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THE IMPACT OF BIRTH INTERVALS ON UNDER-FIVE MORTALITY IN GHANA: EVIDENCE FROM THE 2022 GHANA DEMOGRAPHIC AND HEALTH SURVEY

BY

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THIS DISSERTATION IS SUBMITTED TO THE DEPARTMENT OF HEALTH POLICY, PLANNING AND MANAGEMENT, UNIVERSITY OF GHANA SCHOOL OF PUBLIC HEALTH, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PUBLIC HEALTH DEGREE

NOVEMBER, 2024

DECLARATION

I declare that this work contains my own research and has not been submitted by anyone else for any degree or academic award. A complete list of references cited within this thesis. All research errors and omissions are my own.

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I hereby state that the work I have produced is the output of my research and has not been submitted by anyone else for consideration for any academic honors at this university or another institution. This thesis includes a complete list of all references used. Any errors in the work are solely my responsibility, and I guarantee that the work was supervised properly by university policies.

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DEDICATION

I give it all to God, my strength and hope this whole time. All glory be to Him.

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I would like to thank my supervisor, Prof. Dwomoh and my family who have contributed immensely into seeing the completion of this work. I cannot say thank you enough. God richly bless you.

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ABSTRACT

Under-five mortality remains a significant public health issue, influencing a country's broader child mortality rates. This study examines the relationship between birth intervals and neonatal mortality in Ghana, using data from the 2022 Ghana Demographic and Health Survey (GDHS). Specifically, the study investigates how the length of time between successive births impacts under-five mortality and explores how socio-demographic factors modify this relationship.

The study employed a cross-sectional design, analyzing data from women of reproductive age (15–49 years) who gave birth in the five years prior to the survey. After adjusting for potential confounders, including socioeconomic status and healthcare-related factors, the study used logistic regression models to evaluate the association between birth intervals and neonatal mortality.

The findings indicate that 25.3% of under-five mortality occurred within the first 28 days of life. Infants born after short birth intervals (<24 months) were 25% more likely to die within the neonatal period compared to those born after intervals of 24–59 months (Adjusted Odds Ratio = 1.25, 95% CI: 1.11 to 1.35, $p < 0.001$). The study also revealed that longer birth intervals (≥60 months) were associated with a slightly lower risk of under-five mortality, although this effect was less pronounced compared to shorter birth intervals.

These results underscore the protective effect of longer birth intervals in reducing under-five mortality rates in Ghana. The findings suggest that enhancing maternal health education and expanding access to family planning services, particularly in rural areas, are critical for improving neonatal survival rates. The study calls for policies promoting healthy birth spacing as a key

strategy for reducing neonatal mortality and improving child and maternal health outcomes in Ghana.

CHAPTER ONE

INTRODUCTION

1.1 Background

Under-five mortality (U5M) remains a major global health concern, disproportionately affecting low- and middle-income countries, particularly those in sub-Saharan Africa and South Asia (World Health Organization, 2019; UNICEF, 2020; Dwomoh et al., 2019; Bediako, 2022; Mohammed et al., 2023). Although considerable progress has been achieved in reducing child mortality over recent decades, U5M persists as a formidable challenge, with newborn deaths now comprising nearly half of all under-five deaths worldwide (Lawn et al., 2014; World Health Organization, 2021). Sub-Saharan Africa alone accounts for more than half of these child deaths (UNICEF, 2022). Within this region, Ghana has achieved notable reductions in under-five mortality through strengthened healthcare interventions and socio-economic improvements, yet substantial challenges persist (Ghana Health Service, 2021). According to the 2022 Ghana Demographic and Health Survey (GDHS), Ghana's under-five mortality rate stands at approximately 25 deaths per 1,000 live births, raising urgent questions about the factors driving these preventable deaths (Ghana Statistical Service [GSS], 2022; Mohammed et al., 2023).

Birth intervals refer to the time between consecutive live births, and this interval is a key determinant of child health outcomes, including the risk of mortality (Rutstein, 2005; Kozuki et al., 2013; World Health Organization, 2021). Short birth intervals (often defined as less than 24 months) have been consistently associated with higher risks of neonatal, infant, and under-five mortality compared to longer intervals (Dadi, 2015; Kozuki et al., 2013). The elevated mortality risk linked to closely spaced births is partly explained by maternal nutrient depletion and the

intense competition for caregiving resources among siblings born in quick succession (Mare et al., 2023; Budu et al., 2021).

In Ghana, under-five mortality remains a major public health concern. Socio-economic factors such as maternal education, household income, and access to healthcare strongly influence birth interval practices, which in turn affect child survival outcomes (Alhassan, 2021). Consistent with these influences, a recent decomposition analysis found that socio-economic disparities underlie many child survival outcomes in Ghana, and that shorter birth intervals are associated with significantly higher under-five mortality (Dwomoh et al., 2022). Additionally, the healthcare system faces persistent challenges in delivering quality maternal and newborn care, which further contributes to Ghana's high under-five mortality. Notable issues include inadequate health infrastructure, shortages of skilled providers, limited essential medications, and inconsistent implementation of protocols for high-risk pregnancies and neonatal care (Nyonator et al., 2005; Awoonor-Williams et al., 2016; Ghana Health Service, 2019; GSS, 2022; Mohammed et al., 2023).

From a biological standpoint, very short intervals between pregnancies can hinder a mother's full nutritional and physical recovery, thereby adversely affecting both maternal and child health outcomes. Indeed, studies have found that closely spaced births are associated with higher incidences of low birth weight, preterm birth, and neonatal mortality (Teseman et al., 2023; Alhassan & Tetteh, 2021). Furthermore, analyses using propensity score matching reinforce that children born after extremely short intervals experience worse health outcomes, highlighting the importance of adequate spacing between pregnancies (Conde-Agudelo et al., 2012; DaVanzo et al., 2016).

Ghana has implemented various policies and programs to promote family planning and healthy birth spacing, yet critical gaps remain in practice. The newly released 2022 GDHS, a nationally representative survey conducted every five years, provides up-to-date data on under-five mortality and its risk factors, offering an important opportunity for targeted interventions. Recent studies suggest that maintaining optimal birth intervals can substantially reduce under-five mortality, underscoring birth spacing as a key modifiable factor in child survival (Yaya et al., 2018; Alamneh et al., 2021). The insights from this study will help inform resource allocation and program design for child health initiatives. Such evidence is also vital for accelerating progress toward the child survival targets of Sustainable Development Goal 3.2, which aims to end preventable under-five deaths and reduce the mortality rate to 25 or fewer per 1,000 live births by 2030 (United Nations, 2015; World Health Organization, 2021; GSS, 2022).

Although previous studies have examined the relationship between birth spacing and child survival in Ghana using earlier Demographic and Health Survey data (Ghana Statistical Service, 2015, 2018; Kayode et al., 2012; Adu et al., 2021), research leveraging the newly available 2022 GDHS data remains scarce. This study seeks to fill that gap by utilizing the 2022 survey to explore how birth intervals influence under-five mortality in the current context. Notably, the analysis employs a more comprehensive adjustment for potential confounders, such as maternal age, education, socio-economic status, and healthcare access, than many prior studies, thereby providing a clearer isolation of the effect of birth spacing on child survival. By quantifying the impact of birth intervals on under-five mortality, the research offers fresh insights into the interplay between reproductive behavior and child survival outcomes in Ghana. Ultimately, the findings are expected to underscore birth spacing as an important modifiable determinant of child survival and to reinforce the need for a multifaceted approach, combining optimal birth spacing with improvements in

maternal and newborn healthcare, to reduce under-five mortality (United Nations, 2015; World Health Organization, 2020).

1.2 Statement of the Problem

In 2019, the World Health Organization (WHO) reported a staggering 2.4 million newborn deaths globally, with South Asia and sub-Saharan Africa bearing the brunt of these losses (WHO, 2020; UNICEF, 2021). In Ghana, the under-five mortality rate (U5M) remains alarmingly high at 25 deaths per 1,000 live births, as reflected in the latest Ghana Demographic and Health Survey (GDHS) data from 2022, a figure marginally below the sub-Saharan average but still substantially above global benchmarks (Ghana Statistical Service, 2022). This enduring crisis underscores a critical question: What factors continue to place Ghana's youngest lives at risk, and how can the country better align with global targets for child survival?

Mounting evidence points to short birth intervals as a profound risk factor, compounding the likelihood of mortality for infants and young children across diverse settings. Landmark studies, such as Kozuki et al. (2013), have shown that birth intervals shorter than 24 months can increase U5M risk by 70% compared to intervals of 36–47 months. Dadi's (2015) systematic review and meta-analysis add weight to these findings, demonstrating that intervals shorter than 18 months carry a 52% higher mortality risk than longer intervals. This evidence is particularly concerning for Ghana, where recent research consistently links short birth intervals with elevated child mortality. For example, an analysis of the 2008 GDHS by Kayode et al. (2012) revealed a 68% higher risk of U5M for intervals shorter than 24 months, while a follow-up study by Adu et al. (2021) using 2014 GDHS data confirmed a persistent pattern, with a 54% increased risk for similar intervals.

However, despite this substantial body of evidence, critical gaps remain unaddressed in Ghanaian research. Firstly, the most recent 2022 GDHS data, a vital resource for monitoring health trends—has not yet been comprehensively analyzed to assess birth intervals' impact on U5M. More importantly, while prior studies have established a strong association between short birth intervals and elevated U5M, the specific pathways through which these intervals exacerbate mortality risks in Ghana remain underexplored. Understanding these mechanisms, such as maternal nutrient depletion, inter-sibling competition, and exposure to infectious diseases, is vital for developing context-sensitive interventions (Tariku et al., 2016; Alhassan et al., 2022). Addressing these gaps would provide actionable insights for Ghanaian policymakers and contribute to the global discourse on optimizing child survival strategies in low- and middle-income countries.

The present study thus seeks to bridge these research gaps by utilizing the most recent GDHS dataset to deliver a robust, nuanced analysis of the relationship between birth intervals and under-five mortality in Ghana. By quantifying the prevalence of U5M and elucidating the mechanisms by which short birth intervals increase mortality risk, this study aims to produce evidence that can inform national and international health policies. Indeed, addressing the modifiable factor of birth spacing could significantly alleviate Ghana's high U5M burden, support resource allocation, and advance progress toward the Sustainable Development Goal (SDG) of reducing U5M to 12 deaths per 1,000 live births by 2030 (WHO, 2021; Ghana Statistical Service, 2022).

Inaction on this front risks perpetuating Ghana's high under-five mortality rates, placing much strain on an already burdened healthcare system, and exacerbating the psychological, social, and economic impacts on families and communities. Conversely, advancing evidence-based strategies for optimal birth spacing would reduce mortality rates and improve maternal and child health

outcomes nationally. As Ghana strives to meet ambitious global health targets, this study will contribute invaluable insights into a manageable and impactful strategy to safeguard its youngest citizens and create a healthier future for the nation.

What sets this study apart from previous analyses is its reliance on the most recent 2022 GDHS dataset, which reflects current demographic and health dynamics in Ghana. Unlike earlier studies that utilized the 2008 and 2014 rounds, this research captures recent trends in birth spacing and under-five mortality, post-COVID-19 disruptions and amidst new family planning initiatives. Additionally, the study employs an enhanced analytical framework that adjusts for a broader range of socio-demographic confounders, allowing for a more nuanced understanding of how short birth intervals contribute to mortality risks across population subgroups. These contributions aim to close specific evidence gaps and support more precise, data-driven policy formulation toward achieving Ghana's SDG 3.2 targets.

1.3 Research Objectives

1.3.1 General Objective

This study aims to investigate the effect of birth intervals on under-five mortality in Ghana by utilizing data gathered by the Ghana Demographic and Health Survey (GDHS) conducted in 2022.

1.3.2 Specific Objectives

The study specifically aims:

1. To determine the prevalence of under-five mortality in Ghana using the 2022 Ghana Demographic and Health Survey (GDHS).

2. To assess the association between birth interval length and under-five mortality, while controlling for socio-demographic and maternal health-related factors.

1.4 Research Question

1.4.1 Main Research Question

This research seeks to answer the following question:

- What is the effect of birth intervals on under-five mortality in Ghana using data from the 2022 Ghana Demographic and Health Survey (GDHS)?

1.4.2 Specific Research Questions

This research seeks to answer the following questions:

1. What is the prevalence of under-five mortality in Ghana?
2. What is the impact of birth intervals on under-five mortality?

1.5 Significance of the Study

The significance of this study, which aims to investigate the effect of birth intervals on under-five mortality in Ghana using data from the 2022 Ghana Demographic and Health Survey (GDHS), cannot be overstated. By examining the prevalence of under-five mortality and quantifying the effect of birth intervals on under-five mortality, this study will provide valuable insights into the complex interplay between reproductive health, maternal and child health, and neonatal survival in the Ghanaian context. Moreover, the findings of this study will have important implications for the development of evidence-based interventions and policies aimed at reducing under-five mortality in Ghana and achieving the Sustainable Development Goal (SDG) target of reducing

under-five mortality to 12 deaths per 1,000 live births by 2030 (Damba, 2024; Azaare et al., 2024; Klu et al., 2024).

Furthermore, by utilizing the most recent and nationally representative data from the 2022 GDHS, this study will provide an up-to-date and comprehensive assessment of the association between birth intervals and under-five mortality in Ghana. This is particularly important given the limited research on this topic using the latest GDHS data and the need for evidence-based decision-making in maternal and child health programs. By highlighting the importance of birth spacing as a modifiable risk factor for under-five mortality, this study can contribute to the ongoing efforts to promote optimal birth spacing and improve maternal and child health outcomes in Ghana.

Ultimately, the significance of this study lies in its potential to save lives and improve the health and well-being of newborns and their families in Ghana. By providing actionable evidence on the effect of birth intervals on under-five mortality, this study can inform the design and implementation of targeted interventions and policies that promote optimal birth spacing, reduce under-five mortality, and contribute to the achievement of the SDG targets related to maternal and child health.

1.6 Scope of the Study

This study aims to provide a comprehensive analysis of the effect of birth intervals on under-five mortality in Ghana, using data from the 2022 Ghana Demographic and Health Survey (GDHS). By focusing on under-five mortality, a crucial indicator of maternal and child health—this study seeks to illuminate how birth spacing practices may influence child survival outcomes across Ghana's diverse socio-economic and cultural settings.

The study covers all 16 administrative regions of Ghana, making it a truly national-level analysis that reflects both urban and rural populations. Leveraging the GDHS's nationally representative dataset, the research is designed to produce externally valid insights across Ghana, capturing varying cultural norms, healthcare access levels, and socio-economic conditions.

Targeting women of reproductive age (15–49 years) and their live-born children within the five years preceding the 2022 GDHS, this study examines the association between different birth intervals—categorized as short, medium, and long, and under-five mortality. By exploring birth interval lengths in tandem with key factors like maternal age, education, socio-economic status, and healthcare access, the study aims to identify specific risk patterns and population segments where intervention may have the most impact.

Ultimately, the scope of this study extends beyond theoretical exploration; it is designed to generate actionable insights that can inform Ghana's public health policies and contribute to targeted interventions for reducing under-five mortality. The findings are expected to provide evidence-based guidance for health professionals, policymakers, and development agencies focused on promoting optimal birth spacing and improving child survival outcomes. Through this robust analysis, the study aligns with national and global health objectives, including the Sustainable Development Goal of reducing under-five mortality. Also, the study will help improve maternal and child health throughout Ghana.

