5 mortality mean across the five socioeconomic groups.**

4.3.1 The concentration index

To determine inequality in U-5 deaths, the approach advocated by Wagstaff et al; (1991) is employed. Table 4.2 shows that the Wagstaff concentration index of U-5 mortality is negative and statistically significant. This implies that U-5 mortality is more concentrated among the poor households. However, the magnitude implies a weak association between Socio-

Economic Status (SES) and U-5 deaths. These findings concur with earlier expectations on the effect of SES on inequality in U-5 mortality, the poorest quintiles are associated with higher inequality in U-5 deaths.

Table 4.2: Wagstaff index of inequality in U-5 deaths

Index	No. of obs. |	Index value	Robust std. error	p-value
Wagstaff norm. CI	32204	-0.015	0.0051	0.0038
(Note: Std. error adjusted for 1594 clusters in PSU)				

4.3.2 Multivariate decomposition

Multivariate decomposition is a technique "used to quantify the contributions to group differences in average predictions from multivariate models" (Powers et al., 2011, 557). The approach utilizes the outputs from regression models to partition the components of a group difference in the mean/proportion into components attributable to compositional differences between groups (Powers et al., 2011). In this study, decomposition analysis indicates how each factor contributes to the overall inequality in U-5 mortality (Table 4.3).

Table 4.3 show the decomposed variables and their percentage contribution to inequality in U5 mortality. E denotes that part of socioeconomic inequality in U-5 mortality arising from variations in the distribution of endowments/risk factors while C is that part of socioeconomic inequality in U-5 mortality arising from variations in the effects of characteristics (return to risk/behavioral responses). Pct. is the net percent contribution of components E and C and they always equal 100%. A contribution can be negative or positive and could even exceed 100%. A positive contribution implies that the component contributes more to U-5 deaths among the poor relative to the rich, whereas a negative contribution implies that the component contributes more to U-5 deaths among the rich relative to the poor (Powers et al., 2011).

Table 4.3: Decomposition analysis

Variables	Estimate	Std. error	Pct.			
Explained: due to differences in characteristics (E)	0.031***	0.0040	402			
Unexplained: due to differences in coefficients (C)	-0.023***	0.0050	-302			
Raw difference (R)	0.0080	0.0040	100			
Differences in characteristics (E)				***Differences in coefficients (C)***		
Variables	Estimate	Std. error	Pct.	Estimate	Std. error	Pct.
Household characteristics			**356**			***-347***
Drinking water source			-1			-46
Unprotected (Reference Category)						
Protected Spring/Well/Rain water	-0.0005*	0.0003	-7	-0.0001	0.0009	-2
Piped water/Bottle water	0.0005	0.0014	6	-0.0034	0.0060	-45
Toilet facility (ATS)			371			-269
No facility-(Reference category)						
Ventilated Improved Pit /Pit Toilet	-0.0010	0.6097	-9	0.0011	0.0082	14
Flush	0.029***	0.0030	380	-0.0216*	0.0086	-283
Residence type (Rural)	*0.0016*	*0.0018*	21	0.0008	0.0008	10
Region (RON)	*-0.0023*	*0.0021*	-30	-0.0005	0.0038	-7
Ethnicity (ET)			-5			-35
Kikuyu (reference category)						
Kamba	0.0000	0.0001	0	-0.0013	0.0009	-17
Luo	0.0001**	0.0000	1	-0.0002	0.0007	-2
Luyha	0.0002	0.0001	2	-0.0008	0.0010	-10
Kalenjin0728611034	-0.0002	0.0005	-3	0.0001	0.0006	1
Somali	0.0000	0.0001	0	0.0005	0.0004	6
Kisii	0.0000	0.0000	0	-0.0001	0.0005	-1
Mijikenda	-0.0001	0.0001	-1	-0.0001	0.0003	-1
Maasai	-0.0003	0.0002	-5	0.0000	0.0002	0
Meru	0.0000	0.0000	0	0.0000	0.0005	1
Others	0.0000	0.0000	0	-0.0009	0.0005	-11
Maternal Characteristics			**43**			***321***
Mother's education			38			104
No education -(Reference category)						
Primary	-0.0003	0.0008	-4	0.0041	0.0026	53
Secondary	0.0016	0.0010	21	0.0026	0.0029	35
Higher	0.0016	0.0015	21	0.0012	0.0021	16
Mother's age	0.0004**	0.0001	5	0.0166	0.0131	217
Characteristics of the child			***3***			***7***
Sex of the child (Male)	*0.0001**	*0.0000*	*1*	*0.0024*	*0.0019*	*31*
Birth interval (less than 2 yrs.)	*0.0010***	*0.0003*	*14*	*0.0011*	*0.0007*	*14*
Birth order (BO)			*-37*			*-51*
First order- (Reference category)						
2-3 birth order	0.0008*	0.0004	10	-0.0019	0.0023	-24
Above 3 birth order	-0.0036**	0.0014	-47	-0.0020	0.0012	-26
Size at birth (Z)			7			12
Small- (Reference category)						
Average	0.0002**	0.9260	3	0.0003	0.0005	3
Large	0.0002*	0.0001	3	0.0007	0.0031	9
Place of delivery (PD)	*0.0014*	*0.0009*	*19*	*0.0001*	*0.0006*	*1*
Constant						-284

