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High-Risk Fertility Behaviors: Impact on Child and Risks of Maternal Mortality in Kenya

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HIGH-RISK FERTILITY BEHAVIORS: IMPACT ON CHILD AND RISKS OF MATERNAL MORTALITY IN KENYA

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62 pages

Rapid population increase in Sub-Saharan Africa (SSA) over the last several decades, along with limited healthcare interventions, have exacerbated child and maternal mortality. The maternal mortality ratio (deaths per 100,000 live births) in Sub-Saharan Africa accounts for at least 50 percent of maternal deaths globally. In 2020 alone, 5 million children under the age of 5 died in Kenya. Research also points out that, tragically, many of the mothers and children died of preventable or treatable conditions. Previous research has focused on either biological or socioeconomic determinants of child mortality rather than their joint influences. In this study, we investigate the premise that all social and economic determinants of child mortality and risks of maternal mortality operate through a set of biological mechanisms and proximate determinants to influence mortality. Using data from the 2014 Kenya Demographic and Health Surveys (KDHS) drawn from women aged 15-49, we find that children born to women with primary education or lower were more likely to die before the age of five compared to women with secondary education or higher. Younger women (19 years or younger) were also more likely to experience higher child and maternal mortality rates than older women. Women giving birth to babies with higher-order birth were more likely to experience higher child mortality and risks of maternal mortality rates than those with lower-order deliveries. Women with no education experienced higher rates of child mortality and risk of maternal mortality than those with primary education or higher. Also, children born to married women were less likely to die compared to those born to unmarried women. Overall,

women from rural areas experienced higher rates of child mortality and maternal mortality risk than those from urban areas. The results support much of the previous literature on high-risk fertility behaviors and child mortality, which showed that younger age at first birth and short preceding birth interval significantly increase the risk of child mortality and reduce the chances of antenatal care visits and hospital deliveries. Women from rural areas are less likely to access prenatal care and hospital delivery services than those in urban areas. Furthermore, mothers and children born in health facilities have a lower relative risk of dying than those born at home. Thus, using the Mosley and Chen (1984) analytical framework for determinants of child and maternal survival, I incorporated socio-economic and biological variables to examine the relationship between high-risk fertility behaviors and child mortality and risks of maternal mortality. We discuss the findings in the context of frameworks intended to advance research and influence health policy and medical interventions to improve child survival.
KEYWORDS: High-risk fertility behaviors, child survival, risks of maternal mortality, biological characteristics, social determinants

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CHAPTER I: INTRODUCTION

Rapid population increase in Sub-Saharan Africa over the last several decades and limited healthcare interventions have exacerbated child and maternal mortality (Wekesah et al., 2016). Even though under-five mortality rates and maternal mortality rates have declined worldwide since the 1990s, they are still disturbingly high in Sub-Saharan Africa. According to the World Health Organization, the under-five mortality rate decreased from an estimated 93 deaths per 1,000 live births in 1990 to 38 deaths per 1,000 live births in 2019 (Word Health Organization, 2022). This represents a significant 59% reduction in under-five mortality globally. The decline in under-five mortality can be attributed to improved access to essential healthcare services, such as immunizations, nutrition, and preventive care, that have played a crucial role in saving children's lives (Black et al., 2010). Global initiatives such as the United Nations' Millennium Development Goals and Sustainable Development Goals have also provided a framework for countries to focus on reducing child and maternal mortality (Lozano et al., 2011; United Nations, 2015).

Improvements in child health often coincide with advancements in maternal health, and the reduction in child and maternal mortality reflects overall advances in healthcare systems and services. Word Health Organization (2023) reports that the global maternal mortality ratio (deaths per 100,000 live births) declined by 38% between 2000 and 2017. Efforts to reduce risks of maternal mortality have focused on ensuring skilled attendance during childbirth, improving access to emergency obstetric care, and providing comprehensive reproductive healthcare services. Initiatives such as the Partnership for

Maternal, Newborn, and Child Health and the Global Strategy for Women's, Children's, and Adolescents' Health have been vital in progressing maternal and child health globally. Despite this progress, the maternal mortality ratio (deaths per 100,000 live births) in Sub-Saharan Africa accounts for at least 50 percent of maternal deaths globally (Atahigwa et al., 2020). The Republic of Kenya, a focal case in this thesis, shares similar mortality risks with Sub-Saharan Africa countries. In 2020 alone, 5 million children under 5 died in Kenya (UNICEF, 2021). This translates to about 13,800 children under 5 dying everyday in 2020.

Research has shown that high-risk fertility behaviors are associated with maternal and child survival (Ahinkorah et al., 2021; Casterline &Agyei-Mesa, 2017; Tamirat et al., 2021). High-risk fertility behaviors include teen delivery, high birth order (position in the age hierarchy of siblings; later-born children have higher birth order), narrow birth intervals, and mothers over 34 years in childbirth ((Howlader et al., 2022; Tamirat et al., 2021). At-risk mothers with high-risk fertility behaviors in Kenya and the larger Sub-Saharan African region often lose their lives in childbirth and sometimes during pregnancy. At-risk women with successful deliveries may lose their newborns within 5 years or experience stillbirths. Women with high-risk fertility behaviors endanger their lives and the lives of their fetuses and babies, raising the need for improved maternal health.

High-risk fertility behaviors in Kenya and other parts of Sub-Saharan Africa continue to be associated with poor maternal health outcomes, including maternal and child mortality risks. Despite strong evidence of the relationship between high-risk fertility behaviors and maternal and child deaths, the etiology of these outcomes is not fully understood. In Kenya, research has shown that the Mosley and Chen (1984) framework is valid in predicting and explaining adolescent fertility, which directly affects risks of maternal mortality and child mortality. The framework provides an approach to understanding the underlying factors that

lead to early pregnancy and how these factors contribute to the high mortality rate. This implies that even with an increase in women's age at first birth, young mothers and their children are still at risk of dying because of their socioeconomic vulnerability and lack of access to social services. Therefore, the Mosley and Chen (1984) framework can be used to understand how biological and socioeconomic factors influence child mortality and risks of maternal mortality in Kenya and how these can be addressed to reduce these risks. The government needs to take measures to tackle these issues, such as introducing policies to delay the average age of first childbirth, providing better healthcare access and support, and educating and empowering women to make their own decisions. Therefore, this study seeks to investigate the relationship between high-risk fertility behaviors and child mortality and risks of maternal mortality in Kenya to better understand the underlying causes and generate evidence to inform interventions and policies to improve maternal health outcomes.

Background of the Study

Previous research has investigated the association between reduced maternal care costs and facility birth rates. Gitobu et al. (2018) found that cost was a deterrent to hospital delivery service utilization. Since applying user fees for delivery services in health facilities may limit their demand, eliminating user fees may improve women's access to health facility delivery services. Additionally, long distances from health facilities, unavailability and high costs of transport services, as well as poor roads may hinder the accessibility to free delivery services. Lang'at, et al. (2019) cited increased facility birth rates following Kenya's 2013 free maternity policy (Kenya eliminated user fees for all public health facilities to reduce maternal and child deaths and make maternity services accessible and affordable). After the policy implementation, the study observed a significant, sustained increase of 89%, 97%, and 98% in antenatal care visits, health facility deliveries, and live births. An immediate and significant

increase of 27% was also noted for those women who received Emergency Obstetric Care services in health facilities.

Estimates from the 2008-09 Kenya Demographic and Health Survey show that maternal deaths accounted for about 15% of all deaths among women aged 15-49 in Kenya (Kenya Demographic and Health Survey, 2014). Approximately 6,000 women die every year due to pregnancy-related conditions. Disturbingly, the maternal mortality ratio remained relatively stagnant since 1990, with an estimated 590 deaths per 100,000 live births. Achieving the goal of reducing the maternal mortality rate to three-quarters of the 1990 level has been impeded by a lack of progress in bringing down maternal mortality. To address the high maternal mortality rates in Kenya, the government launched a Maternal and Newborn Health Road Map in 2010, which outlined strategies, priority actions, and activities for improving reproductive health. The challenges to reducing risks of maternal mortality include ensuring access to adequate maternity healthcare services, skilled personnel for managing complications, and addressing issues such as unsafe abortions, malaria, and HIV/Aids.

According to World Health Organization 2023, about 95% of all maternal deaths, most of which would have been prevented, occurred in low and lower-middle-income countries in 2020. The maternal mortality rate in low-income countries was 430 per 100 000 live births, compared to 12 per 100 000 live births in high-income countries. Limited access to quality maternity care and knowledge of the best maternal health practices in the Sub-Saharan African region raises child and maternal mortality and increases the gap between fatalities in low- and middle-income countries and high-income countries. About 1 in 160 women face a lifetime mortality risk during childbirth in low- and middle-income countries, significantly differing from 1 in 3700 women facing a lifetime mortality risk during delivery in high-income countries (Atahigwa et al., 2020). Such disparities in maternal mortality emerge from

socio-economic dynamics surrounding global and regional healthcare. Tamirat et al. (2021) linked high child and maternal deaths to developing countries' limited distribution of health resources. The mortality rates vary regionally, primarily based on factors like women's knowledge of best health practices, access to healthcare facilities and interventions, and the use of contraception.

Unprecedented health pandemics can further worsen current high-risk fertility behaviors. For instance, the advent of the novel coronavirus disease (COVID-19) pandemic compromised most healthcare services, putting expectant mothers and children needing medical attention at high risk of fatality. At its peak infection, the pandemic caused a staggering decrease in access to care for treatment of health conditions other than COVID-19 (Chatterjee, 2022). According to Kimani et al. (2020), Kenya reported decreased antenatal attendance, immunizations, hospital deliveries, and stillbirths during COVID-19. The government imposed lockdowns and curfews. The fear of contracting the virus may have kept many women from accessing reproductive health services. In studying access to maternal health services during the COVID-19 pandemic, Ombere (2021) found that expectant mothers feared attending hospitals for perinatal care due to the possibility of contracting COVID-19. There was an increase in home deliveries with the assistance of traditional birth attendants and traditional midwives, who were also overwhelmed with women who sought their services.

Depicting a structured coverage of fundamental child and maternal mortality interventions across 118 countries in LMICs, Oluoch-Aridi et al. (2020) revealed that COVID-19 was responsible for an 8.3–38.6 percent increase in maternal mortality monthly. For a country whose healthcare system thrives more on preventive than on curative care, the COVID-19 pandemic prevented most Kenyans from receiving immunizations, routine care,

and antenatal care (Asiki et al., 2018). Ahmed et al. (2022) found that declines in healthcare utilization during the COVID-19 pandemic amplified the pandemic's harmful impacts on health outcomes and threatened to reverse gains in reducing maternal and child mortality.