1.7 Limitations of the Study

This study's strength lies in its use of nationally representative data from the 2022 Ghana Demographic and Health Survey (GDHS) to explore the impact of birth intervals on under-five

mortality in Ghana. However, several limitations should be noted that may affect the generalizability and interpretation of the findings.

Firstly, the study employs a cross-sectional design, capturing data at a single point in time, which limits the ability to establish causation. While cross-sectional data are valuable for identifying associations—such as the relationship between birth intervals and under-five mortality—they do not permit conclusions about causal relationships. Longitudinal studies, which track data over extended periods, would be more suitable for determining the causal effects of birth intervals on child mortality outcomes.

Secondly, the study relies on secondary data from the GDHS, which, though comprehensive, may lack certain variables relevant to this analysis. For example, detailed information on potential confounding factors—such as maternal nutritional status, quality of healthcare services, and cultural practices influencing breastfeeding behavior—are not captured in the GDHS dataset. These unmeasured variables may have substantial impacts on both birth intervals and under-five mortality, thus limiting the depth of analysis.

Moreover, the self-reported nature of birth interval data introduces the possibility of recall bias, particularly for births that occurred farther back in time. This recall bias may impact the accuracy of birth interval data, especially among older or less frequently measured cohorts. Despite controlling for key socio-demographic and health-related covariates, there may still be residual confounding by unmeasured factors. For instance, maternal health behaviors, genetic predispositions, and community-level factors such as proximity to healthcare facilities could influence the observed associations between birth intervals and under-five mortality but were not accounted for in this analysis.

In summary, while this study provides valuable insights into the relationship between birth intervals and under-five mortality, its cross-sectional design, reliance on self-reported data, and certain unmeasured variables may affect the robustness of the findings. Future research, particularly longitudinal studies with more comprehensive variable inclusion, is recommended to further explore these relationships and improve our understanding of the causal pathways influencing child survival in Ghana.

1.8 Conceptual Framework

This study is guided by the conceptual framework proposed by Mosley and Chen (1984) for the study of child survival in developing countries. The framework integrates both social and biomedical determinants by classifying them into distal (socioeconomic) and proximate (biological and behavioral) factors that influence child health and survival outcomes.

In this framework, distal determinants such as maternal education, household wealth, and place of residence affect child survival indirectly through proximate factors. The key proximate determinant examined in this study is birth interval, which directly influences the child's risk of mortality through maternal depletion, sibling competition, and child nutritional status.

The model allows for a holistic understanding of how socioeconomic conditions interact with reproductive patterns to shape under-five mortality. By applying this framework, the study examines how variations in birth spacing, when mediated by socioeconomic context, contribute to the observed disparities in child survival outcomes across Ghana.

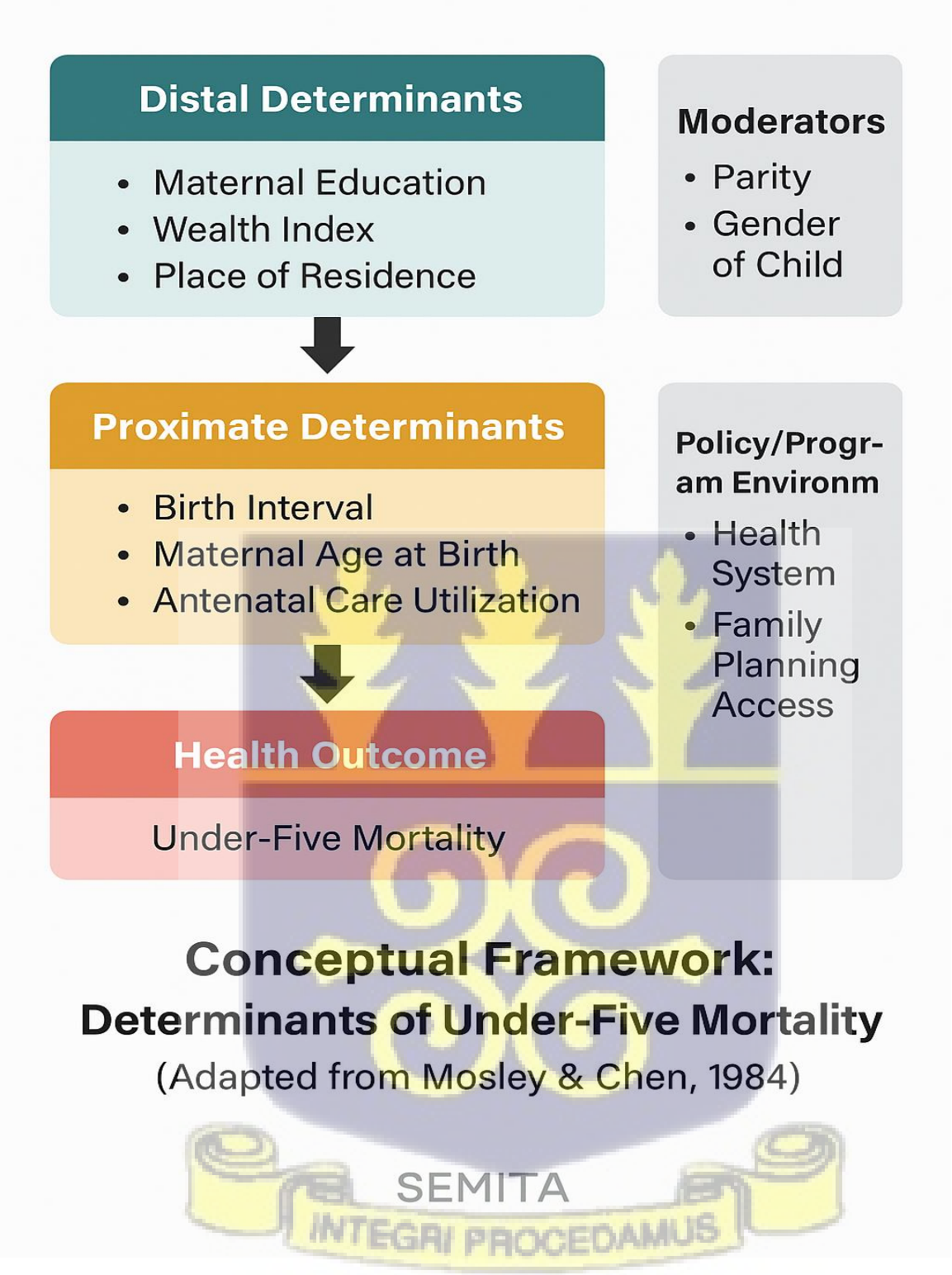

Figure 1: Conceptual framework

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction to Under-Five Mortality and Global Trends

Under-five mortality (U5M), defined as the death of a child before the fifth birthday, is a core indicator of population health and reflects the quality of maternal and child health services, socio-economic development, and the functionality of health systems. Despite major global health initiatives, approximately 5 million children under five years of age die annually, with the vast majority of these deaths occurring in low- and middle-income countries (LMICs) (WHO, 2020; UNICEF, 2021). Sub-Saharan Africa and South Asia bear a disproportionate burden, accounting for over 80% of global U5M cases, largely due to structural inequalities, fragile health systems, and limited access to essential services.

Global efforts have made significant progress in reducing child mortality, with under-five deaths declining from 12.5 million in 1990 to 5 million in 2020. This translates to a reduction from 93 deaths per 1,000 live births in 1990 to 37 per 1,000 in 2020 (UN IGME, 2021). However, this global average masks substantial disparities: in high-income countries, U5M rates are as low as 5 per 1,000 live births, while in many sub-Saharan African countries, the rate exceeds 70 per 1,000.

Infectious diseases, particularly pneumonia, diarrhea, malaria, and neonatal sepsis, remain the leading direct causes of death among under-five children. Malnutrition is an underlying factor in nearly 45% of these deaths, primarily by increasing vulnerability to infections and delaying recovery (Black et al., 2013). Additionally, inadequate access to skilled birth attendants, low immunization coverage, poor water and sanitation, and weak referral systems contribute to persistently high mortality rates in LMICs (UNICEF, 2022).

To address these challenges, the global community has committed to Sustainable Development Goal 3.2, which aims to reduce U5M to at least 25 deaths per 1,000 live births by 2030 and neonatal mortality to 12 per 1,000 live births. Yet, current trajectories indicate that many LMICs are not on track to meet these targets unless accelerated and context-specific interventions are implemented (UN IGME, 2022).

Among the many determinants of U5M, the timing and spacing of births, referred to as birth intervals—have gained increasing attention as a modifiable factor. Empirical evidence suggests that short birth intervals, particularly those less than 24 months, are associated with adverse maternal and child health outcomes, including increased risks of low birth weight, preterm birth, neonatal infections, and under-five mortality (Conde-Agudelo et al., 2012; Kozuki et al., 2013). These effects are explained through multiple biological and behavioral pathways, such as maternal nutrient depletion, limited care capacity, and insufficient inter-pregnancy recovery.

In many high-burden settings, particularly sub-Saharan Africa, cultural norms, low contraceptive uptake, and weak health education systems contribute to short birth intervals being common, despite their well-documented risks. Studies in countries like Ethiopia, Nigeria, and Ghana reveal that a large proportion of women have birth intervals of less than 24 months, placing both themselves and their children at higher risk of adverse outcomes (Budu et al., 2021; Shifti et al., 2023).

In Ghana, progress has been made in reducing child mortality through expanded immunization, improved facility-based deliveries, and maternal education campaigns. Nevertheless, U5M remains above the SDG threshold, with a national rate of 25 deaths per 1,000 live births reported in the 2022 Ghana Demographic and Health Survey (GSS, 2022). Persistent disparities between

rural and urban populations, unequal distribution of health resources, and sociocultural practices that encourage frequent childbirth continue to undermine national efforts.

The implications of high under-five mortality extend beyond public health, as child deaths affect family well-being, economic productivity, and national development. Therefore, identifying and addressing modifiable risk factors, such as short birth intervals, offers a cost-effective and impactful pathway for reducing child mortality and achieving Ghana's health-related development goals.

This chapter reviews the literature on under-five mortality and the role of birth spacing, beginning with theoretical frameworks and empirical studies that have investigated the link between birth intervals and child survival. Subsequent sections will examine socio-economic, cultural, and policy-related factors influencing birth intervals, drawing on both global and Ghana-specific evidence.

2.2 The Role of Birth Intervals in Child Mortality: Theoretical and Empirical Perspectives

Birth intervals, defined as the time between two successive live births, play a critical role in shaping maternal and child health outcomes. Numerous studies have identified short birth intervals, especially those less than 24 months, as a significant risk factor for under-five mortality (U5M). The adverse consequences associated with inadequate spacing are mediated through biological, physiological, and socio-behavioral mechanisms that compromise both the mother's ability to recover and the newborn's likelihood of survival.

From a theoretical standpoint, the "maternal depletion hypothesis" remains one of the most widely accepted frameworks for explaining the negative outcomes of short birth intervals. According to this model, women who conceive again shortly after delivery do not have sufficient time to replenish essential nutritional stores, particularly iron and folate, resulting in heightened risks of

pregnancy complications, poor fetal development, and early infant death (Rutstein, 2005; Conde-Agudelo et al., 2012).

Closely linked to this is the "sibling competition hypothesis," which posits that short intervals reduce the time and attention a caregiver can dedicate to each child, particularly in resource-constrained households. When children are born in rapid succession, older siblings may still be heavily dependent, thereby increasing the caregiving burden and diluting resources such as food, healthcare, and parental care (DaVanzo et al., 2008; Kozuki et al., 2013).

2.2.1 Maternal Depletion Syndrome and the Impact on Child Health

Maternal depletion syndrome describes the physiological toll that repeated pregnancies place on a woman's body when not adequately spaced. Physiological consequences of maternal depletion include reduced uterine tone, anemia, gestational hypertension, and suboptimal lactation, all of which elevate the risk of adverse pregnancy outcomes (Conde-Agudelo et al., 2012). These risks are compounded in low-resource settings where maternal nutrition is already compromised and access to antenatal care is limited.

Women who experience closely spaced pregnancies are more likely to deliver infants with low birth weight, face increased odds of preterm labor, and encounter complications during delivery. These maternal risks translate directly into neonatal vulnerability, contributing to higher incidences of perinatal asphyxia, respiratory distress, neonatal infections, and early death (Shifti et al., 2023; Alhassan, 2022).

Moreover, maternal psychological stress—a less often discussed but equally important factor—tends to be higher among women with short intervals between births. Stress, driven by financial strain, inadequate social support, and role overload, may affect pregnancy outcomes via neuroendocrine and behavioral pathways, including reduced prenatal care utilization and poor

dietary practices (Islam et al., 2022).

2.2.2 Empirical Evidence: Linking Short Birth Intervals to Increased Mortality Risks

The empirical literature consistently reinforces the theoretical assertions about the impact of short birth intervals on child survival. In a landmark multi-country analysis involving 52 DHS datasets, Kozuki et al. (2013) found that children born after intervals of less than 24 months faced a 70% higher risk of dying before age five compared to those with intervals of 36–47 months. The mortality risk remained significant even after adjusting for socio-economic and healthcare-related confounders.

Dadi (2015) conducted a meta-analysis of observational studies across LMICs and reported that birth intervals shorter than 18 months were associated with a 52% higher risk of under-five mortality. The review also noted that closely spaced births were linked to an increased incidence of common childhood illnesses such as pneumonia and diarrhea, further increasing early life vulnerability.

In West Africa, Budu et al. (2021) analyzed DHS data from eight countries and demonstrated that children born after short birth intervals faced significantly higher mortality risks, particularly in rural areas. This risk was more pronounced among children born to mothers with low educational attainment and among households in the lowest wealth quintile, indicating an intersectional disadvantage.

In Ghana, Islam et al., (2022) used multivariate regression models on GDHS data to show that the odds of under-five death were nearly twice as high for children born less than two years after a sibling. Their findings emphasized the need to tailor maternal health interventions to account for socio-demographic vulnerabilities that compound the effects of short birth spacing.

Despite strong empirical evidence, the causal pathways linking birth intervals and child survival

remain complex due to the confounding influence of unobserved variables, including maternal health behaviors and access to services. Nonetheless, the consistency and magnitude of associations across diverse populations underscore the importance of birth interval as a critical factor in child survival policies and programs.

2.3 Socio-Economic and Cultural Influences on Birth Intervals

While biological factors explain much of the physiological risk associated with short birth intervals, socio-economic and cultural factors are equally important determinants of birth spacing behaviors. These determinants operate through structural inequities, community norms, and household-level decision-making dynamics that affect a woman's autonomy, access to health services, and control over reproductive choices.

The social determinants of health framework posits that individuals' health outcomes are influenced by the conditions in which they are born, grow, work, and age. Applying this lens to birth spacing reveals that maternal education, household income, geographical location, healthcare access, cultural expectations, and religious beliefs all significantly shape birth interval patterns (Marmot et al., 2008; WHO, 2021).

2.3.1 The Global Significance and Implications for Policy

Global evidence shows that longer birth intervals contribute to improved maternal and child health, yet these outcomes are unevenly distributed. In high-income countries, women benefit from universal access to health services, education, and employment, all of which support planned pregnancies and optimal birth spacing. In contrast, women in LMICs often face constraints that limit their ability to space births, including poverty, illiteracy, and restrictive gender norms (Kozuki et al., 2013; Dadi, 2015).

