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UNIVERSITY OF GHANA

SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

ASSESSING THE EFFECT OF INCENTIVES TO ENCOURAGE FACILITY-BASED DELIVERY AMONG WOMEN AT GREY BUSH HEALTH FACILITY IN SIERRA LEONE

MOMODU SESAY

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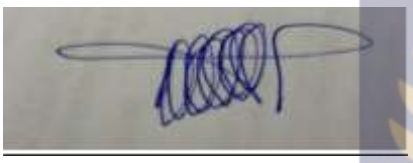
A DISSERTATION SUBMITTED TO THE UNIVERSITY OF GHANA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE MASTER OF PUBLIC HEALTH (MPH) DEGREE

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DECLARATION

I hereby confirm that this dissertation, entitled *'Assessing the Effect of Incentives to Encourage Facility-Based Delivery Among Women at Grey Bush Health Facility in Sierra Leone (2010–2023),'* is my own original work, conducted independently under the supervision and guidance of Dr. Emefa Judith Modey. Except where proper citations or acknowledgments have been made, all content is my own. This work has not been submitted, in whole or in part, for any other academic degree or professional qualification.



Momodu Sesay **Date:** 11th September 2025

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DEDICATION

This dissertation is dedicated to Almighty God, the source of my strength throughout this journey. I also dedicate it to my beloved wife, Mariama Seray Sesay, and to my children, Malikie, Sarah, Ameera, Ruth Hannah, and Fatu Sesay for their unwavering love and support.

Additionally, I dedicate this work to the cherished memory of my late grandmother, Mamy Chernor Saio Sesay; my late mother, Namina Samura, and my late father, Malikie Sesay whose lives, values, and legacy continue to guide and inspire me.

Finally, this dissertation is also dedicated to the memory of my late uncle, Sana Barnard Samura, who always believed in me.

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I also extend my sincere appreciation to Professor Kwasi Torpey, Professor Richmond Aryeetey, Professor John Ganle, and to all the well-wishers and contributors whose names I cannot fully list here. May God bless you all abundantly.

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ABSTRACT

Background:
In Sierra Leone, maternal and infant death rates are still high. Despite the Free Health Care Initiative that offers to make health care services free, challenges due to a cultural preference for delivering at home and barriers of access to the health facility continue to persist. To promote deliveries in healthcare facilities the Mama-Pikin Foundation initiated an incentive program providing delivery kits and transportation allowances to women through the Grey Bush Community Health Centre. This study therefore sought to assess the effect of incentives to encourage facility-based delivery among women at Grey Bush health Facility in Sierra Leone

Methods:
A secondary analysis of health facility records of 5,198 women attending ANC at Grey Bush health facility in Sierra Leone was undertaken over a 14year period of 2010 to 2023. Descriptive analysis was used to report aggregated frequencies and percentages of the various categories of background factors as well as the key maternal health outcomes of supervised deliveries, antenatal care (ANC) contacts, maternal deaths, and home deliveries under investigation. An Interrupted Time Series (ITS) analysis was employed to compare the maternal health outcomes before and after program implementation to explore the intervention effect among women The coefficients for the intervention variable and interaction terms alongside the change levels and confidence intervals were reported to compare trends in pre and postintervention. All analysis was set at 95% confidence level.

Results:

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The analysis revealed that home deliveries decreased substantially from 107.63 in 2017 to 99.49 per 100,000 live births in 2023. This represented a change of 8.14 per 100,000. Supervised deliveries increased from 13.71% before 2017 to 19.39% in 2023. At postintervention, an increase in ANC 4th contacts coverage of 4.04% (P <0.05) was observed. For the 8th ANC contacts, the results reveals a concerning decline over the years, with a sharp drop from 50% in 2017 to 26.82% in 2022. Although a decline in maternal deaths was recorded, the long-term effect was negligible.