High-risk fertility behaviors have subsequently impacted child and maternal fatalities, raising the need for best health intervention practices to contain the problem and limit associated deaths. Practitioners in the Kenyan healthcare workforce can significantly benefit from this study which id designed to identify the multiple factors contributing to high-risk fertility behaviors and mortality. That way, practitioners can know how and when to treat and advise patients on best healthcare practices. Irimu et al. (2021) and Atahigwa et al. (2020) specified that poor routine data in public health facilities undermine fundamental care for mothers and newborns.

Like most developing countries in Sub-Saharan Africa, Kenya's healthcare system lacks sufficient, well-trained practitioners and far-reaching healthcare intervention practices, including facility-based delivery (Oluoch-Aridi et al., 2021; Tamirat et al., 2021). In Kenya, health resources are more available in major cities like Nairobi and Mombasa than in rural settings with dispensary-level facilities and minimum healthcare services. Only 30 percent of those in rural areas can access health facilities within 4 kilometers of their home, compared to 70 percent in urban centers (ITA, 2018). Only a small portion of the country's population can afford quality healthcare (Hussein et al., 2021; Oluoch-Aridi et al., 2021). Worse, poverty-stricken families in Kenya, primarily those in rural and urban slums, record the highest maternal and Under-5 mortality rates (Atahigwa et al., 2020; Hussein et al., 2021). Even though the Kenyan government set up a healthcare framework for reducing child and maternity mortality, mortality decline remains insignificant (Imbo, Mbuthia & Ngotho, 2021). As many people rush into Kenya's urban settings in search of employment and education

opportunities, access to affordable, quality healthcare remains a critical stumbling block for such individuals and those in other parts of the country. Eventually, there becomes a higher probability of high-risk fertility behaviors.

The study identifies Kenya as a low- and middle-income country within the Sub-Saharan African region. The country's emerging economy has allowed investments in the healthcare industry to increase access to affordable, quality care. Kenya today is a fast-growing and pivotal East African economy with major social and political advancements. Despite this, healthcare across Kenya has not kept pace and forestalled some of the health outcomes examined. December 2015 marked the endpoint of the Millennium Development Goals. The Millennium Development Goals (MDGs) are a set of eight international development goals officially established after the United Nations Millennium Summit in 2000, including reducing child mortality and improving maternal health. Despite progress in some areas, Kenya did not achieve the Millennium Development Goals targets of reducing maternal deaths by three-quarters (to 147 per 100 000 live births) and reducing under-5 deaths by two-thirds (to 33 per 1000 live births) (Keats et al., 2018).

Most efforts to reduce child mortality have focused on either biological or socioeconomic variables of high-risk fertility behaviors rather than investigating both biological and socio-economic variables (Marphatia et al., 2017; Muriithi & Muriithi, 2015; Tamirat et al., 2021). Investigating the links between socioeconomic and biological determinants of high-risk fertility behaviors is vital in understanding their contribution to mortality and what can be done to reduce child and maternal mortality rates. Irimu et al. (2021) stressed the need to comprehensively investigate neonatal fatalities, standardized admission criteria, diagnostic criteria of neonatal conditions, and gestation age assessment techniques. Irimu et al. (2021) hinted at the need for a system that enhances maternal and

childcare services by combining unique health indicators and establishing a baseline for the proposed study's integrated approach.

Problem Statement

Poverty and inequality among women and family members is the primary determinant of child mortality and risks of maternal mortality in Kenya. Inability to afford primary care, widespread poverty, and early marriages are prevalent in Kenya. Tamirat et al. (2021) elucidated that maternal high-risk fertility behaviors contributes to infant malnutrition, specifying that children born from women with high-risk fertility behaviors were 40 percent more likely to suffer stunted growth. As a risk factor for low birthweight and chronic malnutrition among newborns, high-risk fertility behaviors emerge from the economic constraints of populations in low- and middle-income countries. Kenya's 2013 free maternity service policy (free maternal healthcare services in all public healthcare facilities), later revised to the Linda Mama program in 2017, caused a considerable increase in facility-based deliveries and reduced child and maternal deaths (Lang'at et al., 2019; Orangi et al., 2021). Reduced maternal care costs, which showed a positive response to facility-based deliveries, place the financial barrier as a leading contributor to child and maternal mortality.

Kenya has come a long way in its attempts to improve access to affordable and quality healthcare and reduce maternal and child mortality rates. In 2004 the country launched the National Hospital Insurance Fund (NHIF) to facilitate access to cheaper healthcare. However, only 11% of the country's population had the National Hospital Insurance Fund coverage by 2019 (Ouma et al., 2020). Most of the country's workforce is in the informal sector and can hardly afford health insurance premiums. The Kenyan Universal Health Coverage (UHC) was launched in 4 of its 47 counties in 2018 to ease access to quality care without financial hardships (Gitau et al., 2021). Due to political and economic waves, most citizens do not

understand the Kenyan Universal Health Coverage's direction and premise (Wangamati & Prince, 2020). Several setbacks in increasing healthcare affordability and access align with financial inhibitors, limiting the success rate of intended outcomes. Kenya is under the low- and middle-income countries, implying that limited financing at the national and individual levels challenges reducing or preventing risky fertility behavioral factors.

Early marriages and home-based deliveries continue to occur within African communities (Tamirat et al., 2021). Additionally, women of lower socioeconomic status have high maternal mortality risks, extending to high child mortality risks (Oluoch-Aridi et al., 2021). Even if low-income earning women can give birth in public health facilities at no cost, many still lack access to high-quality postnatal care (PNC) services, slowing overall improvements in health outcomes for mothers and infants. High birth order (being a later-born child) and narrow birth intervals may occur due to the inability to afford family planning or parents' intention to increase the odds of having sons. Most communities in Sub-Saharan Africa value fertility and more children (Ahinkorah et al., 2020; Casterline & Agyei-Mensah, 2017), yet some are unaware of the underlying health risks. Sub-Saharan Africa accounts for 50 percent of the global fertility (Ahinkorah et al., 2020). The desire for more children can lead to higher fertility rates. However, these women's financial and economic barriers, in turn, impact child and maternal survival.

Objectives of the Study

The objective of the study is to:

1. To examine the relationship between high-risk fertility behaviors (biological characteristics and socio-economic determinants) and child mortality as well maternal mortality risk factors in Kenya.

CHAPTER II: LITERATURE REVIEW

This section reviews the literature on biological and socio-economic determinants of child mortality and the risk of maternal mortality. First, I cover biological characteristics like maternal age at birth, age at marriage, birth intervals, and birth spacing. Second, I summarize the literature covering socio-economic characteristics, including education level, wealth index, antenatal visits, place of delivery, residence, and associated risky fertility traits. The section also includes a conceptual framework and ends with guiding hypotheses.

Biological Determinants of Child Mortality and Risks of Maternal Mortality

Research has shown that HRFB is the most pressing health issue in many low-and middle-income countries (Imbo et al., 2021; Seidu et al., 2021; Tamirat et al., 2021). Fall et al. (2015) study on how maternal age is associated with child and maternal survival showed that both young and advanced maternal ages are associated with adverse birth and child outcomes. Moreover, children of young mothers in low-income and middle-income countries are disadvantaged at birth and in childhood nutrition and schooling. Previous studies on birth showed that the mortality-reducing effects of longer birth intervals substantially reduce the probability of a child dying (Class et al., 2017; Marphatia et al., 2017; Molitoris et al., 2017). According to Molitoris et al. (2017), short durations between births do not allow women to recuperate from previous pregnancies. Also, there is the risk of suffering the same infectious diseases among closely spaced children.

Further, women's age is critical to successful and healthy childbirth (Budu et al., 2021; Dunlop, Benov & Campbell, 2018; Marphatia et al., 2017). An analysis of 312,297 deliveries across 29 countries (including India and Nepal) found that compared with mothers aged 20–24, adolescent mothers under 16 had higher risks of cesarean section delivery, eclampsia, uterine infection, and so on (Marphatia et al., 2017). Such vulnerabilities also

result in higher mortality risks among the children of younger mothers. Children born when their mothers were under 18 were 50 percent more likely to have died before the age of 5 (Marphatia et al., 2017). Altogether, younger maternal age, narrower birth intervals, and short preceding birth intervals significantly increase the risk of under-5 mortality and maternal mortality. Dissemination of such critical knowledge on high-risk fertility determinants to women, health practitioners, and critical stakeholders could potentially reduce associated child and maternal mortality rates.

In Sub-Saharan Africa, the adolescent birth rate remains at 101 births annually per 1,000 women, resulting in hundreds of thousands of additional under-5 mortality rates and tens of thousands of additional maternal deaths in 2020 (United Nations, 2020). In 2020, about 13,800 under-five deaths occurred daily, all of which were highly preventable fatalities (UNICEF, 2021). In many low- and middle-income countries, many females marry before reaching 18 years. In 2011 alone, an estimated 720 million women aged 18 years or older were married under age (UNICEF, 2023). Low- and middle-income countries face severe socio-economic and socio-demographic challenges inextricably linked with child mortality and risk of maternal mortality, including child marriage, narrow birth intervals, and women delivering several children (more than 4). High-risk fertility behaviors remain a significant cause of child and maternal mortality in Kenya.

Socio-economic Determinants of Child Mortality and Risks of Maternal Mortality

Socio-economic characteristics, including residence, religion, wealth index, family planning utilization, place of delivery, and level of education, significantly affect infant and child mortality (Howlader et al., 2022; Tamirat et al., 2021). Despite the decline in child mortality rates over the last several decades in Sub-Saharan Africa, the number of deaths associated with high-risk fertility behaviors remains high. While exploring data from Kenya

Demographic and Health Surveys (KDHS), Kimani-Murage et al. (2014) noted a decline in infant and child mortality rates in rural and urban areas between 1993 and 2008. The child mortality rates declined from 83 percent to 57 percent in Kenyan slums between 2003 and 2010. The disparities in child and maternal mortality rates in Kenya primarily involve the place of residence. However, the decline in mortality rates in the late 20th and early 21st centuries may have been due to global advancements in medicine and healthcare. A different study revealed that Nairobi slum areas have poorer health outcomes than other urban residents and those in rural settings (Atahigwa et al., 2020). Higher child mortality rates in the slums of Nairobi are primarily due to economic constraints and overpopulation relative to available health facilities.