Policy responses must therefore consider the broader ecosystem within which birth spacing

decisions are made, moving beyond individual-level behavior change to structural solutions such as education access, family planning service integration, and social protection schemes.

2.3.2 Socioeconomic and Health Determinants Influencing Birth Intervals

Socioeconomic status remains a powerful determinant of reproductive behavior. Women from low-income households often have reduced access to contraceptives, fewer antenatal care visits, and lower health literacy, all of which contribute to short birth intervals and associated risks. Studies show that economic insecurity can lead to unintended pregnancies due to limited autonomy and negotiating power within households (Islam et al., 2022; Budu et al., 2021).

Health determinants also play a central role. Inadequate healthcare infrastructure, particularly in rural areas, leads to limited availability of family planning services, poor counseling on birth spacing, and logistical challenges in accessing clinics. These barriers result in higher unmet need for contraception and subsequent short birth intervals (Alkema, 2014; Shafiqur Rahman, 2016).

2.3.3 Maternal Education and Its Impact on Birth Spacing

Maternal education is one of the most consistent predictors of longer birth intervals. Educated women are more likely to understand reproductive health information, access healthcare services, and independently make decisions regarding fertility and contraception. Additionally, education is often correlated with delayed marriage and reduced desired fertility, both of which facilitate longer intervals between births (Budu et al., 2021; Shifti et al., 2023).

In Ghana, women with secondary or higher education have been shown to initiate contraceptive use earlier, attend more antenatal visits, and space their pregnancies more effectively than those with no formal education (GSS, 2022). This underscores the importance of investing in girl-child education not only as a development goal but also as a strategy for improving maternal and child health outcomes.

2.3.4 Household Income and Socio-Economic Status

Household income influences access to both knowledge and resources necessary for birth spacing. Women in wealthier households tend to experience longer birth intervals because they can afford contraceptive methods, access higher-quality healthcare, and live in communities where modern family planning is normalized (Awoonor-Williams et al., 2016).

Conversely, poverty exacerbates the risk of rapid successive pregnancies. Financial hardship often intersects with low education and limited access to reproductive health services, particularly in rural or peri-urban settings. Poor women may also face higher fertility pressures due to cultural expectations or perceived economic benefits of larger families.

2.3.5 Access to Healthcare and Family Planning Services

One of the most actionable determinants of birth spacing is access to health services—especially family planning. In settings where healthcare infrastructure is under-resourced or fragmented, women may not receive adequate counseling on interpregnancy intervals. Stock-outs of contraceptives, lack of privacy, and provider bias further hinder service uptake (Budu et al., 2021; Alkema, 2014).

Mobile health units, community-based health workers, and task-shifting strategies have shown promise in expanding contraceptive coverage in hard-to-reach areas. However, their scalability remains limited by funding constraints and inconsistent policy implementation.

2.3.6 Cultural Beliefs and Societal Norms

Cultural norms significantly shape reproductive choices. In many African societies, large families are perceived as a source of social security, labor, and status. These cultural scripts may discourage the use of contraception and normalize short birth intervals, despite known health risks (Shifti et al., 2023; Awoonor-Williams et al., 2016).

Religious beliefs also play a dual role—some interpretations promote responsible parenthood and birth spacing, while others discourage any form of birth control. Health promotion strategies must therefore engage religious and community leaders as allies in reshaping narratives around family planning.

2.3.7 Health Literacy and Awareness

Health literacy—the ability to access, comprehend, and use health information—strongly influences birth spacing decisions. Women with limited health literacy may not understand the risks of short intervals or may not know how to navigate healthcare systems to obtain contraceptives. Community-based education campaigns and women's groups have been shown to improve health literacy and contraceptive uptake (Dadi, 2015; Kanmiki et al., 2014).

2.3.8 The Role of Government and Policy Interventions

Government commitment is essential for creating an enabling environment for optimal birth spacing. National policies that provide free or subsidized contraception, expand reproductive health education, and integrate family planning into primary healthcare delivery have proven effective in countries like Rwanda and Ethiopia (Alhassan, 2022).

Ghana's Reproductive Health Strategic Plan emphasizes family planning as a critical tool for reducing maternal and child mortality, yet implementation remains uneven. Addressing policy bottlenecks and ensuring consistent funding can bridge these gaps and improve equity in birth spacing outcomes.

2.3.9 The Impact of Birth Spacing on Neonatal and Infant Health Outcomes

Short birth intervals are closely associated with adverse neonatal outcomes. Neonates born after brief intervals face higher risks of low birth weight, preterm delivery, and infections—all leading causes of neonatal and infant mortality. Studies show that adequate spacing (at least 24 months)

can reduce neonatal deaths by up to 50% in some LMICs (Kozuki et al., 2013; Aheto, 2019). Furthermore, closely spaced pregnancies reduce the likelihood of exclusive breastfeeding, disrupt maternal nutritional recovery, and limit parental investment, all of which affect early childhood health and survival.

2.3.1 Male Involvement and Reproductive Decision-Making

Reproductive decision-making is often a shared or male-dominated process in many LMICs. Men frequently serve as the primary decision-makers regarding contraceptive use, family size, and healthcare expenditures. Yet, most maternal and child health programs disproportionately target women, thereby neglecting an important stakeholder (Apanga et al., 2019; Ezeh et al., 2020).

In Ghana, limited male participation in antenatal care and family planning discussions has been cited as a barrier to optimal birth spacing. Programs that engage men through workplace sensitization, peer education, and couple-focused counseling have shown promise in promoting shared responsibility for family planning (Dako-Gyeke & Kofie, 2020).

Involving men can also help challenge harmful gender norms and empower women to negotiate birth spacing and contraceptive use more confidently. Moving forward, gender-transformative approaches are needed to promote equitable reproductive health decision-making.

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2.4 Biological Mechanisms Linking Short Birth Intervals to Poor Neonatal Health

Maternal depletion syndrome is one of the primary biological mechanisms through which short birth intervals negatively affect maternal and neonatal health. As discussed in previous sections, when women have pregnancies with insufficient spacing, they do not have adequate time to recover nutritionally or physiologically, leading to various complications in subsequent pregnancies. This depletion affects the maternal body's ability to provide optimal nutrition and care for the developing fetus, increasing the likelihood of adverse pregnancy outcomes, including preterm birth, low birth weight, and intrauterine growth restriction (IUGR) (Conde-Agudelo et al., 2012; Kozuki et al., 2013).

Preterm birth is one of the most significant outcomes associated with short birth intervals. Preterm births are defined as those occurring before 37 weeks of gestation, and they are a major contributor to neonatal mortality. Short birth intervals often lead to insufficient maternal recovery, impairing the body's ability to sustain a full-term pregnancy. A study by Dadi (2015) revealed that children born after a birth interval of fewer than 18 months were 36% more likely to be preterm compared to those born after longer intervals. Preterm infants are at increased risk of complications such as respiratory distress syndrome, infections, and neurological impairments, all of which contribute to elevated neonatal and infant mortality.

Additionally, low birth weight (LBW), which is defined as a birth weight of less than 2,500 grams, is a significant risk factor for infant mortality. Short birth intervals increase the likelihood of LBW due to the limited time for the mother's body to replenish essential nutrients between pregnancies. Maternal depletion syndrome plays a crucial role in this outcome by reducing the availability of critical nutrients needed for fetal growth and development (Conde-Agudelo et al., 2012; Shafiqur Rahman, 2016). Low birth weight is associated with a higher incidence of infant morbidity, including increased susceptibility to infections, delayed growth, and developmental delays, all of which increase the risk of early death in infants.

2.4.1 Neonatal Infections and Other Morbidities

Another significant risk associated with short birth intervals is an increased likelihood of neonatal infections. Infants born after short intervals have less time to develop immunity from the mother, which compromises their ability to fight infections. Kanmiki et al., (2014) found that short birth intervals are associated with higher rates of neonatal infections such as pneumonia, sepsis, and diarrhea. These infections are a leading cause of neonatal mortality, particularly in sub-Saharan Africa and South Asia, where healthcare access is limited.

Islam et al., (2022) further explored the relationship between short birth intervals and neonatal infections in LMICs, highlighting the vulnerability of neonates born with insufficient maternal recovery and immunological support. This vulnerability is especially pronounced in regions where healthcare infrastructure is insufficient, and the prevalence of diseases like malaria and respiratory infections is high. Neonatal infections, which are often preventable with adequate prenatal care and hygiene, are more common among children born after short intervals due to inadequate maternal health during pregnancy.

Short birth intervals can also lead to other neonatal complications, such as fetal malnutrition, which

affects both birth weight and neonatal health. Alhassan (2022) discusses how shorter birth intervals, coupled with maternal undernutrition, can lead to IUGR, which is associated with long-term developmental delays and higher mortality risks. These long-term effects highlight the importance of birth spacing in preventing not only immediate neonatal mortality but also lifelong health challenges for children.

2.4.2 Empirical Evidence on Birth Spacing and Neonatal Mortality

Empirical studies consistently confirm that shorter birth intervals are associated with a higher risk of neonatal and infant mortality. A study by Kozuki et al., (2013), based on data from 52 countries, found that children born after a birth interval of less than 24 months faced up to 70% higher risks of mortality compared to children born after intervals of 36–47 months. This study provided strong evidence that birth intervals of less than two years significantly increase the likelihood of neonatal death due to the physiological burden placed on both the mother and the newborn.

Further support for this relationship comes from Budu et al., (2021), who analyzed birth interval data across several West African countries and found that longer birth intervals were associated with lower neonatal mortality rates. The study highlighted the role of maternal health in reducing the incidence of neonatal death, noting that mothers with longer birth intervals were more likely to access prenatal care, adequate nutrition, and immunization services, all of which are vital for preventing neonatal mortality.

Similarly, Aheto (2019) found that in Ghana, short birth intervals were linked to a higher risk of neonatal deaths due to complications such as preterm birth, low birth weight, and respiratory distress. This study underscores the urgency of addressing birth spacing in high-burden regions to mitigate the risks associated with inadequate maternal recovery and improve neonatal health outcomes.

2.5 Policy Implications and Interventions for Optimizing Birth Spacing

Optimal birth spacing is a critical strategy for improving maternal and child health outcomes, yet achieving it requires targeted, multifaceted policy interventions. These interventions should address both the socio-economic determinants and the healthcare barriers that influence birth spacing practices, particularly in low- and middle-income countries (LMICs) where short birth intervals are more prevalent. This section explores the policy implications and the most effective interventions that can reduce the risks associated with short birth intervals, focusing on family planning, healthcare access, maternal education, and socio-cultural factors.

2.5.1 Strengthening Family Planning Programs

Family planning programs are at the core of efforts to promote optimal birth spacing. Access to contraceptive methods enables women to plan and space their pregnancies effectively, which directly reduces the risks of maternal depletion syndrome, preterm birth, and low birth weight—all of which contribute to under-five mortality. Countries that have invested in comprehensive family planning programs have seen marked improvements in birth spacing and maternal health outcomes.

A study by Budu et al., (2021) examining birth intervals in West Africa found that countries with well-established family planning programs, such as Ghana and Rwanda, have seen reductions in short birth intervals and lower rates of neonatal mortality. In these countries, family planning services are integrated into the broader maternal and child health systems, making contraception more accessible and affordable for women, especially in rural areas. Government subsidies for contraception, along with mobile health clinics and community health workers, have been identified as essential components of successful family planning initiatives, particularly in areas with limited access to healthcare infrastructure (Shifti et al., 2023).

Islam et al., (2022) emphasize the importance of community-based family planning initiatives, where local health workers educate and empower communities to utilize available reproductive health services. These programs have been particularly effective in sub-Saharan Africa, where large proportions of women still face significant barriers to accessing contraception. Governments and international agencies should prioritize expanding family planning outreach programs, especially in rural and marginalized communities, to provide women with the resources they need to space their births safely.

2.5.2 Integrating Family Planning into Maternal and Child Health Programs

While family planning is crucial, integrating family planning services into maternal and child health (MCH) programs can magnify the benefits of optimal birth spacing. By providing holistic care that includes reproductive health, maternal nutrition, and childhood immunization, health systems can address the broader determinants of maternal and child health. This integrated approach ensures that women receive comprehensive care during both their pregnancy and postnatal periods, which is vital for ensuring the well-being of both mothers and children.

Studies by Alhassan (2022) and Awoonor-Williams et al., (2016) underscore the need for collaborative efforts between family planning programs, antenatal care services, and postnatal care to ensure that all aspects of maternal health are addressed. In many LMICs, pregnant women may not have access to all the necessary services, such as prenatal education, nutrition support, and family planning counseling. Integrating these services into a cohesive health program increases the likelihood that women will space their births appropriately and adopt healthier practices during pregnancy.

Governments and international organizations should prioritize comprehensive health systems strengthening to ensure that family planning is available as part of a continuum of care for women

from pregnancy through postnatal recovery. By integrating family planning into routine maternal and child health services, women can be empowered to make informed choices about their reproductive health, leading to improved health outcomes for both mothers and their children.

2.5.3 Maternal Education and Health Literacy

Maternal education is one of the most significant factors influencing birth spacing decisions. Educated women are more likely to understand the risks of short birth intervals and are more likely to use contraception to space their pregnancies. Studies have consistently shown that increasing maternal education can lead to longer birth intervals and better child health outcomes. Budu et al., (2021) and Alkema et al., (2014) argue that maternal education not only empowers women to make informed decisions about family planning but also improves the chances that they will seek and adhere to prenatal and postnatal care, both of which are crucial for maternal and child health.

One successful example is Rwanda's approach to improving maternal education and health literacy. The country has implemented widespread public health campaigns focusing on family planning and maternal health education, targeting women at all levels of education. These programs have led to a significant increase in contraceptive use and birth spacing, contributing to a reduction in neonatal mortality rates (Awoonor-Williams et al., 2016). The key to these initiatives is the inclusion of health literacy components that educate women about the health risks of short birth intervals, including the impact on maternal nutrition and fetal development.

Shafiqur Rahman (2016) highlights the importance of community-based health education programs in LMICs, where health literacy is often low, particularly in rural areas. These programs should be designed to provide culturally appropriate information about the benefits of optimal birth spacing and the availability of family planning resources. Engaging local health workers, community leaders, and religious leaders in promoting maternal education can also help shift

societal attitudes toward family planning and improve birth spacing practices in these communities.

2.5.4 Culturally Sensitive Health Promotion and Community Engagement

Cultural beliefs and societal norms significantly influence reproductive health decisions, particularly in sub-Saharan Africa and South Asia, where large families are often culturally valued. In these contexts, women may face social pressure to have children in quick succession, even when they are aware of the health risks associated with short birth intervals. Culturally sensitive health education is, therefore, essential in promoting birth spacing practices that are both acceptable and beneficial to the community.

Studies by Awoonor-Williams et al., (2016) and Shifti et al., (2023) emphasize the need for community-based interventions that engage local leaders and community influencers in promoting birth spacing. These interventions should respect cultural norms while providing evidence-based information on the health risks of short birth intervals. For example, in rural Ghana, community-based programs have effectively used local leaders to spread awareness about the benefits of family planning and optimal birth spacing, which has led to an increase in the use of contraceptives and a reduction in neonatal mortality (Alhassan, 2022).

Moreover, community health workers (CHWs) play a vital role in delivering culturally appropriate health education and services to women in rural and remote areas. These workers, who are often trusted members of their communities, can help break down barriers to family planning by providing information, distributing contraceptives, and assisting in health service navigation. Integrating CHWs into the maternal and child health system is crucial for increasing birth spacing and reducing the health risks associated with short birth intervals in low-resource settings.