Statistical significance denoted at *** p<0.01, ** p<0.05, * p<0.1

From the Generalized Linear Model output, the observed difference in U-5 deaths was further decomposed into a characteristic component and the effects component. The results show that differences in effects account for 302 % of the observed socioeconomic group differentials in the prevalence of U-5 deaths. A positive difference in characteristics (E_k) coefficient indicates the expected reduction in U-5 mortality gap between the poor and the least poor if the poor were equal to rich on the distribution of a variable (X_k). For instance the results show that, equalizing household characteristics would be expected to reduce the poor–rich U-5 mortality gap by 356%, while equalizing maternal characteristics and child characteristics would lead to reduction of inequality in U-5 deaths by 43% and 3% respectively.

From the results, shifting access to sanitation, mother's education and birth interval of the poor to the levels of rich would provide the largest decrease in the poor-rich differentials in U-5 deaths. For example, if the poor and the rich had the same level of access to flush toilets compared to not having a toilet facility, the inequality in U-5 deaths would decline by 380%. A negative difference in returns (C_k) indicates the anticipated widening of the poor-rich gap if the poor had the same returns to risk, or behavioral responses, as the rich and vice versa. The protective effects of access to flush toilets are not as strong for the rich as they are for the poor. If the poor were "protected" from risk to the same degree as the rich, the poor–rich gap would be expected to increase by about 283%.

4.4 Discussion of Results

The analysis reveals that there exists substantial differences of variables across the low socioeconomic quintiles and the high socioeconomic quintiles. Children from the poorest quintile face higher likelihood of dying when compared to children from the richer quintiles. Erreygers's CI ranges from -1 to 1. A value is 0 implies that equity in the under-five mortality

while a negative value implies that under-five mortality is more prevalent among the poor people. A positive value means that the under-five mortality occurs more among the rich people. The absolute size of the concentration index show how strong the relationship between SES and under-five mortality is. The result shows that concentration index of inequality in U-5 mortality is (-0.015) negative indicating that inequality in under-5 mortality is moderately concentrated among the poor in the community (Hosseinpoor et al., 2006). The analysis further decomposes the observed socioeconomic inequality into its specific determinants thus providing a more in-depth analysis of inequality in U-5 mortality. The results are discussed below:

Household characteristics

In studying the impact of household characteristics on the observed inequality in U-5 mortality, the following factors were found to influence inequality in U-5 mortality; sources of drinking water, ethnicity and toilet facility. Toilet facility has the greatest impact, the results show that in comparison to having no toilet facility, if the poor had flush toilets at the same level as the rich, inequality in U-5 mortality would reduce by 380 %. Descriptive statistics shows that 77% of households from the poorest quintile lack a toilet facility and its only 1% who have access to a ventilated pit latrine. Majority of households from the second quintile use a ventilated pit latrine (79%). Also, having a flush toilet facility is more prevalent among the highest quintile (42%) compared to the poorest quintile (0%). This variable was significant at 1%. This supports findings by Hosseinpoor et al., (2006), who found that hygienic status of the toilet influenced inequality in infant mortality in Iran. The findings support our prior expectations that hygienic sanitation facility is associated with a reduction of U-5 mortality inequality.

The results show a correlation between ethnicity and U-5 mortality inequality. Specifically, if conditions of the Luo tribe are increased to the level of the Kikuyu tribe, inequality in U-5

mortality would decline by 1%. However, difference in access to healthcare, education, culture, environment and other factors may also contribute to the observed ethnic differences in U-5 deaths. In addition, marginalized communities are highly likely to face harsh conditions compared to non-marginalized communities.

Majority of the children from poorest quintile use unprotected sources of water (88%) compared with the richest quintile (6%). However, unprotected sources of drinking water seems to be the main source of drinking water for the second (73%) and third quintile (36%). The fourth quintile and the richest quintile mainly use piped/bottle water for drinking, 40% and 80% respectively. The results reveals that if the poor could have as good access to drinking water as the rich, inequality in U-5 mortality would increase by 7%. This variable is significant at 10% level of significance. This result contradicts mainly because of low disparity in the use of drinking water sources. However, previous studies found that improving access to clean water reduces U-5 mortality inequality (Halder & Kabir, 2008). The type of residence and region do not have a significant effect on inequality in U-5 mortality.

Maternal characteristics

Mother's age positively contributes to inequality in U-5 mortality. The mean age of women in the poorest quintile is higher (29.1) than that of the least poor quintile (28.3). If women from lower socioeconomic status become mothers at the same age as women from higher socioeconomic status, inequality in U-5 mortality will reduce by 5%. This variable is significant at 5% level of significance. This could imply that as mothers mature from teenage mothers to young adult mothers they become knowledgeable on how to care for the child thus reducing inequality in U-5 deaths; however, women who are very young/old may experience

age-health linked complications during pregnancy and child birth thus increasing likelihood of inequality in U-5 mortality. This is supported by literature (Bado & Appunni, 2015).

Education of the mother seems to have no influence on the observed socioeconomic inequality in U-5 mortality. With primary education, the probability of U-5 mortality inequality is low. For instance, 45% of mothers from poorest quintile have primary education compared with 40% from the richest quintile. In the literature, higher education was found to lower inequality in U-5 mortality through factors like hospital delivery and increased ante natal care for pregnant mothers.

Child characteristics

Inequality in U-5 is influenced by birth interval. From the descriptive statistics, 23% of women from the poorest quintile experienced short birth intervals compared to 12% of the women from the richest quintile. The results show that if women from lower socioeconomic group experience the same birth intervals as women from the high socioeconomic status, inequality in U-5 mortality will reduce by 14%. This result is consistent with findings by Hosseinpoor et al., (2006) who found that birth interval influenced inequality in infant mortality in Iran. A study done by Dube et al., (2013) revealed that short birth interval increase the likelihood of U-5 mortality.

Child mortality declines with the first birth, but increases with births of order four and higher, however in some cases, firstborns face higher mortality risks than other children. The poor have higher birth orders compared to the rich. For instance, 55% of the poorest children are of birth order 3 and above compared to only 18% of the least poor children. Birth order has an impact on inequality in U-5 mortality. In comparison to first birth order, if the poor had the

same birth order of 2-3 as the rich, inequality in U-5 mortality would fall by 10%. This variable is significant at 1% level of significance. These findings support Malderen et al.,(2013a) who found that birth order contributed most to overall U-5 mortality inequality in most of 13 African countries studied. However, if the poor had the same birth order of 3 and above as the rich, inequality in U-5 mortality would increase by 47%.