Further, Hussein et al. (2021) revealed that Kenya experienced a surge in under-five mortality in the 1990s, peaking at almost 120/1000 live births before dropping gradually to 42/1000 live births in 2018. Recent declines in child mortalities are much lower than in the late 20th and early 21st centuries. The trend decline in maternal and child mortality rates in Kenya over the last decade (Atahigwa et al., 2020; Hussein et al., 2021) implies the detrimental nature of a rising population with insufficient healthcare resources. Even though urban centers have better healthcare facilities and services, they are densely populated with a significantly high number of low-income earners, raising concerns about affordable health services for most Kenyan families (Tamirat et al., 2021). The situation is slightly different in rural settings where residents have lower education than those in urban areas (Hussein et al., 2021). Limited education and illiteracy directly relate to poverty and poor health practices since such involved individuals need help to secure sustainable jobs. The health facilities in Kenya's rural areas lack sufficient resources and well-trained practitioners. Healthcare

practitioners with insufficient training also put patients at risk (Oluoch-Aridi et al., 2021; Tamirat et al., 2021).

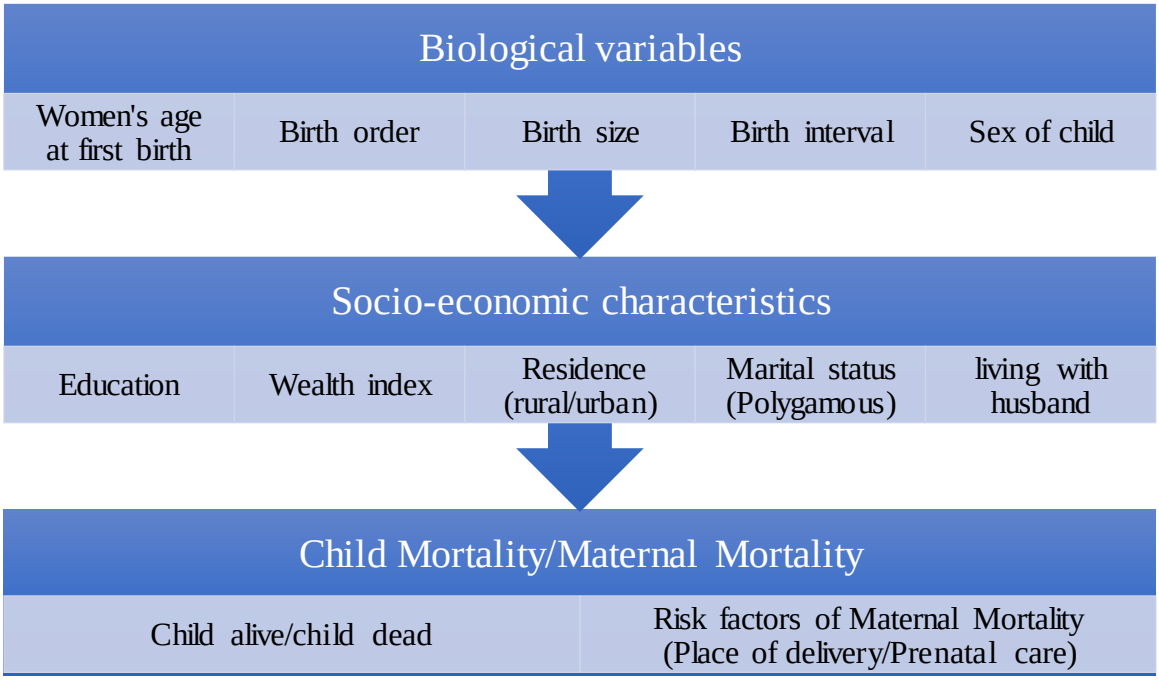
Several studies have shown that mothers' education, wealth index, place of residence, water supply, household economic status, and expenditure on health influence children's survival (Macharia et al., 2019; Muriithi &Muriithi, 2015; Tamirat et al., 2021). Muriithi and Muriithi (2015) found that education, occupation, wealth index, place of delivery, and residence influenced infant and child mortality. Child mortality decreased with an increase in maternal education. Mothers with little to no fundamental education exhibited a high risk of child mortality. Similarly, Imunother (2017) argued that educated women utilize prenatal care services and subject their children to immunization. Children born to poor mothers are at a higher risk of dying than those born to rich mothers (Hussein et al., 2021; Muriithi & Muriithi, 2015). There is a significant interconnection between the socioeconomic determinants of HRFB and mortality. Increasing education, access to healthcare facilities, and improving child living conditions are necessary for reducing child and maternal deaths.

Conceptual Framework

Mosley and Chen (1984) presented an analytical framework for studying child survival in developing countries (Imbo et al., 2021; Shifa et al., 2018). The theoretical framework in this thesis draws from Mosley and Chen's (1984) framework. Researchers have used Mosley and Chen's (1984) position framework as an ideal analytical framework for studying child survival determinants in developing countries(Imbo et al. ,2021). Mosley and Chen (1984) argued that social science research focused on the roles of socio-economic and cultural factors in child deaths. Medical research focused on specific disease processes and used morbidity as the most common outcome variable. The 1984 analytical framework argues

that none of the variables should work independently and suggests studying the combined impact of biological and socio-economic characteristics (Hill, 2003).

The blueprint of Mosley and Chen's (1984) framework was that all background (socioeconomic and cultural) variables have to operate through a limited set of proximate determinants that directly influence the risk of disease and the outcome of disease processes (Shifa et al., 2018). The 1984 framework is relevant in examining biological and socio-economic variables contributing to child and maternal survival. It is quite impractical to study biological and socio-economic health determinants separately, raising the need to incorporate both social and biological variables. Mosley and Chen's (1984) framework guides the choice of dependent and independent variables based on the assumption that socioeconomic determinants affect the survival probability of children through a set of biological mechanisms.



Conceptual framework, adapted from Mosley and Chen's 1984 framework.

Figure 1. *Conceptual framework*

This study has two outcome variables, child `mortality and maternal mortality, determined by child and r maternal mortality risk factors, and several independent and relevant variables informed by existing literature on women's fertility behaviors, most of which are socio-demographic. The proposed study's socio-economic and biological variables, grounded in Mosley and Chen's 1984 analytical framework, determine child and maternal survival by examining the relationships between HRFB and child mortality and risks of maternal mortality.

We argue that adverse reproductive health outcomes of women (child and maternal death) correspond strongly with age at first birth, birth, the number of children, education, wealth index, residence, and marital status. Women who give birth early are more likely to experience complications during childbirth than those who give birth later ((Marphatia et al., 2017). They may also come from low-income families and have limited access to education. These women are less likely to seek prenatal care services and deliver in healthcare facilities (Molitoris et al., 2017). Thus, I hypothesized that there is a significant association between biological variables (such as age, birth order, and number of children) and child mortality as well as risks of maternal mortality. Also, socio-economic characteristics such as education, wealth index, marital status, and rural/urban locations were significantly associated with child and maternal survival.

Specific hypotheses include:

- Children born to young mothers (19 years and below) are more likely to die than those children born to mothers whose age was above 19 years.
- Younger women are likely to experience higher risks of maternal mortality rates than older women.

- Women with many children are more likely to experience higher rates of child mortality and risks of maternal mortality than those with fewer children.
- Women who have shorter birth intervals are likely to experience higher rates of child mortality and risks of maternal mortality compared to women with longer birth intervals.

CHAPTER III: METHODOLOGY

Data for the following analyses were obtained from the Kenyan Demographic and Health Surveys (KDHS) conducted in 2014. The surveys were carried out by the Kenya National Bureau of Statistics (KNBS) in collaboration with the Ministry of Health, National Aids Control Council (NACC), National Council for Population and Development (NCPD), and Kenya Medical Research Institute (KEMRI). The Government of Kenya provided funding for the KDHS with support from various organizations, including the United States Agency for International Development (USAID), the United Nations Population Fund (UNFPA), the United Kingdom Department for International Development (DfID), the World Bank, the Danish International Development Agency (DANIDA), and the United Nations Children's Fund (UNICEF), among others. ICF International provided technical assistance for the survey through the DHS program. The Demographic and Health Surveys (DHS) are a vital source of data for global reproductive health research. This data helps researchers and policymakers understand regional trends in reproductive health, make evidence-based decisions about interventions and services, evaluate the effectiveness of programs, and inform policy design. Ultimately, the data produced by the DHS can help reduce maternal and infant mortality, improve reproductive health services, and protect the health and well-being of women and children

Data and Procedure to Select Sample

Demographic Health Surveys are nationally representative household surveys. The Kenya Demographic Health Surveys utilized a two-stage sample design. In the first stage, stratified sampling techniques were used to select clusters as the primary sampling units (PSUs) with stratified sampling techniques. The second stage involved a systematic sampling of households within each cluster. A Household Questionnaire was used to collect

information on the household's dwelling unit characteristics, characteristics of usual residents and visitors, and identify household members eligible for an individual interview.

Afterward, eligible respondents were interviewed using a women's questionnaire. Relevant information collected from the women's questionnaire included background characteristics (education, marital status, media exposure, and so on), reproductive history, antenatal and delivery care, breastfeeding, and infant feeding practices. After the questionnaires were finalized in English, they were translated into 16 other languages, including Swahili, Borana, Embu, Kalenjin, Kamba, Kikuyu, Kisii, and Turkana. The translated questionnaires were pretested to detect any possible problems in questionnaire translation or flow and gauge the time required for interviews. The interviewers recruited for the Kenya Demographic Health Surveys underwent comprehensive classroom and fieldwork training to familiarize themselves with the questionnaire content and interviewing procedures. Data quality was ensured through various activities, including assigning coordinators to oversee individual teams, observe data collection quality, and maintain uniformity in data collection procedures.

Interviews were conducted for the respondent who provided voluntary informed consent to participate in the survey from the selected households. The sample population was women aged 15–49 who responded to questions related to high-risk fertility behaviors. 32,172 eligible women (aged 15–49 years) were within the selected households. Of these, 31,079 women were interviewed, yielding a final response rate of 96.6%. The final sample analyzed in this study consisted of 14,189 women who responded to questions related to high-risk fertility behaviors and had children under 5 years old. In data analysis, weighting was applied to the data to make it representative at the national, regional, and county levels. The non-proportional allocation to the sampling strata and the fixed sample size per cluster made the

survey non-self-weighting. Therefore, weights were calculated and applied to account for the sampling.

Variable Measurement

Dependent Variables

Under-five Mortality

Child mortality (under-five mortality) is defined as the number of deaths of children below the age of 5 years. For the dependent variable, the Kenya Demographic Health Surveys questionnaire asked women about the month and year of each of their births, whether the child is still alive or not, starting with their first birth. The analysis for this data was based on the index of children who died before reaching their fifth birthday and those alive during the mother's DHS interview, and women who died because of childbirth or pregnancy complications. The dependent variable of child mortality was coded as whether a child is alive or not.