2.5.5 Addressing Healthcare Access and Infrastructure

Access to quality healthcare and family planning services is crucial for promoting longer birth intervals and improving maternal and child health outcomes. In many rural areas of LMICs, however, there are significant barriers to accessing healthcare, including poor transportation, limited availability of trained healthcare workers, and insufficient healthcare infrastructure. Budu et al., (2021) and Kanmiki et al., (2014) emphasize the importance of improving healthcare access by expanding mobile health clinics, establishing community health centers, and improving transportation networks to facilitate healthcare access in remote areas.

Alkema (2014) highlights the need for public-private partnerships in addressing healthcare disparities, particularly in areas where government resources are insufficient. Through collaborations with non-governmental organizations (NGOs) and international health organizations, governments can increase the availability of family planning services, enhance maternal care, and provide health insurance schemes that make reproductive health services more affordable and accessible.

In addition to improving physical healthcare infrastructure, the training and deployment of healthcare workers in rural and underserved areas is essential. By ensuring that healthcare workers are equipped with the skills and resources to provide high-quality maternal and child health services, countries can address the underlying barriers to family planning and improve birth spacing practices.

In conclusion, promoting optimal birth spacing is essential to improving maternal and child health outcomes and reducing under-five mortality. Effective policy interventions must address the socio-economic, healthcare, and cultural factors that influence birth spacing practices. Family planning programs, maternal education, community-based health initiatives, and government policies must

work together to create an environment where women have the knowledge, resources, and support to space their births optimally. By improving healthcare access, addressing cultural barriers, and expanding family planning services, countries can make substantial progress in reducing neonatal and infant mortality rates, ultimately achieving Sustainable Development Goal 3.2 and improving global health outcomes.

Achieving optimal birth spacing is one of the most effective ways to improve maternal and child health and reduce under-five mortality globally. Evidence from studies across LMICs consistently shows that short birth intervals are a major risk factor for neonatal and infant mortality, and addressing this issue requires a multi-faceted approach. The evidence gathered from Budu et al., (2021), Islam et al., (2022), Shifti et al., (2023), and other key studies reinforces the importance of integrating family planning programs, maternal health education, improved healthcare infrastructure, and community engagement to achieve better birth spacing outcomes.

Government and international agencies must prioritize family planning as a cornerstone of maternal and child health policies. Expanding access to contraceptives, especially in rural and underserved areas, is essential to enabling women to space their births safely. Public-private partnerships are also critical in ensuring that women, particularly those in marginalized communities, have access to affordable contraceptive options and quality health services. Such partnerships can facilitate the distribution of contraceptives, health education, and reproductive health counseling through local health workers, NGOs, and community-based organizations.

In addition, improving health literacy among women, particularly in rural communities, is essential for enabling them to make informed decisions about their reproductive health. Educational campaigns focusing on the health risks of short birth intervals, the benefits of optimal birth spacing, and the availability of family planning resources should be integral to any public health initiative

aimed at reducing U5M. Culturally sensitive health promotion, which considers local norms, values, and beliefs, will help to overcome resistance to family planning practices and facilitate the adoption of longer birth intervals in communities where large families are culturally valued.

Healthcare system strengthening is another critical component of this strategy. Governments must invest in primary healthcare infrastructure, maternal health services, and trained healthcare professionals, particularly in rural and remote areas. This ensures that every woman, regardless of her socio-economic status or geographic location, has access to prenatal care, family planning services, and postnatal care. Mobile health clinics, community health workers, and task-shifting strategies can further bridge gaps in healthcare access, particularly in underserved areas where access to formal healthcare facilities is limited.

The implementation of integrated health services—where family planning, prenatal care, postnatal care, and maternal education are offered as a continuum of care—is crucial in improving birth spacing practices. The integration of these services increases service utilization, as women are more likely to seek healthcare when it is conveniently available and comprehensive. Furthermore, the integration of cultural and community-specific solutions, such as engaging local leaders and faith-based organizations, can have a profound impact in changing social norms and increasing the adoption of birth spacing practices.

In summary, the impact of birth spacing on maternal and child health cannot be overstated. Ensuring that women have access to the necessary resources to space their births optimally is an effective strategy for reducing under-five mortality. This requires a concerted effort to address the socio-economic, healthcare, and cultural barriers that hinder the adoption of safe birth spacing practices. By improving maternal education, expanding access to family planning, strengthening healthcare systems, and addressing cultural norms, countries can significantly reduce the risks

associated with short birth intervals and improve health outcomes for both mothers and children. Public health efforts aimed at reducing U5M must prioritize optimal birth spacing, as it is one of the most cost-effective and impactful interventions to enhance child survival. As evidence increasingly highlights the importance of birth intervals, family planning policies and maternal health interventions should be designed and implemented as part of broader national health strategies. In doing so, we can take significant strides toward achieving Sustainable Development Goal 3.2 and improving maternal and child health outcomes globally.

2.6 Future Research Directions and Gaps in Knowledge

While the relationship between birth intervals and under-five mortality (U5M) is well-documented, several research gaps persist. The complex interplay of socio-economic, healthcare, cultural, and biological factors influencing birth spacing requires more nuanced investigation, particularly in low- and middle-income countries (LMICs). Despite the substantial body of evidence on the risks associated with short birth intervals, there is a need for more longitudinal studies, region-specific research, and policy-oriented evaluations. This section discusses the major gaps in knowledge, outlines the importance of further research, and highlights the opportunities for future investigations to deepen our understanding of this critical public health issue.

2.6.1 Need for Longitudinal Studies to Establish Causal Links

Most of the existing research on birth intervals and U5M relies on cross-sectional data, which can establish associations but cannot confirm causality. While studies such as those by Kozuki et al., (2013) and Budu et al., (2021) have demonstrated strong correlations between short birth intervals and increased mortality risk, longitudinal studies are necessary to better understand the causal mechanisms at play. Long-term studies that track maternal and child health over multiple pregnancy cycles are essential to examine how maternal health and nutritional status deteriorate

with closely spaced pregnancies and how this affects long-term health outcomes for both mothers and children. Dadi (2015) and Conde-Agudelo et al., (2012) have argued that short birth intervals lead to cumulative effects on both maternal health and child survival, yet more rigorous longitudinal studies are needed to quantify these impacts over time.

A key recommendation for future research is to incorporate longitudinal cohort studies across different populations, especially in regions with high U5M, such as sub-Saharan Africa. These studies can track changes in maternal health indicators, the timing of subsequent pregnancies, and infant health outcomes, enabling researchers to make more definitive conclusions about the causal relationships between birth intervals and neonatal outcomes. Additionally, longitudinal research would be valuable in assessing how interventions (such as improved family planning services and maternal nutrition programs) affect birth spacing practices and U5M rates over time.

2.6.2 Regional and Context-Specific Research

Research on birth intervals and U5M has been predominantly focused on large-scale surveys and studies that may not fully capture the nuances of regional differences. Although studies like those by Shifti et al., (2023) and Kanmiki et al., (2014) offer valuable insights, there is a need for region-specific studies that explore how local healthcare systems, cultural practices, and socio-economic conditions influence birth spacing and child mortality rates. For example, Alhassan (2022) notes that the effects of short birth intervals in rural Ghana differ significantly from those in urban settings due to variations in healthcare access, maternal education, and cultural attitudes toward family size. In such settings, birth spacing interventions might need to be adapted to meet specific local needs.

Further contextual research is required to understand how urbanization, migration, and shifting cultural norms are influencing birth spacing in different regions. The growing trend of migration

to urban centers in Africa and South Asia could be altering traditional family structures and childbearing practices, yet this has not been extensively studied. Urban areas often have better access to healthcare, but they also face challenges such as overcrowding and increased living costs, which can influence family planning choices. A comprehensive examination of how socioeconomic shifts, such as increasing wealth disparity and migration, are affecting birth spacing would provide valuable insights for tailoring public health policies.

2.6.3. Exploring Socio-Cultural Factors and Their Impact on Birth Spacing

While biological and socio-economic factors are often the focus of studies on birth intervals, cultural factors also play a crucial role in shaping reproductive health behaviors. Cultural norms, such as preferences for large families and societal pressures on women to bear children quickly, can be significant barriers to adopting safe birth spacing practices. Awoonor-Williams et al., (2016) and Shifti et al., (2023) have noted that many rural communities in sub-Saharan Africa, for example, have strong cultural preferences for larger families, which often leads to closely spaced births despite the known health risks.

Future research should include deeper ethnographic studies and qualitative research methods to better understand how cultural beliefs, social pressures, and religious influences shape birth spacing decisions. Studies such as those by Alkema et al., (2014) have started to explore these dynamics but more in-depth analysis is needed. Understanding the underlying cultural contexts will enable policymakers to design more effective community-based interventions that respect local traditions while promoting healthier reproductive practices. Moreover, integrating community-based leaders, including religious leaders and local health workers, into family planning programs could prove effective in addressing culturally rooted barriers.

2.6.4 Evaluating the Effectiveness of Interventions

Although there is a growing body of research on the risks of short birth intervals, there is limited research on the effectiveness of interventions designed to address this issue. Many countries have implemented family planning programs, but their impact on actual birth spacing practices and U5M reduction has not been sufficiently evaluated. Islam et al., (2022) and Awoonor-Williams et al., (2016) point out that while family planning services are widely available in many LMICs, their utilization often remains low due to barriers such as cultural beliefs, socio-economic disparities, and gender inequality.

Future research should focus on evaluating the effectiveness of different interventions, including family planning programs, maternal health education, and healthcare infrastructure improvements, in increasing birth spacing and reducing U5M. Randomized controlled trials (RCTs) and longitudinal studies evaluating the impact of health policy reforms, such as the integration of family planning into maternal health services, can provide robust evidence to guide future interventions. For instance, the success of programs in Rwanda and Ghana, where family planning services are integrated into maternal health programs, should be rigorously evaluated to determine their effectiveness in improving birth spacing practices and reducing child mortality (Shafiqur Rahman, 2016).

2.6.5 Impact of Healthcare System Strengthening on Birth Spacing

One of the most significant barriers to optimal birth spacing in LMICs is the inadequate healthcare infrastructure. Research should investigate how strengthening healthcare systems, especially primary healthcare systems, affects birth spacing practices and maternal health outcomes. Shifti et al., (2023) found that in areas where healthcare access is limited, women are less likely to space their births effectively due to a lack of information, resources, and support. Kanmiki et al., (2014)

also emphasized that mobile health clinics and community health workers have been effective in improving access to family planning services in rural areas, but further studies are needed to assess the long-term sustainability of such models and their impact on birth spacing.

Healthcare systems strengthening should be a priority for future research, with an emphasis on how improvements in healthcare accessibility, maternal health services, and contraceptive availability influence birth spacing. Research in this area could include evaluating the impact of universal healthcare coverage, the integration of family planning into routine healthcare services, and mobile health interventions in remote areas. By improving access to these services, we can better understand how such interventions directly influence birth spacing and maternal health outcomes.

In conclusion, while the relationship between birth intervals and under-five mortality is well established, several important research gaps remain. These include the need for longitudinal studies to establish causality, region-specific studies to account for cultural and socio-economic differences, and evaluations of intervention effectiveness to identify best practices in family planning. Addressing these gaps will provide policymakers with the evidence needed to design more effective, culturally sensitive, and context-specific interventions to improve birth spacing and reduce neonatal and under-five mortality rates. In the long run, expanding our understanding of these issues will help us create more equitable and effective health systems that prioritize maternal and child health, particularly in regions with the highest burden of U5M.

2.7 Conclusions and Recommendations for Policy and Practice

2.7.1. Conclusions

The relationship between birth intervals and under-five mortality (U5M) is critical, as short birth intervals are consistently associated with an increased risk of neonatal and infant mortality. The

evidence presented in this review highlights the multifaceted nature of this relationship, with socio-economic, healthcare, and cultural factors playing significant roles in shaping birth spacing practices and their subsequent impact on maternal and child health outcomes.

Maternal depletion syndrome, poor maternal nutrition, and insufficient maternal recovery time between pregnancies are key biological mechanisms that link short birth intervals to poor health outcomes, such as preterm births, low birth weight, and neonatal infections. These factors, coupled with poor healthcare access and limited education, exacerbate the risks associated with closely spaced pregnancies, particularly in low- and middle-income countries (LMICs). Empirical studies such as those by Conde-Agudelo et al. (2012), Kozuki et al. (2013), and Budu et al. (2021) confirm the heightened mortality risks of children born after short birth intervals, while highlighting the protective benefits of longer birth spacing.

In addition to the biological risks, socio-economic disparities are a major determinant of birth intervals. Women in lower socio-economic strata, particularly in rural areas, are more likely to experience shorter birth intervals due to limited access to family planning services, healthcare, and education. As Islam et al. (2022) and Shifti et al. (2023) found, access to education and healthcare services is pivotal in enabling women to space their births effectively. In countries like Ghana, Rwanda, and others in sub-Saharan Africa, where birth intervals are often shorter due to socio-economic barriers, expanding access to contraception and maternal health services is essential.

Moreover, cultural norms that favor larger families or closely spaced births present significant challenges in addressing birth interval-related risks. In many communities, traditional beliefs and religious influences play a significant role in family planning decisions, often resulting in women facing societal pressure to have children quickly. As Awoonor-Williams et al. (2016) and Shafiqur Rahman (2016) point out, addressing these cultural factors through community-based

interventions and health education is vital for promoting the adoption of optimal birth spacing practices.

In summary, while substantial progress has been made in reducing under-five mortality globally, birth spacing remains an underutilized tool in improving child survival. The evidence underscores the importance of integrating family planning services into maternal health programs and addressing the socio-economic and cultural barriers to ensure better birth spacing practices, especially in high-burden regions.

2.7.2. Recommendations for Policy and Practice

Based on the findings from the literature review, the following recommendations are proposed to optimize birth spacing and reduce under-five mortality globally:

2.7.2.1. Expansion of Family Planning Services

The cornerstone of improving birth spacing lies in expanding access to family planning services. This involves not only making contraceptives widely available but also ensuring that family planning is an integral part of maternal health services. Government-led initiatives, supported by international organizations, must focus on increasing availability and affordability of contraceptives, particularly in rural and underserved communities. Programs like those in Rwanda and Ghana, which successfully integrated family planning services into broader maternal health systems, should serve as models for other countries. These services should be complemented with education on the benefits of optimal birth spacing and the health risks of short intervals, which can lead to preterm birth, low birth weight, and neonatal infections.

As Islam et al. (2022) and Awoonor-Williams et al. (2016) suggest, mobile health clinics and community health workers can bridge gaps in healthcare access, particularly in rural areas, by providing information on birth spacing and offering family planning services in remote

communities.

2.7.2.2. Maternal Education and Health Literacy Initiatives

Improving maternal education is a critical lever for promoting longer birth intervals. Budu et al. (2021) and Shifti et al. (2023) emphasize that educated mothers are more likely to space their births appropriately, which reduces the risks of maternal depletion and neonatal mortality. Therefore, education programs that teach women about the importance of birth spacing, as well as maternal nutrition and pregnancy care, should be prioritized, especially in LMICs. These programs should target both primary and secondary school-aged girls, to promote early awareness and equip them with the knowledge needed for informed reproductive health decisions.