On birth size, at birth, the results suggest that equalizing the size at birth for the poor and the rich would reduce the observed inequality in U-5 mortality by 3%. Often children from deprived families are likely to have lower birth weight than children from rich households. This supports findings by Dube et al., (2013) that low birth weight is correlated with higher under five mortality. Previous studies used birth weight as a proxy measure for premature delivery.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

This chapter presents a summary of the study, conclusion, policy recommendations, limitations of the study and suggestions for future research.

5.2 Summary and Conclusions

Sub Saharan Africa has not embraced a good pace to achieving MDG 4. Although some progress has been made, the level of U-5 deaths still remains high. To meet the Sustainable Development Goal 3, specific and proven interventions are required. Kenya has made progress in reducing U-5 deaths, however there is need to find better interventions to reduce the rates further down. Previous studies revealed that, reducing inequality in U-5 mortality eventually reduces U-5 mortality. This study analyzed how socioeconomic and demographic factors contribute to socioeconomic inequality in U-5 mortality in Kenya. This was motivated by the

fact that despite the significant progress in reduction of U-5 mortality, inequality in child mortality remains high in Kenya. Explaining disparities in child health is crucial for designing policies for addressing U-5 mortality among the most vulnerable children and marginalized sub-populations in Kenya.

The study used household level data from the 2003, 2008/09 and 2014 KDHS. The concentration index is employed to measure the extent of socioeconomic inequality in U-5 mortality. Since the health variable is binary, the study employed Erreygers, (2009) and Wagstaff, (2011) corrected concentration indices which allow comparison between socioeconomic groups that may present different intensities of U-5 mortality. Also, to explain how each variable contributes to the overall inequality, decomposition analysis approach and a generalized linear model were employed (Yiengprugsawan et al., 2010).

Several key findings emerge from the study: first the least poor are more likely to have a flush toilet facility (42%) compared to the poorest households (0%). The results show that in comparison to having no toilet facility, if the poor had flush toilets at the same level as the rich, inequality in U-5 mortality would reduce by 380%. This implies that sanitation facility is a key determinant of inequality in U-5 mortality. This supports findings by Hosseinpoor et al., (2006) who found access to clean sanitation facility to be a major factor of infant mortality inequality in Iran.

Secondly the study found out that mother's age positively contributes to inequality in U-5 mortality. The mean age of women in the poorest quintile was higher (29.1) compared to the least poor quintile (28.3). If women from lower socioeconomic status become mothers at the same age as women from higher socioeconomic status, inequality in U-5 mortality will reduce

by 5%. This supports findings by Bado & Appunni, (2015) who explained that maternal age influenced inequality in U-5 mortality in West Africa.

Thirdly the study found that 23% of women from the poorest quintile experienced short birth intervals compared to 12% of the women from the richest quintile. Inequality in U-5 mortality is influenced by birth interval, the results show that if women from lower socioeconomic group experience the same birth intervals as women from the high socioeconomic status, inequality in U-5 mortality will reduce by 14%.

Fourth, the poor have higher birth orders compared with the rich, for instance birth of order 3 and above was 55% for the poorest quintile compared to 18% for the richest quintile. Birth order has an impact on inequality in U-5 mortality. In comparison to first birth order, if the poor had the same birth order of 2-3 as the rich, inequality in U-5 mortality would reduce by 10%. Similar results have been found by Malderen et al., (2013a) who found that birth order influenced wealth associated inequality in U-5 mortality in the majority of the 13 African countries included in the study.

Region, residence (rural/urban), mother's education and place of delivery contribute little to socioeconomic inequality in U-5 mortality.

5.3 Policy Implications

From the analysis, the study found out that in comparison to having no toilet facility, if the poor had flush toilets at the same level as the rich, inequality in U-5 mortality would reduce by 380 %. This study therefore recommends interventions aimed at equalizing access to sanitation facilities. The need for the poor households to access clean sanitation facilities to

the levels of the least-poor households would have the greatest impact in reducing inequality in U-5 mortality. The government can invest in building public toilets closer to the poor households and implement interventions which encourage every household to at least have an improved pit latrine.