Risk of Maternal Mortality

The risk of maternal mortality is the probability that a woman will die during pregnancy, childbirth, or shortly after pregnancy due to a complication related to the pregnancy. To examine the risks of maternal mortality, this study measured risk factors associated with maternal mortality, which include the place of delivery (healthcare facility vs. home/other) and prenatal care visits. On 'place of delivery,' the women's questionnaire included the question: "Where did you give birth to (NAME)?" This was asked for all the children the woman had. These were coded as; "Respondent's home," "other home," "government hospital" "private hospital," "government health center," "government dispensary," "other public sector," "mission hospital/clinic," "private hospital/clinic" "nursing/maternity home" "other private sector" and "other." Place of delivery was computed

and recoded as “Hospital delivery” and “home/other.” On antenatal visits, the women were asked if they received antenatal visits before delivery. This was recoded as “yes” or “no.” Both the variable of the place of delivery and incidence of antenatal visits is limited to the last-born child for ease of recall.

Independent Variables

Guided by research that points to high-risk fertility behaviors as determinants of infant mortality, biological variables were the key independent variables to capture high-risk fertility behaviors. These included the women’s age at first birth, birth order (a person's position in the age hierarchy of siblings), birth size (number of children), birth interval, and sex. Some variables were recoded to help create tables that are easier to read and identify response patterns, whereas other variables were used as they were coded by the Demographic Health Surveys. The age at which childbearing begins can have a major impact on the health and well-being of both the mother and the child. Demographic Health Surveys use birth history to measure the mother’s age at first birth. In the reproduction section of the questionnaire, the Demographic Health Surveys asked, “Now I would like to record the names of all your births, whether still alive or not, starting with the first one you had. In what month and year was (NAME) born?” Using this history, Demographic Health Surveys coded these responses to the respondent’s age at first birth and recoded the ages ranging from 6 to 45. For this study, age at birth was recoded into ‘19 years old and below,’ ‘20-24’and ‘25+.’

To measure birth order, DHS asked the women about all their births. They asked the following questions: “In what month and year was (NAME) born?” “Is (NAME) still alive?” “If dead, how old (years and months) was (NAME) when he/she died? DHS recorded the birth order number from 1-15. Birth order was recoded into first, second, third, and fourth+. A birth history was collected from each woman interviewed in the 2014 Kenya Demographic

Health Surveys to generate data on the number of children and birth intervals. Women were asked to report on the total number of sons and daughters to whom they had given birth in their lifetime. To ensure that all information was reported on the number of children, women were asked separately about children still living at home, those living elsewhere, and those who had died. The sex, date of birth, and survival status of each child were obtained, and the age at death of deceased children was recorded. Birth intervals will be recoded into "<24 months" and "24+ months." The birth size was recoded into "no children," "1-2," "3-4," and "5+." The sex of the child was used as coded by DHS, female and male.

Control Variables

The survey collected information on the socio-economic characteristics of respondents at the time of the survey. The study's variables include the type of residence, educational level, wealth index, polygamous status, whether living with husband, and marital status. The question "What is the highest level of school you attended?" was asked on the variable education. Kenya Demographic Health Surveys categorizes the responses into: '0' representing:" No education," '1' as "Primary," '2' as Secondary, and '3' as 'Higher.' The variable level of education was recoded into no education, primary and secondary, and above.

In measuring the wealth index, the Kenya Demographic Health Surveys considers urban-rural differences in scores and wealth indicators and uses a method called the "household asset approach." This approach assesses the socioeconomic status of households by considering the assets and utilities they own and collects information on a range of household assets, such as ownership of a mobile phone, car, bicycle, television, refrigerator, access to clean water, and improved sanitation facilities. It also incorporates information on housing quality, such as the type of roofing, floors, and the size of the house. Each of these assets are assigned a weight based on its relative importance in assessing wealth. For

example, owning a car would contribute more to the wealth index than owning a bicycle or motorcycle. These weights are used to calculate a wealth score for each household which are divided into quintiles based on their distribution within the population. The households are then ranked from the poorest to the wealthiest, and each individual woman is assigned the wealth index of her household. The wealth index was recoded into 1) 'poor,' (2) 'middle,' and (3) 'wealthy/rich.'

On the measure place of residence, DHS recorded the county, district, location, and sublocation in the identification section. DHS coded the place of residence as "rural" and "urban." The variables were used as DHS coded them in the data analysis. On the marital status variable, the women were asked about their marital status, if they were living with their partners, and if they were in a polygamous relationship. These variables were recoded into married and unmarried, living with a partner and not, and the variable polygamous household was coded as yes and no (all others which include single women).

Statistical Analysis

For analysis, I first ran descriptive statistics analysis using frequencies and percentages to examine the distribution of all variables (mortality rates, biological and socio-economic characteristics). Next, cross-tabulations (chi-square) were used to identify associations among variables. We also ran a logistic regression to predict, optimize, or explain a number response between the independent and dependent variables. Logistic regressions also allowed us to determine the influence of biological characteristics and socio-economic determinants of high-risk behaviors on the dependent variable. For example, we are able to determine the influence of the e at first birth on child mortality while controlling for other determinants of child mortality. I assessed the strength of the associations. A 95% confidence interval (0.05% level of significance) was chosen for the study. To be significant, the *p-value*

should be less than 0.05. All statistical analyses were performed in SPSS and Stata. Both the descriptive and multivariate analysis were weighted. The non-proportional allocation to the sampling strata and the fixed sample size per cluster made the survey non-self-weighting. Sample weights are inversely proportional to the probability of selection and are used to correct for the under- or over-sampling of different strata during sample selection. Therefore, weights were calculated and applied to account for the sampling. If weights are not used, all calculations will be biased toward the levels and relationships in the over-sampled strata.

CHAPTER IV: RESULTS

Description of Results

This section presents a summary of statistics of all variables in the analysis presented in Table 1. To begin, the frequencies of the dependent variables, child mortality and risk of maternal mortality, are presented. The descriptive results illustrated in Table 1 indicate the frequency rates of child mortality. It can be observed that out of the total number of women interviewed, the child mortality rates were at 2.7%. For access to prenatal/delivery services, the results showed that 5.7 percent of the women had no access to prenatal care or delivery services, 35.9 percent had access to either prenatal or delivery services, whereas 58.4 had access to both. This indicates that the majority of the women have access to both prenatal and delivery services. On the variable place of delivery, findings indicated that only 33.6 percent of women gave birth in hospital/healthcare facilities, whereas 66.4 percent did not. Additionally, 4.4 percent of the women did not have access to prenatal services.

Regarding the respondent's age at first birth (see Table 1), 54 percent of women gave birth at age 19 or below, 36 percent were 20-24 years, and only 10 percent were 25 years or older. It can be observed from the table that the majority of the women give birth to their first child at the age of 19 or younger and below. In regard to the respondents' number of children under 5, the study revealed that 48.5 percent of the respondents had 1-2 children, 29 percent had 3-4 children, and 22.5 percent had more than five children. For birth intervals, 39.2 percent of the women gave birth to their subsequent child in less than 24 months, whereas 60.8 percent gave birth after 24 months and above. On birth order, 25.4 percent of the children born to mothers were firstborns, 23 percent were second-borns, 17.2 percent were third borns, and 34.3 were fourth borns or more. This indicates that most women had more

children with a birth order of 4 or above. For the sex of the child, results indicated that 51.1 percent of the children were males, whereas 48.9 were females.

On socio-economic variables, the majority of the women (54.5 percent) reported to have only primary education, 35.7 percent had secondary education or above, and 9.8 percent had no education. Women also differed by wealth index. The percentage of women from poor, middle, and wealthy households was 39.8, 37.4, and 22.8 percent, respectively. Further, findings on the marital status of women showed that 8.8 percent of the women had never been married, 74.7 were married, 6.8 percent were living together, and 7.4 percent were either divorced or separated. Of the married women, 78.9 percent of the women were living with their husbands, whereas 21.1 percent were not. Lastly, on the variable of place of residence, most women were from rural areas, (61.5%), compared to those from urban areas (38.5 %).

In sum, findings showed that the child mortality rate was 2.7 percent. The common high-risk fertility behaviors that influenced child mortality and risks of maternal mortality were women's age at first birth, number of children, education, and place of delivery. Mothers with less education had more pregnancies and experienced high maternal and child mortality risks. Women with better education (secondary or more) had fewer pregnancies. As they delivered more children, women shifted to home deliveries. Firstborns were significantly more likely to be delivered in a hospital, whereas the rest were more likely to be delivered at home and had high mortality risks. Additionally, mothers with three or more birth orders experienced high child mortality and increased risks of maternal mortality. The study concluded that better access to contraception and improved education and healthcare for women were essential in reducing child mortality and high-ridden health risks for both mother and infant.

Bivariate Analysis

Tables 2 and 3 show cross-tabulations among all the variables in the analysis. The chi-square test is used to show if there is a significant relationship between the variables. The relationship is significant if the asymptotic significance for "Pearson's Chi-Square" is less than or equal to .05. In the output, there was a statistically significant relationship between child mortality and birth order, sex education, and marital status, given the chi-square statistic. Male children had higher mortality rates than female children, with male children having a 2.5 percent child mortality rates compared to female children (2.8%). Compared to 2.6 percent and 2.7 percent of women who were married and living with their partners, the child mortality rate among widowed and divorced women was 7.5 and 5.3 percent, respectively.

A woman with a greater number of children had an increased the risk of child mortality. Results in Table 2 show that women with 1-2 children under 5 (living) had a 2 percent mortality rate compared to those with 3-4 children and 5+ children, whose mortality rates were 2.8 and 3.8 percent, respectively. On the variable birth order, children who are fourth or later (3.6%) on the birth order have higher mortality rates than first, second or third borns whose mortality rates were 1.8,2.2 and 2.7 percent respectively. Women's education level reduces the risk of child mortality. Women with secondary education and above had lower rates of child mortality compared to those with primary and/or no education. Marital status reduces the risk. Widowed and divorced women had higher rates of child mortality than those who were married or living with their partners. Access to prenatal care services and hospital delivery reduces the risk of child mortality. Women who gave birth in a healthcare facility and had access to prenatal care services had lower odds of child mortality.

Next, we discuss the risks of maternal mortality and women's biological and socio-economic characteristics. Results showed that there was a statistically significant relationship

between the risk of maternal mortality dependent variable (place of delivery) and age at first birth, birth interval, birth order, wealth index, marital status, education, and place of residence. As shown in Table 2, 87.5 percent of women aged 25 and above delivered at a healthcare facility compared to 58.5 percent of women aged 19 years and below. However, delivery in the hospital decreases as birth order increases. Fourth or higher-born children were less likely to be delivered in a healthcare facility; 46.9 percent of fourth or higher-born children were delivered in a healthcare facility compared to 67.1 percent of third born, 74.8 percent of second born, and 84.6 percent of the first born. Women with secondary education (86.8 %) were more likely to deliver in a healthcare facility than those without education (28.9 %). Similarly, 56.2 percent of women from poor households are less likely to deliver in a healthcare facility than 25.7 and 7 percent from middle and wealthy households, respectively. Wealth reduces the risk of child and maternal mortality, while the lowest level of wealth increases the risk of maternal mortality. Women with lower wealth experienced higher rates of child mortality (2.8 %t) compared to those with higher wealth index (2.2 %). Similarly, wealth index reduced the odds of access to prenatal care and hospital delivery services and increased the risks of maternal mortality. Compared to the 93 percent of women from higher wealth who delivered in a healthcare facility, only 43.8 percent of women with a low wealth index delivered in hospitals.