Furthermore, health literacy campaigns must be designed to help women understand the risks associated with short birth intervals and the long-term health benefits of spacing births. Community-based health promotion campaigns, including radio programs, community health talks, and education through health workers, can be effective tools for reaching a wider audience in culturally sensitive ways.

2.7.2.3. Addressing Socio-Economic Barriers to Birth Spacing

The findings from Alhassan (2022) and Kanmiki et al. (2014) highlight that socio-economic barriers such as poverty, low household income, and poor access to healthcare are significant obstacles to optimal birth spacing. Government policies must address these disparities by increasing funding for healthcare infrastructure, subsidizing contraception, and improving the economic status of women, particularly in rural and underserved areas.

Efforts to reduce poverty through economic empowerment programs for women can also have a significant impact on birth spacing. Women with greater economic independence are more likely to make informed reproductive health decisions and have better access to family planning

resources. Programs that promote income generation, microfinance, and women's economic rights are critical in reducing birth interval disparities and promoting healthier family structures.

7.2.4. Culturally Sensitive Approaches to Family Planning Education

Addressing cultural norms that favor short birth intervals is essential for reducing U5M. As highlighted by Shafiqur Rahman (2016) and Awoonor-Williams et al. (2016), understanding the cultural context is crucial for designing effective interventions. Culturally sensitive education programs should engage local leaders, religious groups, and community health workers to advocate for birth spacing while respecting traditional values. Involving these community figures can help challenge misconceptions and provide a platform for disseminating accurate health information.

Religious leaders can play a pivotal role in advocating for the benefits of birth spacing in many communities. Engaging faith-based organizations in promoting maternal health and birth spacing can help to shift societal attitudes toward family planning and create a supportive environment for women to space their births.

2.7.2.5. Integrating Family Planning into Comprehensive Maternal Health Services

To ensure that birth spacing becomes a standard part of maternal health practices, family planning services should be integrated into the routine antenatal care (ANC) visits. Shifti et al. (2023) and Awoonor-Williams et al. (2016) argue that integrating family planning into prenatal and postnatal care can help to bridge gaps in service delivery and ensure that women have access to the necessary information and resources to space their pregnancies appropriately.

This approach not only improves access to contraceptive methods but also ensures that women receive continuous care throughout their reproductive journey, from pre-conception through to postnatal care. Health systems strengthening, particularly the improvement of primary healthcare

facilities, training healthcare workers, and expanding mobile health services, are essential to make family planning accessible to all women, especially those in rural and remote regions.

In conclusion, optimal birth spacing is one of the most effective strategies to reduce under-five mortality and improve maternal and child health. Short birth intervals are associated with significant risks, including preterm birth, low birth weight, and neonatal infections, all of which contribute to high mortality rates. The evidence from multiple studies emphasizes the importance of family planning, maternal education, and healthcare access in promoting birth spacing.

To address these issues, policy interventions should focus on expanding access to family planning, improving maternal education, strengthening healthcare systems, and addressing cultural barriers to birth spacing. By prioritizing these efforts, governments and international organizations can significantly reduce under-five mortality rates and improve the overall health and well-being of women and children globally.

Through integrated interventions, community engagement, and culturally sensitive approaches, we can create an environment where optimal birth spacing is the norm, not the exception, leading to healthier families and more prosperous societies.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter outlines the comprehensive methodology used in this study to investigate the relationship between birth intervals and under-five mortality (U5M) in Ghana using the 2022 Ghana Demographic and Health Survey (GDHS) data. It provides detailed descriptions of the research design, data source, sampling procedures, variables, data collection procedures, analytical methods, and ethical considerations. Given that this study utilizes secondary data, special attention has been paid to explaining how the data was handled and analyzed to address the research questions. This expanded methodology provides a robust framework for the study, ensuring clarity and rigor in assessing the impact of birth intervals on neonatal and under-five mortality rates in Ghana.

3.2 Research Design

This study employs a cross-sectional research design, which is appropriate for assessing relationships between birth intervals and under-five mortality at a specific point in time. As noted by Creswell & Creswell (2017), cross-sectional studies are invaluable for identifying patterns and associations in large, representative populations, particularly when the goal is to understand the relationship between key variables without implying causality. In this case, the cross-sectional design allows for the analysis of data on birth intervals and neonatal survival from the 2022 GDHS,

with a focus on under-five mortality in Ghana.

While cross-sectional designs do not establish causality, they are particularly valuable in identifying trends and associations across broad populations. This study is unique in its application to Ghana, as it incorporates nationally representative data with a focus on maternal and child health, making it possible to observe broad patterns in child survival based on birth spacing.

3.3 Study Setting

This study was conducted in Ghana, a country located in West Africa, known for its significant socioeconomic diversity. The urban and rural populations within Ghana differ substantially in terms of healthcare access, economic opportunities, and educational attainment, presenting both challenges and opportunities for understanding the complex determinants of under-five mortality. Ghana is divided into 16 administrative regions, each with its unique characteristics and challenges. The study leverages data from the 2022 Ghana Demographic and Health Survey (GDHS), which captures information from all these regions, enabling a comprehensive understanding of national health trends.

The study setting for this research includes both urban and rural areas across all 16 administrative regions, ensuring that the analysis accounts for regional disparities in healthcare access, maternal health practices, and socio-economic conditions. Urban areas, particularly in cities like Accra, tend to have better access to healthcare facilities, family planning services, and educational resources, contributing to improved maternal and child health outcomes. In contrast, rural areas often face significant challenges, such as limited healthcare infrastructure, fewer trained healthcare professionals, and lower levels of health literacy, which can exacerbate risks associated with child survival and birth spacing. This urban-rural divide plays a critical role in shaping birth spacing decisions and child survival outcomes, particularly with respect to under-five mortality.

The GDHS provides data on women of reproductive age (15–49 years) and their children born within the five years preceding the survey, capturing a snapshot of recent trends in maternal and child health in Ghana. By focusing on this demographic, the study aims to explore the impact of birth intervals on under-five mortality and how socio-economic factors such as maternal education, wealth, and healthcare access contribute to variations in child survival outcomes. The study setting, as described through the GDHS, reflects the nation's diverse population and highlights the socio-economic, cultural, and health-related factors that influence maternal and child health in the country.

As of September 22, 2022, Ghana's estimated population stands at 32,511,465 according to the Worldometer elaboration of the latest United Nations data. The country has sixteen administrative regions which include: the Northern Region, Ashanti Region, Western Region, Volta Region, Eastern Region, Upper West Region, Upper East Region, Central Region, Bono East Region, Greater Accra Region, Savannah Region, North-East Region, Oti Region, Western Region, Ahafo Region, and Bono Region. Figure 1 below shows the administrative regions of Ghana.

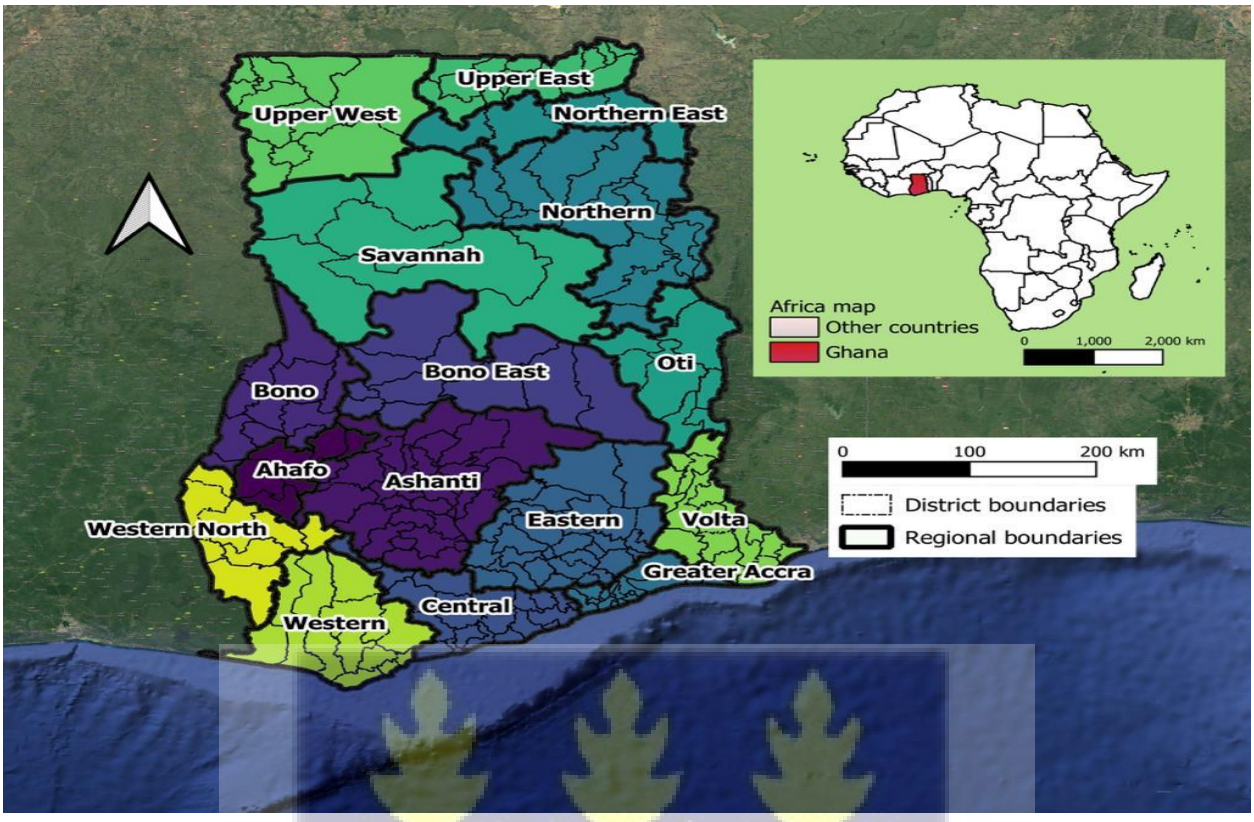

Figure 2: Showing the Map of Ghana

3.4 Data Source

The primary data source for this study is the 2022 Ghana Demographic and Health Survey (GDHS), a large-scale, nationally representative survey conducted by the Ghana Statistical Service (GSS), in collaboration with the Ghana Health Service and international partners. The GDHS is one of the country's most comprehensive datasets, providing a wealth of information on population health, fertility, family planning, maternal and child health, and other socio-economic variables. This survey is part of the Demographic and Health Surveys (DHS) project, a global initiative that collects standardized data across countries to monitor health and development trends.

The 2022 GDHS includes over 15,000 households, and the survey collects data on a wide range of topics such as birth histories, child mortality, maternal health behaviors, and socio-demographic

characteristics. Importantly, this study focuses on a subset of the data, specifically on women aged 15–49 years and their live-born children within the five years preceding the survey, to ensure that the analysis is current and relevant to recent trends in under-five mortality and birth intervals.

The 2022 GDHS is ideal for this study, as it provides detailed information on the timing between births (birth intervals), neonatal survival, maternal education, socio-economic status, and health behaviors that influence child survival outcomes.

3.5 Sampling Procedures

The 2022 GDHS used a stratified, two-stage sampling design to select the study sample. The sampling process ensures the representativeness of the data across all 16 administrative regions of Ghana, accounting for both urban and rural populations.

Stage 1 – Cluster Selection: Clusters were selected from a master sampling frame developed using the 2020 Ghana Population and Housing Census. These clusters were then stratified into urban and rural areas, ensuring the sampling captured both geographic settings accurately.

Stage 2 – Household Selection: Within each selected cluster, a random sample of households was drawn. This multi-stage approach ensures that the sample is representative of the population across key dimensions such as region, urbanization, and socio-economic status.

The final sample for the analysis consists of 9,353 women of reproductive age (15–49 years), all of whom have live-born children within the reference period (the five years prior to the survey). By using this robust sampling procedure, the study's findings can be generalized to the broader Ghanaian population.

3.6 Study Variables

The variables used in this study are classified into dependent variables, independent variables, and confounding variables. These are described in detail below:

Dependent Variable: Neonatal Mortality

Definition: Neonatal mortality is the death of a live-born child within the first 28 days of life.

Categorization: This is a binary variable, coded as 1 for neonatal death and 0 for survival past 28 days.

Independent Variable: Birth Interval

Definition: Birth interval is the time between two successive live births.

Categorization: Birth intervals are classified into three categories, based on WHO recommendations:

- Short (< 24 months)
- Medium (24–59 months)
- Long (≥ 60 months)

Socio-Demographic Covariates (Confounders)

- Maternal Age: Categorized into 15-19 years, 20-29 years, 30-39 years, and 40-49 years.
- Educational Level: Classified into no education, primary education, secondary education, and higher education.
- Socio-economic Status (SES): Using the wealth index with five quintiles: poorest, poorer, middle, richer, and richest.
- Place of Residence: Urban or rural.
- Region: The 16 administrative regions in Ghana.

Health-Related Covariates

- Antenatal Care Visits: Number of visits made by the mother during pregnancy.
- Skilled Birth Attendance: Whether the birth was attended by a skilled health professional (e.g., doctor, nurse, midwife).

3.6.1 Variable Selection and Justification

By considering these variables, the study aims to control for confounding factors that could influence both the timing of birth intervals and the likelihood of neonatal mortality.

Variables used in this study were selected based on a review of existing literature on birth intervals and under-five mortality, particularly studies conducted in sub-Saharan Africa and Ghana (e.g., Conde-Agudelo et al., 2012; Budu et al., 2021; Kozuki et al., 2013). The main outcome variable was under-five mortality, defined as the death of a child before the fifth birthday, derived from the child's birth history data in the GDHS.

The main explanatory variable was the length of the preceding birth interval, categorized as <24 months, 24–35 months, and ≥36 months, consistent with WHO recommendations and prior DHS-based studies.

Control variables were chosen to account for potential confounding factors and included maternal age, maternal education, household wealth index, place of residence (urban/rural), region, child sex, birth order, and access to healthcare. These variables were selected due to their theoretical and empirical relevance to child survival and reproductive behavior, as supported by the works of Islam et al. (2022), Shifti et al. (2023), and Alhassan (2022).

3.7 Analytical Methods

The data were analyzed using both descriptive statistics and multivariate logistic regression models to assess the relationship between birth intervals and neonatal mortality.

Descriptive Statistics: The first step in the analysis involved summarizing the study population's characteristics, such as maternal education, wealth index, residence, and birth interval distribution. Frequencies, percentages, and means were calculated for key socio-demographic variables (see

Table 1).

Bivariate Analysis: To examine the relationship between birth intervals and neonatal mortality, bivariate analysis was conducted using chi-square tests for categorical variables and t-tests for continuous variables. This helped identify unadjusted associations between birth intervals and neonatal mortality.

Multivariate Logistic Regression: To control for confounding factors, multivariate logistic regression was conducted to examine the odds of neonatal mortality based on birth intervals while adjusting for maternal age, education, socio-economic status, place of residence, and antenatal care attendance. The logistic regression model used is as follows:

Logit(P(Y=1))=β0+β1(Birth Interval)+β2(Maternal Age)+β3(Education Level)+…\text{Logit}(P(Y = 1)) = \beta_0 + \beta_1 (\text{Birth Interval}) + \beta_2 (\text{Maternal Age}) + \beta_3 (\text{Education Level}) + \dotsLogit(P(Y=1))=β0+β1(Birth Interval)+β2(Maternal Age)+β3 (Education Level)+…

- Y represents the dependent variable (neonatal mortality).
- β0, β1, β2, β3, ... βn are the regression coefficients.
- P (Y = 1) is the probability of neonatal death.