Conclusion:The incentive-based interventions lead to increased supervised delivery rates, increased ANC contact coverage and reduced maternal deaths. The Mama-Pikin Foundation's approach presents a model for overcoming cultural and logistical obstacles to accessing healthcare in Sierra Leone. Similar incentive programs could be implemented in high-mortality districts, alongside an assessment of the long-term impact and generalizability of such interventions in resource constrained settings.

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LIST OF ABBREVIATIONS

ANC	**Antenatal Care**
BPEHS	**Basic package of Essential Health Services**
CHC	**Community Health Centre**
CHOs	**Community Health Officers**
CHWs	**Community Health Workers**
DHMTs	**District Health Management Teams**
DMO	**District Medical Officer**
FCC	**Freetown City Council**
FHCI	**Free Health Care Initiative**
HFR	**Health Facility Record**
ITS	**Interrupted Time Series**
MDSR	**Maternal Death Surveillance and Response**
MHCP	**Maternal Health Care Providers**
MMR	**Maternal Mortality Rate**
MOHS	**Ministry of Health and Sanitation**
PHUs	**Peripheral Health Units**
SBA	**Skilled Birth Attendant**
SLDHS	**Sierra Leone Demographic Health Survey**
SRH	**Sexual Reproductive Health**
TBAs	**Traditional Birth Attendants**
WDC	**Ward Development Committee**
WHO	**World Health Organization**

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CHAPTER ONE (1)

BACKGROUND

1.0 Introduction

Maternal and infant mortality remain major global public health concerns, particularly in low- and middle-income countries where access to quality maternal health services is often limited (Allen et al., 2023). According to the World Health Organization, maternal mortality continues to pose a serious global challenge despite ongoing efforts to reduce preventable deaths associated with pregnancy and childbirth (World Health Organization, 2023). In 2020 alone, approximately 800 women died each day from preventable causes related to pregnancy and childbirth, which is equivalent to one maternal death nearly every two minutes. These figures highlight the urgent need to strengthen access to quality maternal healthcare services, ensure skilled birth attendance, and provide timely emergency obstetric care to prevent avoidable maternal deaths worldwide (World Health Organization, 2023).

The burden of maternal mortality is disproportionately concentrated in low- and middle-income countries. In 2020, about 87% of global maternal deaths, estimated at approximately 253,000 deaths, occurred in these countries. Sub-Saharan Africa accounted for the largest share, contributing roughly 70% of the total maternal deaths (around 202,000), while Southern Asia accounted for approximately 16% (about 47,000 deaths) (Sharrow et al., 2022). These figures demonstrate the persistent inequalities in maternal health outcomes regions.

Despite these disparities, progress has been made in reducing maternal mortality globally. Regions such as Eastern Europe and Southern Asia have recorded significant reductions in maternal mortality ratios, declining by approximately 70% (from an MMR of 38 to 11) and 67% (from 408 to 134) respectively. Sub-Saharan Africa has also made progress, achieving a 33% reduction in maternal mortality over recent years (World Health Organization, 2023). Similarly, the overall maternal mortality rate in the least-developed countries has decreased by nearly 50% (Prasad et al., 2023). However, these improvements remain uneven, and the burden

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of maternal deaths continues to fall heavily on resource-constrained settings.

Although increased facility-based deliveries and other maternal health interventions have contributed to the global decline in maternal mortality, nearly 95% of maternal deaths still occur in low- and lower-middle-income countries (Tholandi et al., 2023). This situation reflects persistent gaps in access to quality maternal health services, including skilled birth attendance, emergency obstetric care, and adequate health system capacity.

Transportation costs represent a critical but often underestimated barrier to facility-based deliveries. For women living far from hospitals or clinics, the expense of traveling long distances can constitute a substantial portion of household income. As a result, some women delay seeking care or avoid health facilities altogether (Ronsmans et al., 2014).