Because the probability of a child or mother dying is typically much greater if the woman does not access prenatal hospital delivery services, this risk of maternal mortality is examined. Table 2and 3, shows the cross-tabulation results of the different risk-related measures that are meaningful to interpret. Given the chi-square statistic, all the biological and socioeconomic characteristics were significantly associated with both outcomes. Access to prenatal and hospital delivery services differed by the age of the women at first birth. Women

who were 25 years or older at the time of first birth were more likely to have access to both prenatal/health care delivery services (87 %) compared to those who were 19 years and below (57.4 %). On the contrary, the higher the birth order of these women, the less likely they were to go for prenatal services and deliver in the hospital. Unlike the 68 percent of male children delivered in healthcare facilities, only 65 percent of the females were delivered in hospitals.

Access to prenatal and hospital delivery services increases with greater mothers' education; more than three-quarters of mothers who have completed secondary or higher education had access to both prenatal and hospital delivery services, compared with 27.4 percent of mothers without education. Only 42.8 percent of women in the low wealth index had access to both prenatal and hospital delivery services compared with around 9 in 10 children in the high wealth index. Similarly, 66 percent of married women living with their husbands were more likely to access these services than those who were not. Lastly, a greater proportion of women in urban areas (83.4%) than in rural areas (57.4 %) had access to prenatal and hospital delivery services.

Binary Logistic Regression Findings

A logistic regression was performed to ascertain the effects of biological variables (age at first birth, sex, birth order, birth interval, and the number of children and socio-economic variables (education, wealth index, marital status, polygamous household, place of residence and living with husband) on child mortality and maternal mortality occurring. In the logistic regression model 1, the full model accounts for biological variables, socio-economic characteristics, and maternal mortality risks in testing its effects on child mortality. The sample selection, number of children, birth interval, education, residence, wealth index, marital status, polygamous household, and prenatal care are significant predictors of child mortality. This is presented in Tables 4, 5, and 6.

An odds ratio of 1 indicates that the condition or event under study is equally likely to occur in both groups. An odds ratio greater than 1 indicates that the condition or event is more likely to occur in the first group whereas an odd ration of less than 1 indicates that the event is less likely to occur. Women with a birth interval of < 24 months were 73 percent (.782) more likely to experience under-five mortality than those with a birth interval of >24 months. Similarly, children born to women with a birth order > 4 had higher odds of under-five mortality (2.066) than did first, second, and third borns. Education was a significant negative predictor of child mortality. The odds of under 5 child mortality for a woman with no education is 68 percent (1.471) higher than those with primary or higher education. This indicates that children born from mothers with no education were more likely to die compared to those born to mothers with primary education or higher. The wealth index, as a measure of socioeconomic status, was a significant positive predictor of child mortality. With an increase in a woman's wealth index, there was a .835 chance that they are less likely to experience child mortality. Living in rural areas increases the risks of child mortality. Similarly, unmarried women are more likely to experience child mortality than married women. On biological characteristics that influence child mortality, the number of children significantly increases the chances of experiencing child mortality. Access to prenatal care significantly influenced child mortality.

Table 5 shows the adjusted odds ratios of Model 2 predicting the risk of maternal mortality occurring in hospital delivery. It can be observed from Table 5 that all variables except the number of children and polygamous households have a statistically significant ($p<0.01$) influence on the place of delivery. To begin, age at first birth was a significant predictor in the model. Children born to mothers aged 19 years or younger were 73 percent (1.267) less likely to be delivered in a healthcare facility than those born to mothers aged 20

or older. This indicates that women aged 20 and above are more likely to deliver in a hospital compared to those 19 years and below. Moreover, male children are more likely to be delivered in hospitals than female children. On the contrary, with an increase in the number of children a woman has, they are less likely to deliver in healthcare facilities. With an increase in a child's birth order, there is a decrease in hospital delivery.

The odds of hospital delivery for a woman with primary education or higher are almost 3 times (2.477) higher than those without an education. This indicates that women with no education are less likely to give birth in hospitals compared to those with primary education+. The wealth index, as a measure of socioeconomic status, was a significant positive predictor of the place of delivery of women. With an increase in a woman's wealth index, the chances of women with a higher wealth index to give birth in healthcare facilities are three times higher than those from middle and lower wealth index in Kenya. Whereas living in rural areas reduces the chances of women delivering in healthcare facilities, married women are almost twice as likely to deliver in healthcare facilities compared to unmarried women.

Finally, we summarize Model 3 with the dependent variable, prenatal care. The binary regression model showed that the biological variables, age at first birth (p = .006) and birth interval (p<0.01) are significant predictors of child mortality. Prenatal care access differed by age of women at first birth. Women (adolescents) who were 19 years or younger at first birth were less likely to have received prenatal care services compared to those who were 20 years or older. Additionally, number of children was a significant predictor in the model. For every one-unit increase in the number of children, there is a predicted decrease of .814 in the chances of accessing prenatal care. On socio-economic variables, women's education at the primary or higher level significantly increases the odds of a woman going for prenatal care.

Similarly, in Kenya, household wealth increases the chances of antenatal care visits at women from middle and rich households compared to poor ones. Finally, unmarried women were less likely to have received prenatal care than married women. A woman in Kenya who is married or living with their partner is 2 times more likely to have received prenatal care compared to unmarried women.

Multivariate models were used to test the hypothesis that high-risk fertility behaviors of women are significantly associated with under-5 child mortality and risks of maternal mortality. The hypothesis tested was if biological and socio-economic characteristics have a significant impact on under-5 mortality. The results indicate that the number of children, education, place of residence, and access to antenatal visits each significantly impact child mortality. Therefore, the results are significant indicating that we fail to reject the null hypothesis that the number of children, education, place of residence, and access to antenatal visits are significantly associated with childhood mortality and adopt the alternate. This, therefore, implies that the number of children, education, place of residence, and access to antenatal visits have an influence on childhood mortality. The results were similar to the hypothesis that women's biological and socio-economic characteristics influence hospital delivery. Results indicated that age at first birth, birth interval, birth order, sex of child, education, residence, wealth index and marital status influences the chances of healthcare deliveries. To test the hypothesis than women who deliver when they are younger (19 years or older) are less likely to deliver in a hospital, the multivariate results showed that age at first birth is significantly associated with healthcare deliveries (p <.01.) Therefore, the results are significant indicating that we reject the null hypothesis that age at first birth is not significantly associated with healthcare deliveries and adopt the alternate. This, therefore, implies that age at first birth is a significant factor that influences women's decision to deliver

in the hospital. Similarly, the results showed that women who live in urban areas are more likely to deliver in healthcare facilities than women who reside in rural areas. These results indicate that the higher the number of children a woman has, the lower the chances of delivering in a healthcare facility. The hypothesis was therefore supported.

CHAPTER V: DISCUSSION

Summary

This study assessed the high-risk fertility behaviors and childhood and maternal mortality in Kenya. Descriptive statistics, crosstabulations, and binary logistic regressions were conducted in SPSS to analyze data. Overall, the results confirm that high-risk fertility behaviors greatly impact child mortality rates and maternal mortality risk factors in Kenya. The logistic regression analysis shows that biological and socio-economic characteristics are significant predictors of mortality among women and children. Biological factors discussed include women's age at first birth, number of children, birth order, birth interval, and the sex of the child. Age at first birth decreases the risks, whilst the number of children increases the risk. Both mothers and children born to young mothers (19 years or younger) are more likely to die than those children born to older women, thus implying that age at first birth is a significant factor that influences child and maternal mortality. With an increase in women's age, there is a decreased likelihood of them and their children dying. However, the more children the women have, the less likely they are to deliver in a hospital hence an increased chance of dying. Delivering at a young age also contributes to curtailing educational attainment and good financial stability.

The results of socioeconomic characteristics are similar; household wealth and education decrease the risk of mortality Marital status and living with a husband lower the risk of child and maternal mortality. Living in a rural residence is associated with an increase in risk on both outcomes. Finally, access to prenatal care services and hospital delivery reduces the risk of child mortality. These results demonstrate the importance of considering both the biological and socio-economic influences on both outcomes (child mortality and risks of maternal mortality), as their effects are crucial for health and community

development. The study showed that the effects of biological characteristics such as age, birth interval, and number of children are consistent with previous literature.

My findings support the study by Amir-ud-Din et al. (2021) in that both studies demonstrate the potential effects of high-risk fertility behaviors on child mortality. My study suggests that maternal age, the number of children, and the short preceding birth interval, and sex all correlate with higher rates of child mortality. The findings show that teen birth is associated with adverse birth and child outcomes. Moreover, my results are consistent with the findings of Fall et al. (2015) in that both studies reveal the potential for also adverse birth and child outcomes associated with both younger and advanced maternal age. Younger women are at a high risk of mortality, including the death of their children, because their body is not mature enough to handle the stresses that come with birth.

Concerning the number of children, the study indicated a strong and positive relationship between the total number of children, birth interval, and mortality. Older women are more likely to seek out antenatal care services and deliver in hospitals compared to younger ones. However, the more children these women have, the less likely they are to deliver in hospital. In addition, it was clear that the higher the number of children a woman has, the greater the chance of them dying. Women with many children contributes to birth spacing issues and not allowing women to recuperate from previous pregnancies, increasing their chances of dying (Molitoris et al., 2017). These vulnerabilities also result in higher risks of mortality among mothers and children (Marphatia et al., 2017). The adolescent birth rate remains at 101 births annually per 1,000 women, resulting in hundreds of thousands of additional under-5 deaths and tens of thousands of additional maternal deaths (Nations, 2020).

Consistent with previous literature, the findings of my study showed that socio-economic characteristics such as education and wealth index, place of residence, and marital

status influence a child's and mother's well-being. The findings revealed that there is a positive relationship between the wealth Index of women and child and maternal mortality. Previous literature found that infants and children born to poor mothers were at a higher risk than those born to mothers from a higher household wealth index (Muriithi & Muriithi, 2015). Similarly, the findings of this study showed that mothers who delivered in healthcare facilities had a relatively lower risk of dying and of child mortality compared to those born at home The findings of this study are also consistent with Muriithi and Muriithi (2015) who found that children born in rural areas are more likely to die than those born in urban areas.