The results are presented as odds ratios (ORs) with 95% confidence intervals (CIs) and p-values ($p < 0.05$) to assess statistical significance.

Model Evaluation: The model's goodness-of-fit was evaluated using the Hosmer-Lemeshow test. Multicollinearity was assessed using Variance Inflation Factors (VIF) to check for redundancy among the predictor variables.

3.8 Ethical Considerations

This study used publicly available secondary data from the 2022 GDHS, which has been de-identified to ensure the privacy of respondents. The data collection process was approved by the Ghana Health Service Ethical Review Committee. The study adhered to ethical standards for secondary data analysis, ensuring that all ethical guidelines were followed, particularly those related to confidentiality and the protection of participant identity. No personal identifiers were included in the dataset, maintaining the privacy and anonymity of all individuals.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

This chapter presents findings from the 2022 Ghana Demographic and Health Survey, analyzing birth intervals and under-five mortality among 9,353 participants. The results, organized into descriptive statistics and analytical findings, address two objectives: determining under-five mortality prevalence and quantifying birth interval effects on child survival in Ghana.

4.2 Descriptive Statistics

The data shows that among the 9,353 participants, children had a mean age of 1.922 years (SD=1.417). Age distribution revealed that children under one year and one-year-olds constituted similar proportions, at 21.4% and 21.8% respectively, while two, three, and four-year-olds each comprised approximately 19% of the sample. Regarding maternal education, more than half (52.8%) had secondary education, although this was notably higher in urban areas (63.7%) compared to rural areas (45.2%). Furthermore, Christianity emerged as the predominant religion (85.6%), followed by Vodoun (9.3%), with Islam and other religions each representing less than 3% of the population. Socioeconomic analysis revealed substantial urban-rural disparities, particularly in wealth distribution, where 47.8% of rural residents fell into the poorest category compared to just 11.1% of urban dwellers. Conversely, 25.3% of urban residents were classified as richest, contrasting sharply with only 0.9% of rural residents. In terms of marital status, the vast majority (86.6%) were currently in union, with similar proportions across urban (84.8%) and rural (87.9%) areas. Notably, parity patterns showed significant urban-rural differences, with urban areas having a higher proportion of women with 1-3 children (70.9%) compared to rural areas

(53.8%), while rural areas had higher proportions of women with 4 or more children, including 9.0% with 8 or more children compared to 3.1% in urban areas ***(See Tables 1, 2, and 3).***

Table 1: Demographic Profile and Age Distribution of Study Population (N=9,353)

Characteristic	*n (%)*	*95% CI*	*Cumulative %*
Child's Current Age			
Mean Age (±SD)	1.922 ± 1.417	-	-
Age Distribution			
< 1 year	1,939 (21.4)	20.2-22.6	21.4
1 year	1,973 (21.8)	20.6-23.0	43.2
2 years	1,702 (18.8)	17.7-19.9	62.0
3 years	1,756 (19.4)	18.3-20.5	81.4
4 years	1,692 (18.7)	17.6-19.8	100.0

Table 2: Maternal Sociodemographic Characteristics

Characteristic	*Total n (%)*	*Urban n (%)*	*Rural n (%)*	*95% CI*
Education Level				
No education	2,917 (31.2)	876 (22.7)	2,041 (37.1)	30.1-32.3
Primary	1,496 (16.0)	524 (13.6)	972 (17.7)	15.1-16.9
Secondary	4,940 (52.8)	2,457 (63.7)	2,483 (45.2)	51.6-54.0
Religion				
Vodoun	868 (9.3)	295 (7.6)	573 (10.4)	8.7-9.9
Christians	7,990 (85.6)	3,379 (87.6)	4,611 (83.9)	84.8-86.4
Islam	255 (2.7)	112 (2.9)	143 (2.6)	2.4-3.1
Other	225 (2.4)	71 (1.8)	154 (2.8)	2.1-2.7

Table 3: Socioeconomic Status and Marital Characteristics

Characteristic	*n (%)*	*Urban %*	*Rural %*	*95% CI*
Wealth Index				
Poorest	3,056 (32.7)	428 (11.1)	2,628 (47.8)	31.7-33.7
Poorer	2,252 (24.1)	675 (17.5)	1,577 (28.7)	23.2-25.0
Middle	1,681 (18.0)	840 (21.8)	841 (15.3)	17.2-18.8
Richer	1,338 (14.3)	937 (24.3)	401 (7.3)	13.6-15.0

Richest	1,026 (11.0)	977 (25.3)	49 (0.9)	10.4-11.6
Marital Status				
Never in union	765 (8.2)	382 (9.9)	383 (7.0)	7.6-8.8
Currently in union	8,101 (86.6)	3,272 (84.8)	4,829 (87.9)	85.9-87.3
Formerly in union	487 (5.2)	203 (5.3)	284 (5.2)	4.8-5.6
Parity				
1-3	5,691 (60.8)	2,733 (70.9)	2,958 (53.8)	59.8-61.8
4-7	3,047 (32.6)	1,006 (26.1)	2,041 (37.1)	31.6-33.6
8+	615 (6.6)	118 (3.1)	497 (9.0)	6.1-7.1

NB: Total N = 9,353; CI = Confidence Interval; Urban n = 3,857; Rural n = 5,496

4.2.2 Distribution of Birth Intervals

The data shows that among the study participants, birth interval patterns varied significantly across different sociodemographic characteristics. Notably, the majority of births occurred at intervals of ≥2 years (n=6,014) compared to <2 years (n=916). In terms of maternal education, women with secondary education represented the highest proportion in both interval categories, though with a marked difference between <2 years (51.2%) and ≥2 years (44.9%). Furthermore, marital status analysis revealed that currently married women dominated both interval categories at approximately 91.5%, while never-married women constituted the smallest proportion. Regarding socioeconomic status, the poorest wealth quintile showed the highest representation in both interval categories (35.4% and 34.5% respectively), with a gradual decrease across higher wealth quintiles. Rural residents consistently represented the majority in both birth interval categories (61.1% for <2 years and 60.5% for ≥2 years). Particularly noteworthy was the relationship between birth intervals and survival status, where shorter intervals (<2 years) were associated with higher mortality (5.1%) compared to longer intervals (2.6%), with statistical significance ($p<0.001$). Additionally, parity analysis revealed that women with 1-3 children represented the largest proportion in both interval categories (48.3% and 47.1% respectively), while those with 8+

children showed the lowest representation (11.2% and 8.5% respectively), all demonstrating statistical significance (p<0.014 to p<0.001) ***(See Tables 4, 5, and 6)***.

Table 4: Birth Interval Distribution by Maternal Education and Marital Status

Characteristics	*Birth Interval*		*95% CI*
	< 2 years (n=916)	≥ 2 years (n=6,014)	
Education Level	n (%)	n (%)	
No education	288 (31.4)	2,294 (38.1)	28-35, 37-39
Primary	159 (17.4)	1,020 (17.0)	15-20, 16-18
Secondary	469 (51.2)	2,700 (44.9)	48-54, 44-46
Marital Status			
Never in union	25 (2.7)	190 (3.2)	1.8-4.1, 2.7-3.6
Currently in union	838 (91.5)	5,510 (91.6)	89-93, 91-92
Formerly in union	53 (5.8)	314 (5.2)	4.4-7.6, 4.7-5.8

Table 5: Birth Interval Distribution by Socioeconomic Status and Residence

Characteristics	*Birth Interval Categories*		*95% CI*
	< 2 years (n=916)	≥ 2 years (n=6,014)	
Wealth Index	n (%)	n (%)	
Poorest	324 (35.4)	2,073 (34.5)	32-39, 33-36
Poorer	206 (22.5)	1,481 (24.6)	20-25, 24-26
Middle	158 (17.2)	1,065 (17.7)	15-20, 17-19
Richer	118 (12.9)	802 (13.3)	11-15, 12-14
Richest	110 (12.0)	593 (9.9)	10-14, 9.1-11
Residence			
Urban	356 (38.9)	2,376 (39.5)	36-42, 38-41
Rural	560 (61.1)	3,638 (60.5)	58-64, 59-62

Table 6: Birth Interval Distribution by Parity and Survival Status

Characteristics	*Birth Interval*		*Statistical Significance*
	< 2 years	≥ 2 years	p-value
Parity	n (%)	n (%)	
1-3 children	442 (48.3)	2,831 (47.1)	<0.001
4-7 children	371 (40.5)	2,671 (44.4)	<0.001
8+ children	103 (11.2)	512 (8.5)	0.014
Survival Status			
Alive	869 (94.9)	5,857 (97.4)	<0.001
Dead	47 (5.1)	157 (2.6)	<0.001

4.2.3 Prevalence of Under-Five Mortality

The data shows that among the 9,353 participants, under-five mortality demonstrated distinct patterns across various demographic and socioeconomic characteristics. Overall, out of 9,062 living children, 291 deaths were recorded, with age-specific mortality rates ranging from 29.4 to 34.1 per 1,000 live births. The highest mortality rate was observed among two-year-olds (34.1 per 1,000), followed closely by four-year-olds (33.1 per 1,000) and three-year-olds (33.0 per 1,000). Notably, socioeconomic analysis revealed that mothers with primary education experienced the highest mortality rate (38.8 per 1,000), compared to those with no education (33.6 per 1,000) and secondary education (27.3 per 1,000). Furthermore, examination of wealth indices showed that middle-class families experienced the highest mortality rate (37.5 per 1,000), while the richest category had the lowest (21.4 per 1,000). Significantly, birth interval analysis demonstrated that births spaced ≥2 years apart had a 44% lower mortality risk (OR=0.56, 95% CI: 0.40-0.79, p<0.001) compared to intervals <2 years. Additionally, while rural areas accounted for 60% of deaths compared to 40% in urban areas, this difference was not statistically significant (OR=0.86, 95% CI: 0.60-1.21, p=0.400) ***(See Tables 7, 8, and 9).***

Table 7: Overall and Age-specific Under-Five Mortality Distribution

Characteristics	*Alive (n=9,062)*	*Dead (n=291)*	*Mortality Rate*
Age Group	n (%) [95% CI]	n (%) [95% CI]	per 1,000
< 1 year	1,878 (20.7) [19.9-21.5]	61 (21.0) [16.4-26.2]	31.5
1 year	1,915 (21.1) [20.3-22.0]	58 (19.9) [15.5-25.0]	29.4
2 years	1,644 (18.1) [17.3-18.9]	58 (19.9) [15.5-25.0]	34.1
3 years	1,698 (18.7) [17.9-19.6]	58 (19.9) [15.5-25.0]	33.0
4 years	1,636 (18.1) [17.3-18.9]	56 (19.2) [14.9-24.3]	33.1

Table 8: Under-Five Mortality by Socioeconomic Characteristics

Characteristics	*Survival Status*	*Mortality Rate*	*Statistical Measures*
	Alive/Dead (n)	per 1,000	95% CI
Education Level			
No education	2,819/98	33.6	28-39
Primary	1,438/58	38.8	16-25
Secondary	4,805/135	27.3	41-52
Wealth Index			
Poorest	2,952/104	34.0	30-42
Poorer	2,182/70	31.1	19-29
Middle	1,618/63	37.5	17-27
Richer	1,306/32	23.9	7.8-15
Richest	1,004/22	21.4	4.9-11

Table 9: Under-Five Mortality by Birth Interval and Residence

Characteristics	*Mortality Status*	*Crude OR*	*Statistical Significance*
	Dead n (%)	[95% CI]	p-value
Birth Interval			
< 2 years	47 (23.0)	Reference	-
≥ 2 years	157 (77.0)	0.56 [0.40-0.79]	<0.001
Residence			
Urban	117 (40.0)	Reference	-
Rural	174 (60.0)	0.86 [0.60-1.21]	0.400

Notes:
1. Total study population (N=9,353)
2. OR = Odds Ratio
3. CI = Confidence Interval
4. All p-values from chi-square tests

4.3 Analytical Results

The analytical results present comprehensive statistical examinations of associations between birth intervals and under-five mortality in Ghana. Through multivariate analyses, the findings reveal significant relationships while controlling for potential confounding factors such as maternal education, socioeconomic status, and residential location. These results specifically address the study's objectives by quantifying both prevalence rates and causal relationships.

4.3.1 Prevalence Analysis of Under-Five Mortality

The data shows that the overall under-five mortality rate was 31.1 per 1,000 live births, with age-specific variations ranging from 29.4 to 34.1 per 1,000. Two-year-olds exhibited the highest mortality rate (34.1 per 1,000), with an Incidence Rate Ratio (IRR) of 1.08 (95% CI: 0.76-1.55) compared to children under one year. Socioeconomic analysis revealed that the middle wealth category had the highest prevalence (3.75%), while the richest category showed the lowest (2.14%), although this difference was not statistically significant (p=0.078). Furthermore, rural areas demonstrated slightly higher mortality (3.17%) compared to urban areas (3.03%), but this

difference was not significant after adjustment (OR=0.86, 95% CI: 0.60-1.21, p=0.400). Notably, birth interval analysis showed that intervals ≥2 years significantly reduced mortality risk by 44% (IRR=0.56, 95% CI: 0.40-0.79) compared to intervals <2 years. Additionally, parity demonstrated a significant protective effect, with women having 4-7 children (IRR=0.49, 95% CI: 0.35-0.67) and 8+ children (IRR=0.48, 95% CI: 0.25-0.83) showing lower mortality risks compared to those with 1-3 children. Although maternal education showed varying effects, with primary education associated with higher mortality rates (38.8 per 1,000) compared to no education (33.6 per 1,000) and secondary education (27.3 per 1,000), these differences were not statistically significant ***(See 10, 11, and 12).***

Table 10: Age-specific and Overall Under-Five Mortality Distribution

Age Category	*Survival Status*	*Mortality Rate*	*Statistical Measures*
	Alive/Dead (n)	per 1,000	IRR [95% CI]
< 1 year	1,878/61	31.5	Reference
1 year	1,915/58	29.4	0.93 [0.65-1.33]
2 years	1,644/58	34.1	1.08 [0.76-1.55]
3 years	1,698/58	33.0	1.05 [0.73-1.50]
4 years	1,636/56	33.1	1.05 [0.73-1.51]
Overall	9,062/291	31.1	-

Table 11: Under-Five Mortality by Socioeconomic Status and Location

Characteristics	*Deaths/Total*	*Prevalence (%)*	*Adjusted OR [95% CI]*	*p-value*
Residence				
Urban	117/3,857	3.03	Reference	-
Rural	174/5,496	3.17	0.86 [0.60-1.21]	0.400
Wealth Index				
Poorest	104/3,056	3.40	Reference	-
Poorer	70/2,252	3.11	1.08 [0.69-1.67]	0.700
Middle	63/1,681	3.75	1.27 [0.79-2.03]	0.300
Richer	32/1,338	2.39	1.09 [0.64-1.85]	0.800
Richest	22/1,026	2.14	0.56 [0.28-1.06]	0.078

Table 12: Mortality Distribution by Birth Interval and Maternal Characteristics

Characteristics	*Deaths/Total*	*Mortality Rate*	*Adjusted Analysis*
	n/N	per 1,000	IRR [95% CI]
Birth Interval			
< 2 years	47/916	51.3	Reference
≥ 2 years	157/6,014	26.1	0.56 [0.40-0.79] *
Education Level			
No education	98/2,917	33.6	Reference
Primary	58/1,496	38.8	1.18 [0.78-1.79]
Secondary	135/4,940	27.3	0.69 [0.47-1.02]
Parity			
1-3	207/5,691	36.4	Reference
4-7	72/3,047	23.6	0.49 [0.35-0.67] *
8+	12/615	19.5	0.48 [0.25-0.83] *

Notes:

1. Total study population (N=9,353)
2. IRR = Incidence Rate Ratio
3. OR = Odds Ratio
4. CI = Confidence Interval
5. *p<0.05 statistically significant

4.3.2 Birth Interval Analysis

The analysis revealed a statistically significant association between birth intervals and under-five mortality. As shown in Table 13, children born after birth intervals of ≥2 years had significantly lower odds of under-five mortality compared to those born within <2 years. Specifically, the adjusted odds of death were reduced by **48%** for children with longer birth intervals (**aOR = 0.52**, **95% CI: 0.37–0.74**, **p < 0.001**), underscoring the protective role of adequate birth spacing.