Several strategies have been identified to further reduce maternal and infant mortality. Key among these are improving access to and quality of reproductive, maternal, and newborn health services, and expanding universal health coverage to ensure that women receive comprehensive care before, during, and after pregnancy (Khatri et al., 2022; Sidze et al., 2022). Other critical strategies include addressing the various causes of maternal mortality as well as reproductive and maternal morbidities and disabilities that affect women's health and well-being (Solnes Miltenburg et al., 2023). Strengthening health systems to generate high-quality data is also essential for identifying priority needs and guiding effective policy responses (Seward et al., 2022). In addition, ensuring accountability within health systems is crucial for improving both the quality of care and equity in maternal health services (Debie et al., 2022).

Evidence shows that care provided by skilled health professionals before, during, and after childbirth significantly reduces the risk of maternal mortality and related complications (Dol et al., 2022; Karkee et al., 2022). However, many women in developing countries still lack access to skilled maternal healthcare. More than one-third of pregnant women do not have contact with skilled health professionals before delivery, and an estimated 57% of births occur without the presence of skilled birth attendants (Mayra et al., 2022). This limited access

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contributes substantially to preventable maternal and neonatal deaths.

Sierra Leone continues to experience one of the highest maternal mortality rates globally. In 2019, the maternal mortality ratio was estimated at 717 deaths per 100,000 live births (World Bank, 2022). Adolescent girls are particularly affected, with over one-third of women aged 20–24 giving birth before the age of 18. The lifetime risk of maternal death in the country is estimated at 1 in 17. Infants born to adolescent mothers also face increased risks of illness and death, many of which are preventable with appropriate maternal and newborn care services (Shafiq et al., 2024; Turienzo et al., 2023).

In response to the high burden of maternal and infant mortality, the Government of Sierra Leone has implemented several strategies to improve maternal health outcomes. The Maternal Deaths Surveillance and Response system emphasizes improving the quality of maternal healthcare services, particularly emergency obstetric care, by ensuring the availability of essential medicines, supplies, and trained personnel while promoting institutional deliveries (Fornah, 2022; WHO, 2021). One of the key interventions introduced to address financial barriers to healthcare is the Free Health Care Initiative for pregnant women, lactating mothers, and children under five years of age. By removing user fees, this program has helped improve access to essential health services and encouraged more women, particularly those from low-income households, to seek care at health facilities.

At the facility level, additional community-based and incentive-driven interventions have also been introduced to promote institutional deliveries. In January 2017, the Mama-Pikin Foundation, a national non-profit organization working at Grey Bush Community Health Centre (CHC), introduced an incentive program aimed at encouraging pregnant women to deliver at the facility. The program provides delivery kits and transportation allowances to women who give birth at the health center, thereby addressing common barriers such as transportation costs and lack of delivery supplies.

Despite these interventions, home deliveries remain common in many communities, which

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continue to pose significant risks for both mothers and newborns. Understanding the effectiveness of incentive-based strategies in promoting facility-based deliveries is therefore critical for improving maternal health outcomes. This study therefore aims to evaluate the effectiveness of the Mama-Pikin Foundation intervention at Grey Bush Community Health Centre in reducing home births, increasing facility-based deliveries, and contributing to the reduction of maternal deaths.

1.1 Problem Statement

Despite various national and global efforts to improve maternal health, home delivery remains common in many parts of sub-Saharan Africa, including Sierra Leone. Several structural and socioeconomic factors influence pregnant women's decisions to deliver at home rather than in health facilities. These include poor infrastructure, long travel distances to health facilities, and high transportation costs, which continue to limit timely access to skilled birth care (Kpogho et al., 2021). Although initiatives such as free maternal healthcare have attempted to remove financial barriers to service utilization, indirect costs particularly transportation remain a major obstacle for many women, especially those living in rural or underserved communities.

In rural and underserved areas where access to fully equipped health facilities is limited, maternal and child mortality rates are reported to be nearly twice as high as those in urban centers (Statistical Service Sierra Leone and ICF Macro, 2020). Limited availability of skilled birth attendants in these settings significantly increases the risk of adverse outcomes during childbirth. Without access to skilled care, complications such as infections, obstructed labor and complications associated with preterm or low-birth-weight infants may go unmanaged.