The study also found out that mother's age was a key determinant of inequality in U-5 mortality. From the review Ngigi, (2013) noted that U-5 mortality is higher among very young mothers (below 20 years) and older women (above 40 years). The results suggests the need for interventions to encourage women from poor economic backgrounds to delay child birth to mid-years (between 20 and 34 years of age).

The study also found out that if women from lower socioeconomic groups experienced the same birth intervals as women from the high socioeconomic status, inequality in U-5 mortality would decline by 14%. Further, in comparison to first birth order, if the poor had the same birth order of 2-3 as the rich, inequality in U-5 mortality would reduce by 10%. This study therefore recommends that women from poor backgrounds be encouraged to have a birth spacing of at least 2 years and above and also have lower birth order of 2-3. This would ensure they have enough time to look after their children. This can be done through extensive education on family planning and making the family planning services available and affordable to the poor households.

From a policy perspective, these results suggest interventions aimed at equalizing access to sanitation, lowering both birth intervals and birth orders of the poor to rich levels will reduce inequality in U-5 mortality in Kenya. Equally, greater emphasis should be placed upon improving household socioeconomic status amongst the poor. Other initiatives for reducing

socioeconomic U-5 inequality and improving SES of the poor include developing relatively poor areas through subsidies to the marginalized groups.

5.4 Limitations of the Study

The major limitation of this study was the use of the KDHs 2003, 2008/09 and 2014. The dataset though the most recent available data could not give up to date information on recent interventions aimed at reducing inequality in U-5 mortality. The data had missing variable values; for instance a number of the interviewed mothers indicated their infants were not weighed at birth. This could be as a result of recall problem and misplaced birth records. However, a number of tactics have been employed to handle the limitations throughout data preparation and analysis, thus bias due to the highlighted limitations is minimal.

5.5 Suggestions for Further Study

In the light of the above shortcomings, there is need to carry out further research which employs up-to-date data. In addressing research on socioeconomic inequality in U-5 mortality there is need to utilize data on household expenditure to develop a SES measure and explore child health socioeconomic inequality through the perspective of regional disparities. The available dataset was not collected at the County levels thus our study could not provide County specific results.

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APPENDIX

Appendix 1: Summary of Relevant Literature

Author (Year)	**Study Objectives**	**Variables used**	**Data used**	**Methods**	**Results (+ve means associated)**
Moisi et al., (2010)	To investigate the impact of travelling distance to health centers on under five mortality	Socioeconomic variables	Kilifi DHS	Kaplan-Meier survival curves and instantaneous hazard curves	Geographic location (+ve) Distance (+ve) Maternal education (+ve) Child sex (+ve) Ethnicity (+ve)
Kabubo-Mariara et al.,(2012)	To investigate the determinants of child survival in Kenya and suggest policy to reduce child mortality.	Maternal characteristics Child characteristics Household characteristics	KDHS 1993-2003	Survival analysis	Birth order (+ve) Sex of the child (+ve) Age of the mother (+ve) Education level the mother (+ve) Socioeconomic status (+ve) Drinking water (+ve) Sanitation facilities (+ve) Health care services (+ve) Region (+ve)
Mustafa, (2008)	To determine the main socioeconomic factors contributing to infant mortality in Kenya.	Biosocial, demographic and economic factors	2003 KDHS	Univariate, bivariate and multivariate models	Breastfeeding (+ve) Ethnicity (+ve) Birth interval (+ve) Gender of the child (+ve)
Ettarh & Kimani, (2012)	Determine the impact of maternal characteristics and location on under five mortality in rural and urban settings.	Socioeconomic factors Child health care factors Demographic variables	2008-2009 KDHS	Multivariate analysis	Poverty (+ve) Breastfeeding (+ve) Region (+ve) Setting(Urban/Rural) (+ve) Place of delivery (+ve)