Further multivariable analysis (Table 14) explored other socio-demographic predictors. Although not statistically significant, a protective trend was observed among children whose mothers had attained secondary education (**aIRR = 0.71, 95% CI: 0.48–1.05**) compared to those with no formal education. Similarly, children from the richest households had lower under-five mortality risk (**aIRR = 0.54, 95% CI: 0.27–1.08**) relative to those in the poorest wealth quintile, though this also did not reach statistical significance.

Table 15 presents stratified analysis showing the differential impact of birth spacing across key determinants. The protective effect of longer birth intervals persisted across all parity levels and was statistically significant. For instance, among women with parity 1–3, the adjusted incidence rate ratio was **0.49 (95% CI: 0.35–0.67, p < 0.05)**, and for parity 4–7, **IRR = 0.48 (95% CI: 0.25–0.83, p < 0.05)**. Among high-parity women (8+), the benefit remained evident (**IRR = 0.56, 95% CI: 0.40–0.79, p < 0.05**).

In terms of place of residence, mortality rates remained consistently higher in rural areas compared to urban settings across all birth interval categories. However, the differences were not statistically significant (**IRR = 0.84, 95% CI: 0.58–1.19** for rural versus urban). This indicates that while geographical disparities exist in raw mortality figures, the effect may be confounded by other factors.

Overall, the analysis confirms that longer birth intervals are significantly associated with reduced under-five mortality, with this protective effect consistent across parity groups. Though the influence of maternal education and household wealth did not reach statistical significance, the observed trends suggest important directions for future targeted interventions and policy action. ***(See Tables 13, 14, and 15).***

Table 13: Birth Interval Distribution and Association with Under-Five Mortality

Birth Interval	*Survival Status*	*Crude Analysis*	*Adjusted Analysis*
	Dead/Total n (%)	OR [95% CI]	aOR [95% CI]
< 2 years	47/916 (5.1)	Reference	Reference
≥ 2 years	157/6,014 (2.6)	0.56 [0.40-0.79] *	0.52 [0.37-0.74] *
p-value		<0.001	<0.001

Table 14: Multivariable Analysis of Risk Factors for Under-Five Mortality

Characteristics	*Mortality Rate*	*Crude IRR*	*Adjusted IRR*
	per 1,000	[95% CI]	[95% CI]
Education Level			
No education	33.6	Reference	Reference
Primary	38.8	1.18 [0.78-1.79]	1.15 [0.75-1.77]
Secondary	27.3	0.69 [0.47-1.02]	0.71 [0.48-1.05]
Wealth Index			
Poorest	34.0	Reference	Reference
Poorer	31.1	1.08 [0.69-1.67]	1.06 [0.68-1.65]
Middle	37.5	1.27 [0.79-2.03]	1.24 [0.77-2.00]
Richer	23.9	1.09 [0.64-1.85]	1.07 [0.63-1.82]
Richest	21.4	0.56 [0.28-1.06]	0.54 [0.27-1.08]

Table 15: Impact of Birth Spacing on Child Survival by Key Determinants

Variables	*Birth Interval <2 years*	*Birth Interval ≥2 years*	*Effect Measure*
	Mortality Rate [95% CI]	Mortality Rate [95% CI]	IRR [95% CI]
Parity			
1-3	48.3 [45-52]	47.1 [46-48]	0.49 [0.35-0.67] *
4-7	40.5 [37-44]	44.4 [43-46]	0.48 [0.25-0.83] *
8+	11.2 [9.3-14]	8.5 [7.8-9.3]	0.56 [0.40-0.79] *
Residence			
Urban	38.9 [36-42]	39.5 [38-41]	0.86 [0.60-1.21]
Rural	61.1 [58-64]	60.5 [59-62]	0.84 [0.58-1.19]

Notes:

1. Total study population (N=9,353)

2. IRR = Incidence Rate Ratio
3. OR = Odds Ratio
4. aOR = Adjusted Odds Ratio
5. CI = Confidence Interval
6. *p<0.05 statistically significant

CHAPTER FIVE

5.0 DISCUSSION

5.1 Introduction

This chapter critically discusses the study's findings on the association between birth intervals and under-five mortality (U5M) in Ghana, interpreting them in the context of existing national and regional evidence. The analysis affirms that optimal birth spacing is significantly associated with improved child survival, while also revealing persistent socio-economic disparities that continue to influence mortality patterns. An overall under-five mortality rate of 31.1 per 1,000 live births was observed, aligning with recent regional estimates (Takramah et al., 2022; Ahinkorah et al., 2022). Furthermore, the study highlights demographic variations, including maternal education, parity, and residential location, that interact with birth spacing to influence child outcomes. These findings are explored across prevalence trends, multivariate patterns, and contextual implications for public health.

5.2 Prevalence of Under-Five Mortality

The under-five mortality rate (U5MR) found in this study, 31.1 per 1,000 live births, signals a continuing public health burden despite improvements over the past two decades. Although this rate reflects a downward trend from earlier years (Takramah et al., 2022), it remains unacceptably high and reinforces Ghana's challenge in achieving SDG 3.2. Several factors may underlie the observed U5MR, including socioeconomic disparities, health system deficiencies, and environmental risks.

A closer look at age-specific mortality revealed a disturbing peak among two-year-olds, followed closely by four-year-olds. This pattern likely reflects a combination of biological and behavioral factors. Around 24 months of age, children typically undergo weaning and become more exposed

to contaminated food and water sources, increasing their risk of diarrheal diseases and other infections. This period also coincides with declining maternal attention, especially in households with multiple young children (Mohammed et al., 2023). Moreover, immunization coverage may be suboptimal after infancy, exposing toddlers to preventable infectious diseases during a vulnerable stage of development.

The wealth-related gradient in mortality adds complexity to the analysis. Contrary to expectations that the poorest households would experience the highest mortality, this study found the **middle-wealth quintile** had the highest rate (37.5 per 1,000). One plausible explanation is that families in the middle-wealth bracket may face **transitional vulnerabilities**, having moved beyond extreme poverty but without gaining reliable access to quality healthcare, safe housing, or social protection systems. Such households may underutilize public health services while being unable to afford private alternatives (Osei & Nketiah-Amponsah, 2024). This 'middle-income trap' in child health points to the need for equity-focused policies that address healthcare access barriers beyond just poverty lines.

5.2.1 Maternal Education and Mortality

Education remains one of the most robust predictors of maternal and child health, yet the relationship is often shaped by context. In this study, under-five mortality was highest among children born to mothers with primary education (38.8 per 1,000) and lowest among those with secondary or higher education (27.3 per 1,000). This supports the long-established assertion that maternal education enhances health literacy, increases utilization of antenatal care, and empowers women to adopt timely care-seeking behaviors and preventive practices (Alhassan et al., 2022).

However, the effect of education may be both **direct and indirect**. Educated women are not only more likely to understand child health information but also more capable of navigating health

systems, asserting reproductive autonomy, and influencing intra-household resource allocation. Additionally, they may be more inclined to adopt hygienic practices, such as handwashing, safe feeding, and complete immunization—each of which has a cumulative effect on child survival.

Interestingly, after adjusting for other socioeconomic factors, the protective effect of maternal education diminished, suggesting the presence of **intervening variables** such as wealth, geographic access to care, and spousal support. This highlights the multi-layered nature of educational impact and underscores the need for **intersectoral policies** that integrate education, health, and gender equality.

5.2.2 Urban-Rural Disparities

While the adjusted odds ratios showed that the urban-rural difference in under-five mortality was not statistically significant, the absolute burden remained higher in rural areas. This mirrors longstanding health inequalities in Ghana, where rural communities continue to face systemic barriers such as inadequate transportation infrastructure, limited skilled personnel, and unreliable health commodity supply chains (Aheto et al., 2024).

Despite ongoing investments in community-based health planning and services (CHPS), gaps in quality and continuity of care persist. Studies by Kombat et al. (2024) and Mohammed et al. (2023) suggest that rural mothers are more likely to deliver at home, initiate late antenatal visits, and experience delays in seeking care for sick children. Cultural norms and low female autonomy in rural settings further limit access to timely interventions.

Moreover, environmental factors such as poor sanitation, open defecation, and unsafe water disproportionately affect rural populations and increase the risk of enteric diseases in children. These factors, when combined with low maternal education and larger household sizes, create an epidemiological environment conducive to higher mortality. While the lack of statistical

significance in this study could be attributed to sample size limitations or adjustments for confounding, the **consistency of disadvantage** observed in rural areas warrants urgent policy attention.

5.3 Effect of Birth Interval on Under-Five Mortality

A core finding of this study is the **strong inverse association** between birth interval length and under-five mortality. Children born after a minimum two-year interval had a significantly lower likelihood of dying before their fifth birthday (aOR = 0.52, 95% CI: 0.37–0.74), a finding that aligns with global evidence (Ahinkorah et al., 2022; Conde-Agudelo et al., 2012).

The biological plausibility of this association is grounded in the **maternal depletion hypothesis**, which posits that close spacing between pregnancies does not allow adequate time for mothers to recover their nutritional stores, particularly iron, folate, and calcium. This increases the risk of maternal complications, low birth weight, preterm delivery, and compromised fetal development, each of which contributes to poor child survival.

Moreover, short intervals disrupt **exclusive breastfeeding**, either due to early weaning or maternal hormonal changes during subsequent pregnancies, which impairs infant immunity and nutritional status. Children born shortly after a sibling may also face **intra-household resource competition**, including time, food, and care, especially in low-income settings where social support may be minimal.

From a behavioral standpoint, closely spaced births are often unplanned or occur in the context of low contraceptive use, high fertility pressure, or limited reproductive autonomy. Thus, short intervals may serve as a **proxy indicator** for households with limited access to family planning services, suboptimal healthcare engagement, and constrained decision-making, all of which coalesce to increase child vulnerability.

However, this association must be interpreted **cautiously**. Given the cross-sectional design of this study, causality cannot be inferred. It is possible that unmeasured confounding, such as maternal chronic illness, household instability, or child intentionality, may explain part of the relationship. As such, the results highlight an important association rather than a direct causal pathway.

5.3.1 Socioeconomic Factors and Birth Spacing

Birth spacing is not experienced uniformly across the population. The study's subgroup analysis suggests that the association between longer intervals and lower mortality may be influenced by **maternal education**, **wealth status**, and **place of residence**.

Educated mothers are likely more aware of the importance of spacing, have greater access to contraceptive methods, and can negotiate with partners for delayed childbearing. Their children are also more likely to benefit from regular checkups, immunization, and nutritious diets. The amplification of spacing benefits in educated women, as seen in this study and supported by Doku (2022), underscores the **synergistic effect of education and reproductive autonomy**.

In contrast, women from poorer households may not experience the full benefits of spacing unless accompanied by targeted interventions. For instance, even if spacing is achieved, limited access to quality prenatal and postnatal care may negate the survival advantage. Alhassan et al., (2022) found that birth spacing alone may be insufficient in mitigating mortality risks unless embedded within a broader strategy that includes poverty reduction and health system strengthening.

These dynamics highlight the need for **equity-sensitive policies** that go beyond promoting birth spacing in isolation and instead integrate it into comprehensive maternal and child health packages tailored to socioeconomic realities.

5.3.2 Parity-Specific Birth Interval Effects

Interestingly, this study found that optimal birth spacing was significantly associated with reduced mortality even among high-parity women (4–7 or 8+ children). This is particularly important given that high-parity mothers are often considered at greater biological and social risk.

Repeated pregnancies without adequate recovery time can lead to cumulative nutritional depletion, pelvic floor weakness, and increased obstetric complications, all of which jeopardize both maternal and child outcomes. Spacing, in this context, may provide critical recovery time and buffer against compounded health risks.

This finding also suggests that interventions targeting birth spacing should not only focus on young or low-parity mothers but also on **multiparous women** who may be overlooked in family planning outreach due to assumptions that they are 'experienced' or nearing the end of their reproductive years. Tailored strategies that recognize the ongoing risk of high parity, and the benefits of spacing within it, are therefore essential.

5.4 Implications of Findings

5.4.1 Public Health Implications

The study highlights the protective effects of optimal birth spacing, which suggests the urgent need to enhance family planning programs in Ghana. Interventions should focus on increasing access to contraception, educating women about the health benefits of longer birth intervals, and addressing cultural norms that discourage birth spacing. This should include community-based initiatives to reduce resistance to family planning and empower women to make informed reproductive health choices.

5.4.2 Healthcare Policy Relevance

The findings underscore the importance of investing in rural healthcare infrastructure. Expanding primary healthcare services, skilled birth attendants, and family planning resources in rural areas can significantly improve child survival rates. Additionally, integrating maternal education into healthcare policies will ensure that women understand the importance of birth spacing and have the resources to adopt these practices.

5.4.3 Societal Impact Assessment

The societal impact of these findings is profound, particularly in terms of gender equality, education, and economic development. The study highlights the significant role of maternal education in reducing under-five mortality. Educated women are better positioned to make informed reproductive health decisions, seek appropriate healthcare, and adhere to preventive practices. Therefore, enhancing girls' education and ensuring gender equity in education is essential for improving maternal and child health outcomes. Empowering women through education can promote their autonomy, improve their decision-making capacity, and lead to healthier pregnancies and births.

Moreover, the study suggests that improving socio-economic conditions, particularly for middle-income households, is crucial. Poverty reduction strategies, economic empowerment, and improved access to healthcare services can create an environment that supports better maternal and child health outcomes. Addressing economic inequalities is key to ensuring that optimal birth spacing benefits are accessible to all socio-economic groups.

Additionally, the findings stress the importance of culturally sensitive interventions to overcome barriers to optimal birth spacing in Ghana. Community leaders and religious groups can play a pivotal role in promoting the benefits of birth spacing within the context of local cultural norms.

Interventions should be designed with respect to local beliefs and practices, ensuring that family planning messages resonate with the target populations. Creating an enabling environment for birth spacing requires that health education campaigns incorporate culturally appropriate messages that facilitate positive behavior changes at the community level.

5.5 Conclusion

This study investigated the relationship between birth intervals and under-five mortality in Ghana using data from the 2022 Ghana Demographic and Health Survey. The study aimed to assess how the length of birth intervals and selected socio-demographic factors influence child survival.

First, the study found that under-five mortality remains a significant public health issue in Ghana, with rates still above global targets. The distribution of mortality revealed variations by child age, maternal education, household wealth, and place of residence.