In home delivery settings, access to emergency obstetric care is also limited, meaning that life-threatening complications such as postpartum hemorrhage may not be treated in time (Frontières, 2012). Similarly, delays in referrals for complications such as fetal distress or prolonged labor increase the likelihood of poor maternal and neonatal outcomes (Getachew et al., 2021).

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Given the continued prevalence of home deliveries and the associated risks for mothers and newborns, it is important to evaluate whether incentive-based strategies can effectively increase facility-based deliveries in resource-constrained settings. This study therefore seeks to assess the effectiveness of the Mama-Pikin Foundation intervention at Grey Bush Community Health Centre in reducing home births, increasing facility-based deliveries, and ultimately contributing to the reduction of maternal mortality.

1.3 Research Objectives

1.3.1 Main Objective

The main goal of this study is to assess the effect of incentives to encourage facility-based delivery among women at Grey Bush health Facility in Sierra Leone

1.3.2 Specific Objectives:

The specific objectives of the study are.

1. To determine the effect of incentives on deliveries conducted at the facility by skilled health personnel

2. To estimate the number of ANC contacts completed among pregnant women seeking care at the facility

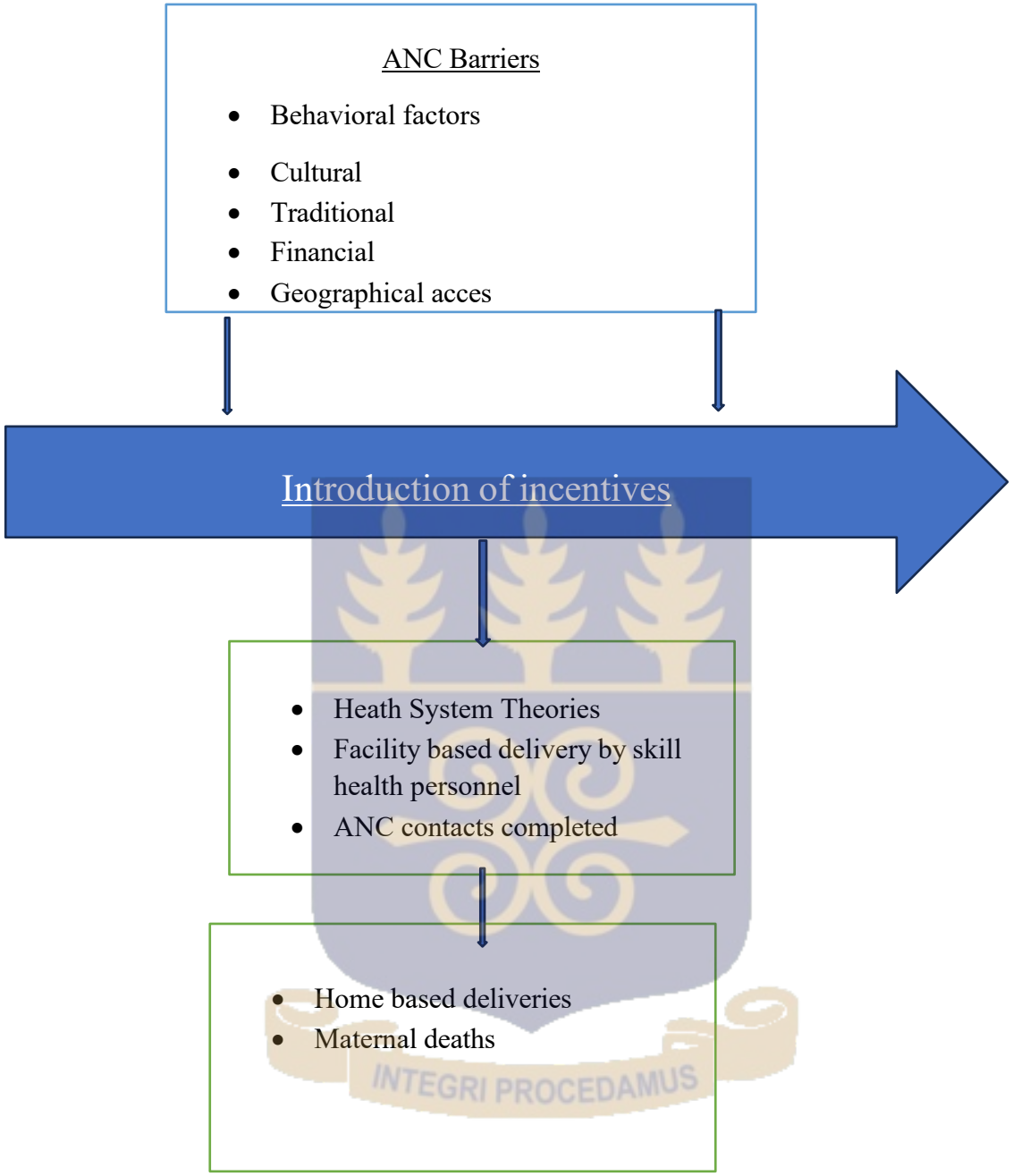
3. Identify the effect of incentives on home deliveries conducted in the catchment communities