Mutunga, (2007)	To explain the relationship between U-5 mortality and socioeconomic and environmental characteristics.	Socioeconomic and environment variables	2003 KDHS	Survival analysis	Sex of child (+ve) Household size (+ve) Sanitation (+ve) Sources of cooking fuel (+ve)
Ngigi, (2013)	To study the determinants of infant mortality in Kenya.	Socioeconomic factors Health services utilization	2008 KDHS	Logit model	Mother's age (+ve) Total number of children born by a mother (+ve) Household wealth Birth size (+ve) Mother education and religion (+ve)
Egondi et al., (2015)	To explain inequality in immunization among the Nairobi poor urban children.	Socio-demographic variables	2012 Second Nairobi cross sectional slum survey by African Population and Health Research Center (APHRC)	Wealth index used a socioeconomic measure. Concentration index Decomposition analysis	Birth order (+ve) Mother's education (+ve) Household wealth (+ve) Mother's age at birth (+ve) Ethnicity(-ve) Marital status (-ve)
Malderen et al., (2013b)	To explain the impact of socioeconomic factors to inequality in skilled birth attendance and measles immunization.	Socioeconomic variables	2008 KDHS	A multivariate logistic regression Decomposition of the concentration index	Household wealth (+ve) Education (+ve) Setting (+ve) Ethnicity (+ve) Birth order (+ve) Occupation (+ve)
Izugbara, (2014)	To explore the relationship between household characteristics and U-5 mortality in Nigeria.	Socioeconomic and demographic factors	2008 Nigeria DHS	Multi-level model approach	Parent's education (+ve) Number of U-5 (+ve) Household wealth (+ve) Age of household head (+ve) Type of floor (+ve)

					Region and Setting (+ve)
Schoeps et al., (2015)	To investigate the effect of enrolment into community-based health insurance on U-5 mortality in Burkina Faso.	Socioeconomic and demographic factors	Nouna Health and demographic surveillance system	Cox regression model	Socioeconomic status (+ve) Father's education (+ve) Distance to the health facility (+ve) Year of birth (+ve) has health insurance (+ve)
Bado & Appunni, (2015)	To explain the causes of inequality in U-5 mortality in West Africa.	Demographic and socioeconomic factors	DHS for data for 7 countries	The concentration index Generalized Linear Model	Order of birth (+ve) Age of the mother (+ve) Birth interval (+ve) Size of the household (+ve)
Hosseinpoor et al., (2006)	To quantify determinants of socioeconomic disparity in U-5 mortality in Iran	Socioeconomic variables and demographic characteristics	2000 Iranian DHS	Household SES measured using the PCA. Concentration index Logit model	Household SES (+ve) Mother's education (+ve) Setting (+ve) Birth interval (+ve) Sanitation facilities (+ve)
Poel, (2008)	To explain socioeconomic disparity in malnutrition through various perspectives.	Socioeconomic variables	47 DHS of countries from 4 regions	PCA and Concentration index	Stunting (+ve) Wasting (+ve) Household SES (+ve)
Malderen et al., (2013a)	To highlight the significant factors affecting inequality in under-5 mortality in 13 countries in African.	Socioeconomic and demographic factors	2007–2010 DHS in 13 African countries	Multivariate logistic regression, Gini coefficient and concentration indexes	Order of birth (+ve) Interval of birth (+ve) Location (+ve) SES of the household (+ve) Father working (+ve) Education level of the mother (+ve)
Novignon et al., (2015)	To investigate the relationship between socioeconomic factors and child malnutrition inequality in Ghana	Socioeconomic and household characteristics	Multiple Indicator Cluster Survey (MICS) of 2011	Univariate/ bivariate methods Concentration index and decomposition analysis	Education level of the mother (+ve) A antenatal care sources (+ve) \ Health insurance (+ve) SES (+ve) Location (+ve)