The findings of this study are consistent with some of the studies from previous literature (Avogo & Somefun, 2019; Asif, 2022; Brat et al., 2013; Muriithi & Muriithi, 2015). The results of a significant, positive relationship association between education, marital status and wealth, and access to prenatal care and hospital delivery are consistent with the findings of Muriithi and Muriithi (2015) who found that education, occupation, wealth index, place of delivery, and place of residence had an influence on mother and child survival. In the present study, women with primary education or higher, those who lived in urban areas and had middle or higher wealth status had higher rates of prenatal and hospital services compared to those with no education, poor, and from rural areas. Similarly, Asif (2018) found that mothers with a higher level of education can take care of her child and herself during and after the pregnancy compared to uneducated or less educated mothers, reducing the risks of child and maternal death which can be possibly attributed to better knowledge and awareness about maternal health issues. Research also found that educated women are more likely to participate actively in the labor force; they give birth less and are more likely to have healthy and well-nourished children than those without education (Asif, 2022). The literature supports

these findings showing that women with primary education or more have less child mortality rates than those without education.

The findings of this study show that women with at least some level of education are more likely to utilize prenatal care services, deliver in healthcare facilities, and have lower rates of child mortality compared to those without any education. The results of a positive correlation between education and access to prenatal and hospital delivery services are consistent with the findings of Greenaway et al. (2017) who conducted research and found that mothers' education is strongly associated with health knowledge which helps explain the association between maternal education and use of health services. These findings also support the findings of Avogo & Somefun (2019) as they found that lower levels of education among women contribute to increased risks of high child parity and shorter birth intervals hence increased risk of child and maternal mortality rates. This is worth noting as women's education would be crucial in decreasing maternal and child mortality.

As found in the findings of my study, the lower the wealth index of women, the higher the child and maternal mortality rates. The findings support that of the existing literature which implies that the mother's wealth index and expenditure on health significantly influence child and mother survival (Muriithi &Muriithi, 2015; Okiro, 2020: Tamirat et al., 2021). The findings of my study are consistent with that of Asif (2022) who found that wealthier households have better living standards and better availability of health facilities compared to those who are poor. On the contrary, women with lower wealth status are less likely to access prenatal care services and give birth in healthcare facilities. The study's findings showed that residing in urban areas significantly reduces the risk of child mortality and maternal deaths. This is consistent with that of Malderen et al. (2019) who found that although the urban-rural difference is narrowing in some countries due to a more rapid

mortality decline in rural areas than in urban areas, an urban advantage persists in many countries and children and women from urban areas are less likely to die from maternal health related issues than those from rural areas. This urban advantage can be attributed to access to health services and better economic opportunities for families. The findings also support that of Mwangi and Murithi (2015) who argued that infants born to mothers residing in rural areas have high mortality rates due to the unavailability of adequate health facilities.

These results support much of the previous literature (Asif, 2022; Malderen et al., 2019; Muriithi &Muriithi, 2015; Okiro, 2020: Tamirat et al., 2021) on high-risk fertility behaviors and their significant influence on child mortality. The study makes a valuable contribution to the literature as it highlights the combined effect of biological and socio-economic characteristics of women on mortality. A few recommendations arise from this study, and research on the negative effects of high-risk fertility behaviors must consider the combined effect of biological and socio-economic determinants of child and maternal mortality. Health interventions for women must account for factors that improve the conditions of daily living among women and address risk factors and stressors within the community.

As mentioned before, Mosley and Chen's (1984) Framework was relevant to this study because it posits several interconnected links between fertility behaviors and health and mortality outcomes across different contexts. Specifically, it suggests that high fertility rates, high parity, and parental age are associated with lower chances of survival for children and worse health outcomes for mothers. Mosley and Chen's (1984) framework has been presented in previous literature to show that individual characteristics, such as age, can significantly impact fertility behavior and subsequent health outcomes (Muriithi &Muriithi, 2015; Okiro, 2020: Tamirat et al., 2021). This framework is supported by the findings of this study as there

was a significant impact of both biological and socio-economic determinants on child mortality and risks of maternal mortality. The study found that high risk fertility behaviors, such as age at first birth (19 years or below), inadequate spacing between pregnancies, giving birth to a large number of children, education and place of residence increased the risk of both maternal and child mortality.

Strengths and Limitations

A strength of this study was using the Demographic and Health Survey 2014 data set. This dataset was large and nationally representative, which can be generalized to the Kenyan population. It also contained many variables that could be tested on high-risk fertility behaviors. It included biological characteristics and socio-economic characteristics, child mortality, maternal mortality risk factors of the place of delivery, and antenatal care among women in Kenya. An additional strength was the ability to use one dataset that provided a good range of data on high-risk fertility behaviors of women and child mortality. Also, the Demographic Health Survey data sets are made widely available, and one can access the data over the internet at no cost.

A limitation of this study was that DHS surveys in Kenya are typically conducted about every 6 years and therefore annual estimates of key indicators are not available from the surveys. The most recent demographic health survey in Kenya was done in 2014. Because the DHS survey used was collected in 2014, which is quite old, the data may not accurately represent the current estimates on high-risk fertility behaviors and mortality which may be more, especially given the outbreak of the COVID-19 pandemic. An additional limitation of the study is the reliance on self-reported data. The interviewed women report information such as prenatal visits, date of birth of children, and place of delivery which the women may have a recall bias. These limitations notwithstanding, our study makes a valuable contribution

to the influence of high-risk fertility behaviors and child and maternal mortality and well-being. For future research, researchers should examine and consider the community characteristics and their effects on women and develop and evaluate interventions to reduce adverse outcomes associated with high-risk fertility practices. Additionally, there is a need for a longitudinal study to investigate the effects of high-risk fertility behaviors on child and maternal mortality. Longitudinal studies would allow for tracking changes in fertility and mortality over time, which could better identify long-term trends. Additionally, there should be a qualitative study (interviews with women on struggles and risks related to their pregnancies) to understand better the social, cultural, and economic factors associated with high-risk fertility behaviors, such as the role of family and community beliefs. Finally, further survey research should be used to compare fertility behavior in rural and urban areas, to understand how the environment influences fertility.

CHAPTER VI: CONCLUSION

The research on high-risk fertility behaviors and mortality has indicated that both biological and socio-economic characteristics influence maternal and child well-being. This research has found that women who give birth at a younger age (19 years or younger) are more likely to experience higher mortality rates than those who are older. It also shows that the lower the women's wealth index, the higher their maternal and child death rates. Women from low-income households experienced higher mortality rates than those from high income households. The Mosley and Chen (1984) Framework stresses the need for a comprehensive study and intervention approach that address the combined influence of biological and socio-economic factors driving high-risk fertility behaviors and mortality. The findings of this study on high-risk fertility behaviors and mortality align with the Mosley and Chen (1984) framework, which argues that socioeconomic and biological factors influence the well-being of mothers and their children. This research demonstrates that women who give birth at a younger age and those with lower wealth experience higher mortality rates than those who are older and from higher-income households. This further illustrates that poverty and lack of access to health care delivery services, proper prenatal care, and education among other biological and socio-economic characteristics, are key factors in the mortality rates of both mothers and their children. The findings of the study highlight the need for an effective intervention to curb the high child and maternal mortality rates, especially in early marriages and teenage pregnancies. Thus, interventions like providing subsidized maternal health care, improving access to health care and education in rural settings, and emphasizing the importance of birth spacing can be used to reduce the impact of these socioeconomic and

biological factors on the health of mothers and their children in Kenya. There is also a need to invest in reproductive healthcare with a focus on the use of contraceptives to manage the number of children a woman has. In rural community settings, there is a need to invest more in the depleted health care system, health education tailored toward community culture, and subsidized maternal health care services by the government to empower and improve the status of women, which may, in turn, reduce child and maternal mortality and prompt better utilization and survival chances of women in Kenya. Community-level healthcare providers are critical in addressing high-risk fertility behaviors and reducing child and maternal mortality risks in Kenya, particularly in rural areas. These providers include community health workers, community health extension workers, traditional birth attendants, and other community-based healthcare workers who are trusted by the local population. There is a need to conduct a needs assessment to identify the specific training needs of community healthcare providers, provide hands-on training that combines theoretical knowledge with practical skills and to involve the local community in the training process by engaging community leaders, women's groups, among other relevant stakeholders. There is a clear need to invest in maternal health education tailored to the culture of the community to ensure women are empowered to make the right choices and adequately equipped to care for themselves and their children in a safe and responsible manner. Additionally, the government and other relevant stakeholders should focus on developing and improving policies and legislations that promote maternal and child health through adequate healthcare services, provide financial aid and incentives to pregnant women, and protect women's rights, especially in rural areas. Finally, there is a need to invest in research and data collection to assess progress and address the biological and socio-economic risk factors influencing under-5 mortality and risks of maternal mortality.

REFERENCES

Ahinkorah, B. O., Seidu, A. A., Armah-Ansah, E. K., Budu, E., Ameyaw, E. K., Agbaglo, E., & Yaya, S. (2020). Drivers of desire for more children among childbearing women in sub-Saharan Africa: implications for fertility control. *BMC Pregnancy and Childbirth, 20, 1-11*. https://doi.org/10.1186/s12884-020-03470-1

Ahmed, T., Roberton, T., Vergeer, P., Hansen, P. M., Peters, M. A., Ofosu, A. A., Mwansambo, C., Nzelu, C., Wesseh, C.S., Smart, F., Alfred, J.P., Diabate, M., Baye, M., Yansame, L.M., Wendrad, N., Muhamud, N.A., Mbaka, P., Yuma, S., Ndiaye, Y., Sadat, H.…& Shapira, G. (2022). Healthcare utilization and maternal and child mortality during the COVID-19 pandemic in 18 low-and middle-income countries: An interrupted time-series analysis with mathematical modeling of administrative data. *PLoS Medicine, 19(8), e1004070*. https://doi.org/10.1371/journal.pmed.1004070

Asif, M. F., Pervaiz, Z., Afridi, J. R., Safdar, R., Abid, G., & Lassi, Z. S. (2022). Socio-economic determinants of child mortality in Pakistan and the moderating role of household's wealth index. BMC Pediatrics, 22, 1–8. https://doi.org/10.1186/s12887-021-03076-2

Asiki, G., Shao, S., Wainana, C., Khayeka–Wandabwa, C., Haregu, T. N., Juma, P. A., Muhammed, S., Wambui, D., Gong, E., Lijing, L.Y., & Kyobutungi, C. (2018). The policy environment for prevention, control, and management of cardiovascular diseases in primary health care in Kenya. *BMC Health Services Research*, 18(1), 1-9. https://doi.org/10.1186/s12913-018-3152-4