4. To determine the effect of incentives on maternal deaths recorded in the facility

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Figure 1: Conceptual framework



The conceptual framework was adapted from a study by Edward N. Okeke in 2020 titled "Maternal Cash Transfers Led to Increases in Facility Deliveries and Improved Quality of Delivery Care in Nigeria".

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Narrative of Conceptual frameworks:

Maternal and neonatal mortality rates are influenced by facility-based deliveries, particularly skilled attendance at birth. Home births, particularly in rural or underserved areas, are often riskier due to the lack of medical professionals and equipment and contribute to increased deaths and disability among women and neonates. Incentives play a key role in influencing maternal health outcomes, as they offer pregnant women various benefits to encourage delivery at health facilities rather than at home (Okeke et al, 2020). These incentives could be direct financial and non-financial incentives and may include delivery buckets, soap, lappa/wraper, mackintosh, financial assistance (transport refund) to the facility to overcome barriers to healthcare. By providing such rewards, the goal is to make facility-based deliveries more attractive and accessible to women in the community.

A woman's perception of the need for skilled birth attendance strongly influences her choice of delivery location. When childbirth is viewed as a normal, low-risk event, women may prefer home delivery, especially in settings where traditional practices are widely accepted. However, awareness of potential complications increases the likelihood of seeking facility-based care (Nigusie, Azale et al. 2022). Health system factors also play a critical role. Geographic access, including distance and transportation, can limit service use, while poor infrastructure further constrains access. Additionally, perceived and actual quality of care such as skilled staff, essential supplies, and respectful treatment significantly influence utilization decisions (Kruk, Gage et al. 2018).

The introduction of incentives over time was expected to lead to an increase in skilled facility-based deliveries, where women give birth in health facilities under the care of trained medical professionals like Community Health Officers (CHOs), nurses, or midwives. These deliveries offer significant advantages, such as emergency care and a safe environment for both the mother and baby. Where incentives are introduced, more women are encouraged to choose skilled care in health settings, reducing the risks associated with home deliveries that lack

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trained professionals and medical resources (Melhado et al, 2013).

As more women are incentivized to give birth at health facilities, home deliveries are expected to decrease. Maternal deaths are likely to decrease as more pregnant women will visit the health facility for skill care services. Providing incentives will result in increased numbers of women attending ANC sessions, early detection of birth complications and fewer preventable maternal deaths.



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1.4 Justification

Incentives are designed to encourage women to choose the safer option of delivering at a health facility, helping to lower the incidence of home births. An increase in facility-based deliveries, ANC contacts completed, decreased home deliveries, and a reduction in maternal deaths will improve maternal health outcomes for mothers and neonates.

Knowledge of how incentive can contribute to increased facility-based deliveries in the Sierra Leone context will contribute to the understanding of incentive-based interventions to improve maternal health outcomes and inform policy decisions aimed at reducing maternal and neonatal mortality rates in Sierra Leone.