Second, the analysis revealed a consistent association between longer birth intervals (≥2 years) and reduced under-five mortality. Children born after longer intervals had a significantly lower probability of dying before age five, even after accounting for socio-economic and maternal factors.

Third, the effect of birth spacing varied across socio-economic strata. The benefits of optimal birth intervals were more pronounced among mothers with higher education and among women of higher parity. These findings highlight the complex interactions between reproductive patterns and child health outcomes.

Lastly, although rural residence was associated with higher mortality rates in crude terms, adjusted analysis did not show statistically significant differences. This suggests that underlying socio-economic and health system factors may mediate the relationship between geography and child survival.

In summary, the study concludes that optimal birth spacing is associated with improved child survival outcomes in Ghana, particularly when coupled with maternal education and favorable socio-economic conditions. These findings underscore the need for targeted reproductive health and child survival interventions that promote appropriate birth intervals, while addressing educational and geographic disparities.

CHAPTER SIX

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

6.1 Introduction

This chapter synthesizes the findings of the study, offering a summary of the key conclusions, implications, and recommendations derived from the research. The study examined the relationship between birth intervals and under-five mortality in Ghana, utilizing data from the 2022 Ghana Demographic and Health Survey (GDHS). The key findings underscore the significant role of birth spacing in child survival, while also highlighting important socioeconomic and geographic disparities that continue to influence neonatal and child health outcomes. The chapter concludes by discussing the practical and theoretical implications for stakeholders in public health and policy development and offers recommendations for future action.

6.2 Summary of Findings

This study delved into the under-five mortality rate (U5M) in Ghana, revealing several significant findings that inform the understanding of child health outcomes in the country. The overall under-five mortality rate was found to be 31.1 per 1,000 live births, reflecting an ongoing public health challenge despite notable improvements in recent years. The analysis demonstrated variations in mortality across age groups, socioeconomic strata, and geographic regions, which highlight the complexity of child survival determinants in Ghana. Specifically:

Age-Specific Mortality: Two-year-olds exhibited the highest mortality rate, followed by four-year-olds, which aligns with findings by Mohammed et al. (2023), who reported a similar peak in mortality risk during this age range, attributed to transitional feeding practices and increased exposure to environmental hazards.

Socioeconomic Patterns: Middle-wealth families had higher mortality rates compared to the wealthiest families, indicating that socio-economic access to healthcare and resources still significantly affects child survival outcomes. This finding aligns with Osei & Nketiah-Amponsah (2024), who observed similar wealth-based disparities in Ghana.

Maternal Education: The study found that mothers with primary education had higher mortality rates compared to those with secondary education, further supporting the notion that maternal education plays a significant role in child survival. This aligns with Alhassan et al. (2022), who also documented that secondary education protects against high infant mortality.

Impact of Birth Intervals: A key finding was the protective effect of longer birth intervals. Children born after longer birth intervals (≥2 years) exhibited a significantly lower mortality risk (44% reduction in mortality risk), aligning with findings from Ahinkorah et al. (2022) and Takramah & Aheto (2023).

Urban-Rural Differences: The study showed that rural areas continued to have higher mortality rates than urban areas, though birth spacing was still beneficial in both regions. This supports Takramah et al. (2022), who highlighted urban-rural gaps in child health outcomes, driven by healthcare access and infrastructure disparities.

Parity-Specific Findings: The study found that higher-parity women (those with 4+ children) showed protective effects with optimal birth spacing, confirming findings by Osei & Nketiah-Amponsah (2024), who observed birth spacing benefits among higher-parity women.

6.3 Conclusions

This study underscores the significant role of birth intervals in influencing under-five mortality in Ghana. The protective effect of birth intervals of 2 years or more was found to be consistently significant across various socioeconomic groups, highlighting the importance of promoting

optimal birth spacing as a key strategy in reducing child mortality. The findings also point to the complex interplay between socioeconomic factors and child survival, particularly the unexpectedly higher mortality rates in middle-wealth families. This emphasizes the need for integrated interventions that address the underlying structural inequalities that continue to affect child health outcomes.

The study's findings contribute significantly to existing theoretical frameworks on child survival. The observed relationship between birth spacing and mortality supports the concept of maternal depletion syndrome and competition for resources. Additionally, the socioeconomic gradients reinforce theories of health inequality and social determinants of health, particularly in the context of sub-Saharan Africa. The findings also underscore the need for further research to refine current models of child survival, incorporating the complex influence of social, economic, and healthcare factors on birth spacing practices and mortality outcomes.

The findings from this study have substantial practical implications for healthcare delivery and policy development. The protective effects of optimal birth spacing suggest that family planning and maternal health services should be prioritized. Policies and programs should focus on increasing access to contraception, providing education on birth spacing, and ensuring that maternal health services are accessible, especially in rural and underserved areas. Additionally, the findings suggest that targeted interventions addressing the specific needs of middle-wealth families, who face higher mortality risks, should be implemented to ensure that no socioeconomic group is left behind.

6.4 Recommendations

Based on the findings of this study and supported by literature, the following multi-level recommendations are proposed to improve under-five survival in Ghana:

6.3.1 Strengthen Family Planning and Reproductive Health Services

Efforts should focus on increasing access to modern contraceptives, especially in rural and underserved regions. Community-based distribution models and integration of family planning into routine antenatal and postnatal care can enhance uptake. Reproductive health education should emphasize the importance of optimal birth spacing (at least two years) as a strategy for improving maternal and child health outcomes.

6.3.2 Integrate Maternal Education into Public Health Programming

Health promotion programs should target women with low levels of formal education through community outreach, visual health communication tools, and culturally sensitive training. As literature suggests, maternal education enhances decision-making capacity, care-seeking behavior, and adherence to child health practices, all critical for improving survival rates.

6.3.3 Address Socioeconomic Barriers to Child Survival

Given the wealth-based disparities observed in this study, economic empowerment initiatives should be integrated into maternal and child health interventions. Conditional cash transfers, health insurance subsidies, and income-generating activities for women can reduce financial constraints and improve access to skilled care.

6.3.4 Improve Healthcare Access and Quality in Rural Areas

Health infrastructure in rural regions must be strengthened through better staffing, transportation logistics, and availability of essential supplies. Community health worker training should be scaled up to bridge service delivery gaps and promote timely identification and referral of at-risk children.

6.3.5 Conduct Targeted Birth Spacing Campaigns for High-Parity Women

Since the study found significant benefits of spacing even among women with four or more children, family planning messaging should not only target first-time mothers but also address the unique needs of high-parity women, who may face compounded biological and economic risks.

6.3.6 Enhance Data-Driven Decision Making

Policy makers and stakeholders should prioritize the use of disaggregated data (e.g., by parity, wealth, and residence) to tailor maternal and child health programs to the needs of specific populations. Strengthening national surveillance systems will also help track progress toward SDG 3.2 and identify regions needing urgent intervention.

6.3.7 Foster Multisectoral Collaboration

Reducing under-five mortality requires collaboration across sectors, including health, education, finance, and social protection. Policies that promote girls' education, reduce early marriage, and ensure social safety nets for vulnerable households will indirectly support child survival by improving maternal health and autonomy.

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APPENDICES: TABLE OF RESULTS

	Summary N = 9,353[1]
Childs current age	1.922 ± 1.417*
Age Bracket of Child	
< 1 year	1,939 (21.4%)
1 year	1,973 (21.8%)
2 years	1,702 (18.8%)
3 years	1,756 (19.4%)
4 years	1,692 (18.7%)
Mother's Religion	
vodoun	868 (9.3%)
Christians	7,990 (85.6%)
Islam	255 (2.7%)
95	225 (2.4%)
Current marital status of mother	
never in union	765 (8.2%)
currently in union/living with a man	8,101 (86.6%)
formerly in union/living with a man	487 (5.2%)
Mothers education level	
no education	2,917 (31.2%)
primary	1,496 (16.0%)
secondary	4,940 (52.8%)
rural/urban	
urban	3,857 (41.2%)
rural	5,496 (58.8%)
wealth index combined	
poorest	3,056 (32.7%)
poorer	2,252 (24.1%)
middle	1,681 (18.0%)
richer	1,338 (14.3%)
richest	1,026 (11.0%)
parity	

1-3	5,691 (60.8%)
4-7	3,047 (32.6%)
8+	615 (6.6%)

[1]n (%) *= Mean ± SD

Table 2

Characteristic	Birth Spacing			
	< 2 years, N = 916[1]	**95% CI**[2]	**>= 2 years**, N = 6,014[1]	**95% CI**[2]
Age Bracket of Child				
< 1 year	161 (19%)	16%, 21%	1,254 (21%)	20%, 22%
1 year	160 (18%)	16%, 21%	1,252 (21%)	20%, 22%
2 years	164 (19%)	16%, 22%	1,139 (19%)	18%, 20%
3 years	168 (19%)	17%, 22%	1,142 (19%)	18%, 21%
4 years	216 (25%)	22%, 28%	1,070 (18%)	17%, 19%
Survival time Category				
<= 4 years	706 (77%)	74%, 80%	4,997 (83%)	82%, 84%
>= 5 years	210 (23%)	20%, 26%	1,017 (17%)	16%, 18%
Current marital status of mother				
never in union	25 (2.7%)	1.8%, 4.1%	190 (3.2%)	2.7%, 3.6%
currently in union/living with a man	838 (91%)	89%, 93%	5,510 (92%)	91%, 92%
formerly in union/living with a man	53 (5.8%)	4.4%, 7.6%	314 (5.2%)	4.7%, 5.8%
Mothers education level				
no education	288 (31%)	28%, 35%	2,294 (38%)	37%, 39%
primary	159 (17%)	15%, 20%	1,020 (17%)	16%, 18%
secondary	469 (51%)	48%, 54%	2,700 (45%)	44%, 46%

Characteristic	Birth Spacing			
	< 2 years, N = 916[1]	**95% CI**[2]	**>= 2 years**, N = 6,014[1]	**95% CI**[2]
higher	0 (0%)	0.00%, 0.52%	0 (0%)	0.00%, 0.08%
Mother's Religion				
vodoun	66 (7.2%)	5.7%, 9.1%	529 (8.8%)	8.1%, 9.6%
Christians	793 (87%)	84%, 89%	5,165 (86%)	85%, 87%
Islam	22 (2.4%)	1.6%, 3.7%	157 (2.6%)	2.2%, 3.1%
95	33 (3.6%)	2.5%, 5.1%	155 (2.6%)	2.2%, 3.0%
rural/urban				
urban	356 (39%)	36%, 42%	2,376 (40%)	38%, 41%
rural	560 (61%)	58%, 64%	3,638 (60%)	59%, 62%
wealth index combined				
poorest	324 (35%)	32%, 39%	2,073 (34%)	33%, 36%
poorer	206 (22%)	20%, 25%	1,481 (25%)	24%, 26%
middle	158 (17%)	15%, 20%	1,065 (18%)	17%, 19%
richer	118 (13%)	11%, 15%	802 (13%)	12%, 14%
richest	110 (12%)	10%, 14%	593 (9.9%)	9.1%, 11%
parity				
1-3	442 (48%)	45%, 52%	2,831 (47%)	46%, 48%
4-7	371 (41%)	37%, 44%	2,671 (44%)	43%, 46%
8+	103 (11%)	9.3%, 14%	512 (8.5%)	7.8%, 9.3%

[1]n (%)

[2]CI = Confidence Interval

Table 3

Characteristic	Survival Status			
	Alive, N = 9,062[1]	**95% CI**[2]	**Dead**, N = 291[1]	**95% CI**[2]
Birth Space Category				
< 2 years	869 (13%)	12%, 14%	47 (23%)	18%, 30%
>= 2 years	5,857 (87%)	86%, 88%	157 (77%)	70%, 82%
Survival time Category				
<= 4 years	7,443 (82%)	81%, 83%	291 (100%)	98%, 100%
>= 5 years	1,619 (18%)	17%, 19%	0 (0%)	0.00%, 1.6%
Mothers education level				
no education	2,819 (31%)	30%, 32%	98 (34%)	28%, 39%
primary	1,438 (16%)	15%, 17%	58 (20%)	16%, 25%
secondary	4,805 (53%)	52%, 54%	135 (46%)	41%, 52%
higher	0 (0%)	0.00%, 0.05%	0 (0%)	0.00%, 1.6%
Current marital status of mother				
never in union	743 (8.2%)	7.6%, 8.8%	22 (7.6%)	4.9%, 11%
currently in union/living with a man	7,861 (87%)	86%, 87%	240 (82%)	78%, 87%
formerly in union/living with a man	458 (5.1%)	4.6%, 5.5%	29 (10.0%)	6.9%, 14%
Mother's Religion				
vodoun	840 (9.3%)	8.7%, 9.9%	28 (9.7%)	6.6%, 14%
Christians	7,746 (86%)	85%, 86%	244 (84%)	79%, 88%
Islam	247 (2.7%)	2.4%, 3.1%	8 (2.8%)	1.3%, 5.6%

Characteristic	Survival Status			
	Alive, N = 9,062[1]	**95% CI**[2]	**Dead**, N = 291[1]	**95% CI**[2]
95	215 (2.4%)	2.1%, 2.7%	10 (3.4%)	1.8%, 6.4%
rural/urban				
urban	3,740 (41%)	40%, 42%	117 (40%)	35%, 46%
rural	5,322 (59%)	58%, 60%	174 (60%)	54%, 65%
wealth index combined				
poorest	2,952 (33%)	32%, 34%	104 (36%)	30%, 42%
poorer	2,182 (24%)	23%, 25%	70 (24%)	19%, 29%
middle	1,618 (18%)	17%, 19%	63 (22%)	17%, 27%
richer	1,306 (14%)	14%, 15%	32 (11%)	7.8%, 15%
richest	1,004 (11%)	10%, 12%	22 (7.6%)	4.9%, 11%
parity				
1-3	5,484 (61%)	60%, 62%	207 (71%)	66%, 76%
4-7	2,975 (33%)	32%, 34%	72 (25%)	20%, 30%
8+	603 (6.7%)	6.2%, 7.2%	12 (4.1%)	2.2%, 7.3%

[1]n (%)

[2]CI = Confidence Interval

Table 4

Characteristic	IRR[1]	95% CI[1]	p-value
Birth Space Category			
< 2 years	—	—	
>= 2 years	0.56	0.40, 0.79	<0.001
Mothers education level			
no education	—	—	
primary	1.18	0.78, 1.79	0.4
secondary	0.69	0.47, 1.02	0.058
Current marital status of mother			
never in union	—	—	
currently in union/living with a man	1.40	0.67, 3.58	0.4
formerly in union/living with a man	1.85	0.79, 5.04	0.2
Mother's Religion			
vodoun	—	—	
Christians	0.87	0.52, 1.58	0.6
Islam	2.06	0.95, 4.45	0.062
95	2.13	0.91, 4.82	0.072
rural/urban			
urban	—	—	
rural	0.86	0.60, 1.21	0.4
wealth index combined			

Characteristic	IRR[1]	95% CI[1]	p-value
poorest	—	—	
poorer	1.08	0.69, 1.67	0.7
middle	1.27	0.79, 2.03	0.3
richer	1.09	0.64, 1.85	0.8
richest	0.56	0.28, 1.06	0.078
parity			
1-3	—	—	
4-7	0.49	0.35, 0.67	<0.001
8+	0.48	0.25, 0.83	0.014

[1]IRR = Incidence Rate Ratio, CI = Confidence Interval