Atahigwa, C., Kadengye, D. T., Iddi, S., Abrams, S., & Van Rie, A. (2020). Trends and determinants of health facility childbirth service utilization among mothers in urban slums of Nairobi, Kenya. Global Epidemiology, 2, 100029. https://doi.org/10.1016/j.gloepi.2020.100029

Avogo, W. A., & Somefun, O. D. (2019). Early marriage, cohabitation, and childbearing in West Africa. *Journal of Environmental and Public Health, 2019*. https://doi.org/10.1155/2019/9731756

Black, R. E., Cousens, S., Johnson, H. L., Lawn, J. E., Rudan, I., Bassani, D. G., Jah, B.P., Cilbuskis, R., Walker, C.F., Eisel, T., Liu, L. & Mathers, C. (2010). Global, regional, and national causes of child mortality in 2008: A systematic analysis. *The Lancet, 375(9730), 1969-1987*. https://doi.org/10.1016/S0140-6736(10)60549-1

Budu, E., Chattu, V. K., Ahinkorah, B. O., Seidu, A. A., Mohammed, A., Tetteh, J. K., Arthur-Holmes, F., Adu, C., & Yaya, S. (2021). Early age at first childbirth and skilled birth attendance during delivery among young women in sub-Saharan Africa. *BMC Pregnancy and Childbirth, 21*, 1-12. https://doi.org/10.1186/s12884-021-04280-9

Casterline, J. B., & Agyei-Mensah, S. (2017). Fertility desires and the course of fertility decline in sub-Saharan Africa. *Population and Development Review, 43*, 84-111. http://www.jstor.org/stable/26622875

Chatterjee, Rhitu. 2022. A 'staggering' Number of People Couldn't Get Care during the Pandemic, Poll Finds. https://www.npr.org/sections/health-shots/2022/08/08/1116264151/poll-1-in-5-seriously-ill-black-americans-had-a-hard-time-getting-medical-care

Dunlop, C. L., Benova, L., & Campbell, O. (2018). Effect of maternal age on facility-based delivery: analysis of first-order births in 34 countries of sub-Saharan Africa using demographic and health survey data. *BMJ Open, 8(*4), e020231. http://dx.doi.org/10.1136/bmjopen-2017-020231

Fall, C. H., Sachdev, H. S., Osmond, C., Restrepo-Mendez, M. C., Victora, C., Martorell, R., Stein, S.D., Sinha, S., Tandon, N., Adair, L., Bas, I., Norris, S., & Richter, L. M. (2015). Association between maternal age at childbirth and child and adult outcomes in the offspring: a prospective study in five low-income and middle-income countries (COHORTS collaboration). *The Lancet Global Health, 3(7),* e366-e377. https://doi.org/10.1016/S2214-109X(15)00038-8

Greenaway, E. S., Leon, J., & Baker, D. P. (2012). Understanding the association between maternal education and use of health services in Ghana: exploring the role of health knowledge. *Journal of biosocial science*, 44(6), 733-747. https://doi.org/10.1017/S0021932012000041

Gitau, T., Kamita, M., Muli, E., Mweni, S., Waithanji, R., Mutisya, F., Kirira, P., Nzioka, A., Figueroa, J., & Makokha, F. (2021). The impact of measures to curb COVID-19 on patient attendance at 10 Machakos County, Kenya hospitals. *Journal of Global Health,* 11. https://doi.org/10.7189%2Fjogh.11.05016

Gitobu, C. M., Gichangi, P. B., & Mwanda, W. O. (2018). The effect of Kenya's free maternal health care policy on the utilization of health facility delivery services and maternal and neonatal mortality in public health facilities. *BMC Pregnancy and Childbirth, 18(1),* 1-11. https://doi.org/10.1186/s12884-018-1708-2

Howlader, M. H., Roshid, H. O., Kundu, S., Halder, H. R., Chanda, S. K., & Rahman, M. A. (2022). Determinants associated with high-risk fertility behaviours among reproductive aged women in Bangladesh: a cross-sectional study. *Reproductive Health, 19(1),* 1-10. https://doi.org/10.1186/s12978-022-01333-w

Hussein, M. A., Mwaila, M., & Helal, D. (2021). Determinants of Under-Five Mortality: A Comparative Study of Egypt and Kenya. *Open Access Library Journal, 8(9*), 1-23. 10.4236/oalib.1107889.

Imbo, A. E., Mbuthia, E. K., & Ngotho, D. N. (2021). Determinants of neonatal mortality in Kenya: evidence from the Kenya demographic and health survey 2014. *International Journal of Maternal and Child Health and AIDS, 10(2),* 287. 10.21106/ijma.508

Irimu, G., Aluvaala, J., Malla, L., Omoke, S., Ogero, M., Mbevi, G., Waiyego, M., Mwangi, C., Were, F., Gathara, D., Agweyu, A., Akech, S., & English, M. (2021). Neonatal mortality in Kenyan hospitals: a multisite, retrospective, cohort study. *BMJ Global Health, 6(5),* e004475. https://gh.bmj.com/content/bmjgh/6/5/e004475.full.pdf

Kimani, R. W., Maina, R., Shumba, C., & Shaibu, S. (2020). Maternal and newborn care during the COVID-19 pandemic in Kenya: Re-contextualising the community midwifery model. *Human Resources for Health, 18,* 1-5. (2020). https://doi.org/10.1186/s12960-020-00518-3

International Trade Administration (ITA). (2018). Kenya - Universal Healthcare Coverage. The Kenyan Government aims to provide medical insurance coverage for every Kenyan within the next five years. https://www.trade.gov/market-intelligence/kenya-universal-healthcare-coverage

Kenya Demographic and Health Survey. (2014). Kenya. https://dhsprogram.com/pubs/pdf/fr308/fr308.pdf

Kimani-Murage, E. W., Fotso, J. C., Egondi, T., Abuya, B., Elungata, P., Ziraba, A. K., Kabiru, C, W., & Madise, N. (2014). Trends in childhood mortality in Kenya: The urban advantage has seemingly been wiped out. *Health & Place, 29,* 95-103. https://doi.org/10.1016/j.healthplace.2014.06.003

Lang'at, E., Mwanri, L., & Temmerman, M. (2019). Effects of free maternity service policy in Kenya: an interrupted time series analysis. *The Lancet Global Health, 7*, S21. https://doi.org/10.1016/S2214-109X(19)30106-8

Lozano, R., Wang, H., Foreman, K. J., Rajaratnam, J. K., Naghavi, M., Marcus, J. R., Dwyer-Lindgren, L., Lofgren., Philips., Atkinson, C., Lopez, A, D., & Murray, C. J. (2011). Progress towards Millennium Development Goals 4 and 5 on maternal and child mortality: an updated systematic analysis. *The Lancet,* 378(9797), 1139-1165. https://doi.org/10.1016/S0140-6736(11)61337-8

Macharia, P. M., Giorgi, E., Thuranira, P. N., Joseph, N. K., Sartorius, B., Snow, R. W., & Okiro, E. A. (2019). Sub-national variation and inequalities in under-five mortality in Kenya since 1965. *BMC Public Health, 19(1),* 1-12. https://doi.org/10.1186/s12889-019-6474-1

Marphatia, A. A., Ambale, G. S., & Reid, A. M. (2017). Women's marriage age matters for public health: a review of the broader health and social implications in South Asia. Frontiers in Public Health, 269. https://doi.org/10.3389/fpubh.2017.00269

Molitoris, J., Barclay, K., & Kolk, M. (2019). When and where birth spacing matters for child survival: an international comparison using the DHS. Demography, 56*(4),* 1349-1370. https://doi.org/10.1007/s13524-019-00798-y

Muriithi, D. M., & Muriithi, D. K. (2015). Determination of infant and child mortality in Kenya using the cox-proportional hazard model. *American Journal of Theoretical and Applied Statistics, 4(5),* 404-413. 10.11648/j.ajtas.20150405.21

Oluoch-Aridi, J., Afulani, P. A., Guzman, D. B., Makanga, C., & Miller-Graff, L. (2021). Exploring women's childbirth experiences and perceptions of delivery care in peri-urban settings in Nairobi, Kenya. *Reproductive health, 18,* 1-14. https://doi.org/10.1186/s12978-021-01129-4

Oluoch-Aridi, J., Chelagat, T., Nyikuri, M. M., Onyango, J., Guzman, D., Makanga, C., Miller-Graff, L., & Dowd, R. (2020). COVID-19 effect on access to maternal health services in Kenya. *Frontiers in Global Women's Health,* 19. https://doi.org/10.3389/fgwh.2020.599267

Ombere, S. O. (2021). Access to maternal health services during the COVID-19 pandemic: experiences of indigent mothers and health care providers in Kilifi County, Kenya. Frontiers in Sociology, 6, 613042. https://doi.org/10.3389/fsoc.2021.613042

Orangi, S., Kairu, A., Malla, L., Ondera, J., Mbuthia, B., Ravishankar, N., & Barasa, E. (2021). Impact of free maternity policies in Kenya: an interrupted time-series analysis. BMJ Global Health, 6(6), e003649. http://dx.doi.org/10.1136/bmjgh-2020-003649

Ouma, P. N., Masai, A. N., & Nyadera, I. N. (2020). Health coverage and what Kenya can learn from the COVID-19 pandemic. Journal of Global Health, 10(2). 10.7189/jogh.10.020362

Seidu, A. A., Ahinkorah, B. O., Anjorin, S. S., Tetteh, J. K., Hagan Jr, J. E., Zegeye, B., Adu-Gyamfi, A, B., & Yaya, S. (2023). High-risk fertility behaviours among women in sub-Saharan Africa. *Journal of Public Health, 45*(1), 21-31. https://doi.org/10.1093/pubmed/fdab381

Shifa, G. T., Ahmed, A. A., & Yalew, A. W. (2018). Socioeconomic and environmental determinants of under-five mortality in Gamo Gofa Zone, Southern Ethiopia: a matched case-control study. *BMC International Health and Human Rights, 18*(1), 1–11. https://doi.org/10.1186/s12914-018-0153-7

Tamirat, K. S., Tesema, G. A., & Tessema, Z. T. (2021). Determinants of maternal high-risk fertility behaviors and its correlation with child stunting and anemia in the East Africa region: A pooled analysis of nine East African countries. *PloS one, 16*(6), e0253736. https://doi.org/10.1371/journal.pone.0253736

Umutesi, G., McEvoy, M. D., Bonnet, K., Druffner, S., Schlundt, D. G., Atieli, H. E., China, J, N., Onyango, K., & Newton, M. W. (2021). Factors influencing mothers' decisions regarding obstetrical care in Western Kenya: a mixed-methods study. *BMC Women's Health,* 21(1), 210. https://doi.org/10.1186/s12905-021-01355-9

UNICEF. (2021). Under-five mortality. https://data.unicef.org/topic/child-survival/under-five-mortality/

UNICEF. (2023). Child marriage: Child marriage threatens the lives, well-being, and futures of girls around the world. https://www.unicef.org/protection/child-marriage

United Nations. (2020). The Sustainable Development Goals Report, 2020. https://unstats.un.org/sdgs/report/2020/

Wangamati, C, K., & Prince, R. (202). Kenya is making moves towards Universal Health Coverage. What are we to make of them? *University of Oslo*. https://www.med.uio.no/helsam/english/research/projects/universal-health-coverage-africa/news-and-blog/blog/kenya-is-making-moves-towards-universal-health-cov.html

Wekesah, F. M., Mbada, C. E., Muula, A. S., Kabiru, C. W., Muthuri, S. K., & Izugbara, C. O. (2016). Effective non-drug interventions for improving outcomes and quality of maternal health care in sub-Saharan Africa: a systematic review. *Systematic Reviews, 5*, 1-18.

Word Health Organization. (2022). Child mortality (under 5 years). https://www.who.int/news-room/fact-sheets/detail/levels-and-trends-in-child-under-5-mortality-in-2020#

World Health Organization. (2023). Maternal mortality. https://www.who.int/news-room/fact-sheets/detail/maternal-mortality

APPENDIX

Table 1 Summary Statistics of all Descriptive Analysis

Variables	Frequency	Percent
Dependent: Child mortality		
Not dead	13812	97.3
Child dead	377	2.7
Prenatal care and hospital delivery		
No access	486	3.4
Access to either prenatal care/delivery	4412	31.1
Both	9276	65.4
Place of delivery		
Home/Other	4760	33.6
Hospital/healthcare facility	9415	66.4
Prenatal care		
No	618	4.4
Yes	13550	95.5
Independent: Biological determinants		
Respondent's age at first birth		
19 years & below	7656	54.0
20-24 years	5113	36.0
25+ years	1420	10.0
Number of children<5		
1-2	6879	48.5
3-4	4118	29.0
5+	3192	22.5
Birth interval		
Less than 24 months	5563	39.2
24 months+	8626	60.8
Birth order		
First	3608	25.4
Second	3270	23.0
Third	2442	17.2
Fourth+	4868	34.3
Sex of Child		
Male	7246	51.1
Female	6942	48.9
Table Continues		

Table Continued		
Socio-economic characteristics		
Education		
No education	1391	9.8
Primary education	7726	54.5
Secondary+	5072	35.7
Wealth index		
Poor	5643	39.8
Middle	5316	37.5
Rich	3230	22.8
Marital status		
Never been married	1244	8.8
Married	10600	74.7
Living together	961	6.8
Widowed/divorced/separated	1384	9.7
Living with husband		
Yes	4298	30.3
No	1150	8.1
Place of residence		
Urban	5461	38.5
Rural	8728	61.5
Source: *Demographic and Health Survey 2014*		

Table 2 Cross-tabulation of child mortality rates (%)

	Child_dead		
Variables	Yes	No	Chi-Square
Age at first birth			
19 years and below	2.7	97.3	
20-24	2.6	97.4	
25+	2.5	97.5	
			.350*
Number of Children			
1-2 children	2	98	
3-4 children	2.8	97.2	
5+	3.8	96.2	
			28.558*
Birth Interval			
Less than 24 months	2.6	97.4	
24 months+	2.7	97.3	
			.090*
Birth Order			
First	2.2	97.8	
Second	1.8	98.2	
Third	2.7	97.3	
Fourth+	3.6	96.4	
			27.394*
Sex			
Male	2.5	97.5	
Female	2.8	97.2	
			1.452*
Socio-economic Characteristics			
Education Attainment			
No Education	2.7	97.3	
Primary Education	2.9	97.1	
Secondary+	2.2	97.8	
			5.971*

Table Continues

Table Continued			
Wealth Index			
Low	2.8	97.2	
Middle	2.7	97.3	
Upper	2.2	97.8	
			2.901*
Marital status			
Unmarried	4.2	95.8	
Married	2.65	97.45	
			41.089*
Living with husband			
Yes	2.6	97.4	
No	2.2	97.8	
	87.6	12.4	.761*
Type of Residence			
Urban	2.5	97.5	
Rural	3	97	
			3.689*
Source: Demographic and Health Survey 2014, *P<0.01			

Table 3 Crosstabulation of Risk of Mortality Rates (%)

Prenatal			
Variables	Yes	No	Chi-Square
Age at first birth			
19 years and below	94.6	5.4	
20-24	97.4	3.2	
25+	97.2	2.8	
			46.742*
Number of Children			
1-2 children	97.3	2.7	
3-4 children	96.1	3.9	
5+	91.4	8.6	
			187.029*
Birth Interval			
Less than 24 months	95.9	4.1	
24 months+	95.5	4.5	
			1.031*
Birth Order			
First	97.3	2.7	
Second	97.3	2.7	
Third	97.3	2.7	
Fourth+	92.4	7.6	
			180.696*
Sex			
Male	95.6	4.4	
Female	95.7	4.3	
			.098*
Socio-economic Characteristics			
Education Attainment			
No Education	82.4	17.6	
Primary Education	96	4	
Secondary+	98.8	1.2	
			698.996*

Table Continues

Table Continued

Wealth Index			
Low	92.1	7.9	
Middle	97.4	2.6	
Upper	99	1	
			295.932*
Marital status			
Unmarried	95.75	4.25	
Married	93.9	6.1	
			37.149*
Living with husband			
Yes	97.1	2.9	
No	96.6	3.4	
			.859*
Type of Residence			
Urban	97.9	2.1	
Rural	94.2	5.8	
			111.619*

Healthcare delivery P<0.01

Variables	Yes	No	Chi-Square
Age at first birth			
19 years and below	41.5	41.5	
20-24	72.3	27.7	
25+	87.5	12.5	
			575.903*
Number of Children			
1-2 children	79.9	20.1	
3-4 children	62.6	37.4	
5+	42.2	57.8	
			1428.744*

Table Continues

Table Continued

Birth Interval			
Less than 24 months	73.1	26.9	
24 months+	62.1	37.9	
			184.340*
Birth Order			
First	84.6	15.4	
Second	74.8	25.2	
Third	67.1	32.9	
Fourth+	53.1	33.6	
			1462.573*
Sex			
Male	67.6	32.4	
Female	65.2	34.8	
			9.480*
Socio-economic Characteristics			
Education Attainment			
No Education	28.9	71..1	
Primary Education	59.7	40.3	
Secondary+	86.8	13.2	
			1974.381*

Table Continues

Table Continued

Wealth Index			
Low	43.8	56.2	
Middle	76.3	25.7	
Upper	93	7	
			2466.322*
Marital status			
Unmarried	64	36	
Married	62.75	37.25	
			132.42*

Table Continues

Table Continued

Living with husband			
Yes	66.8	33.2	
No	62.6	37.4	
			7.329*
Type of Residence			
Urban	84.4	15.6	
Rural	55.2	44.8	
			1287.377*

Source: Demographic and Health Survey 2014, *P<0.01

Table 4: Model 1 Regression Analysis Results
Logistic Regression among all Variables: Biological variables, socio-economic characteristics, and maternal mortality risks in testing its effects on under-5 mortality.

Variables	**Kenya, 2014**
Biological characteristics	OR (95% CI)
Women age at first birth	
19 years and below	1
20+	1.034(0.832, 1.286)
Number of children	
1-2 children	1
3+	2.066 (1.593, 2.680) *
Birth Interval	
< 24 months	1.00
24 months>	.782 (0.615,0.994) *
Sex	
Male	1.00
Female	1.151 (0.935, 1.417
Socio-economic characteristics	
Respondent's Education	
None	1
Primary/higher	1.471 (0.991, 2.185) *
Place of Residence	
Urban	1
Rural	0.669 (0.526, 0.851) ***
Wealth Index	
Poor	1.00
Middle/higher	0.873 (0.676, 1.28) *
Polygamous household	
All others including single women	1
Polygamous	1.542 (01.074, 2.214) *
Marital status	
Unmarried	1
Married	0.773 (0.595, 1.004) *
Prenatal care visit	
No	1
Yes	0.462 (0.308, 0.691) ***

Table Continues

Table Continued	
Place of delivery	
Home/other	1
Healthcare facility	1.091 (0.849, 1.403)
Source: Demographic and Health Survey, 2014	

Table 5: Model 2 Regression Analysis Results

Results of Logistic Regression among biological variables, socio-economic characteristics, and maternal mortality risk (Hospital delivery).

Variables	**Kenya, 2014**
Biological characteristics	OR (95% CI)
Women age at first birth	
19 years and below	1
20+	1.469(1.351, 1.597) ***
Number of children	
1-2 children	1
3+	0.432 (0.394, 0.475) ***
Birth Interval	
< 24 months	1.00
24 months>	1.002(0.912,1.100) ***
Sex	
Male	1.00
Female	0.858(0.792, 0.930***
Socio-economic characteristics	
Respondent's Education	
None	1
Primary/higher	2.477 (2.157, 2.845) ***
Place of Residence	
Urban	1
Rural	0.981 (0.834, 1.155) ***
Wealth Index	
Poor	1.00
Middle/higher	2.925(2.680, 3.193) ***
Polygamous household	
All others including single women	1
Polygamous	0.981 (0.834, 1.155) *
Marital status	
Unmarried	1
Married	1.109 (0.995, 1.235)
Place of delivery	
No	1
Yes	4.791 (3.842, 5.975**)
Source: Demographic and Health Survey, 2014	

Table 6: Model 3 Regression Analysis Results

Results of Logistic Regression among biological variables, socio-economic characteristics, and maternal mortality risk (prenatal care).

Variables	**Kenya, 2014**
Biological characteristics	OR (95% CI)
Women age at first birth	
19 years and below	1
20+	1.267(1.056, 1.520) **
Number of children	
1-2 children	1
3+	0.753 (0.610 0.930)
Birth Interval	
< 24 months	1.00
24 months>	1.346(1.113,1.629) ***
Sex	
Male	1.00
Female	1.092(0.922, 1.293)
Socio-economic characteristics	
Respondent's Education	
None	1
Primary/higher	3.649 (3.002, 4.435) ***
Place of Residence	
Urban	1
Rural	0.886 (0.698, 1.155)
Wealth Index	
Poor	1.00
Middle/higher	2.925(2.680, 3.193) ***

Table Continues

Table Continued	
Polygamous household	
All others including single women	1
Polygamous	0.981 (0.834, 1.126)
Marital status	
Unmarried	1
Married	1.994 (01.625, 2.445) ***
Prenatal care visit	
No	1
Yes	4.798 (3.852, 5.975) **
Source: Demographic and Health Survey, 2014	