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CHAPTER TWO (2)

LITERATURE REVIEW

2.0 Introduction

This section of the study reviews literature based on the various objectives of the study. This section was compiled using evidence from science direct, PubMed and google scholar. Literature research was restricted to the last ten years.

2.1 Regional variation in Hospital based deliveries among Pregnant women in Africa

Hospital based delivery have been recognized as a key intervention that prevents complications often leading to mortalities among women in pregnancy. Numerous studies examining women's choice of delivery location have reported mixed findings. While some evidence shows a preference for hospital deliveries, other women choose to give birth at home. For example, a cross-sectional study conducted in the Manna district of Ethiopia, within East Africa, found that 86.4% of women utilized institutional delivery services. Key factors influencing this choice included frequent antenatal care visits, good awareness of labor danger signs, a higher household wealth index, the husband's education level (primary or higher), maternal age under 40, and living within 30 minutes of a health facility (Yoseph et al., 2020).

In contrast, data from West Africa specifically Nigeria revealed different trends. According to the 2013 Nigeria Demographic and Health Survey (Eneh 2017), up to 62% of women did not use health facilities for childbirth. Similarly, other studies from Nigeria indicated that only 46.6% of women were attended to by skilled health professionals in hospitals, while 25% gave birth at home or were assisted by traditional birth attendants (Okonofua et al., 2018). The study from Nigeria further revealed that over three-quarters of women with no formal education, and 92% of those who did not attend antenatal care (ANC) during pregnancy, did not use health facilities for childbirth. Lower level of education, poor household, aged 25-34 years, being unmarried, never attended antenatal clinic, experienced difficulty getting to health facility and lived in the

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most socioeconomically disadvantaged communities were factors that prevented women from delivering in hospitals (Adedokun & Uthman, 2019).

2.2 Number of Antenatal Care contacts completed by pregnant women

The fourth antenatal care (ANC) contact holds significant importance in maternal health for several reasons. By visit four, healthcare providers can be comprehensive in their examination of maternal weight gain (or loss), vital signs, and fetal growth. Importantly, monitoring is necessary to detect possible complications before they occur (World Health Organization2016). It provides education to mothers about pregnancy, childbirth, as well as postpartum care hence preparing them for delivery and newborn (Lassi et al., 2016). They enable early identification of risks like pre-eclampsia, gestational diabetes, and other common pregnancy-associated co-morbid conditions which if identified late can have profound repercussions (Singh et al., 2018). Essential vaccinations like tetanus toxoid can be administered during this visit, and advice on approaches to prevent common maternal health problems can be provided (Kumar et al., 2017). The fourth visit can also be used to screen maternal mental health, which is essential not only for the mother but also very important for the well-being of the child (Murray et al., 2011). Meanwhile, it can improve Continuation in Care by augmenting the number of routinized ANC contacts implying a culture of quality health hence, it creates better birth outcomes (Adetayo et al., 2020).

The recommended number of ANC contacts was reviewed and revised to 8ANC contact in 2018 by the WHO. The recommendation of 8 contact is based on research that shows regular checkups throughout the pregnancy help identify risks, monitor the baby's development, and ensure proper care.

In Sierra Leone, data from the DHS states that, only 22.0% of the surveyed women had eight or more ANC contacts. It also shows that by timing of ANC contact, only 44.8% of women initiated their first ANC contact in the first trimester (Sserwanja, Q., et al. 2022)

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A variety of factors affect the number of antenatal care (ANC) contacts women attend. Those who began ANC after the first trimester were less likely to complete the recommended eight or more visits. Similarly, younger women especially those aged 15 to 19, were less likely to attend the full number of visits (Sserwanja, Q., et al. 2022).

On the other hand, factors that were positively linked to attending eight or more ANC contacts included being employed, living in the southern region, using the internet, having fewer children (fewer than five), coming from wealthier backgrounds, and having fewer barriers to accessing healthcare facilities (Sserwanja et al. 2022). The completion of four ANC contacts has shown great variation from 63.9% in Northern Ethiopia, 20.8% in Uganda (Wondemagegn, E. T. et al. 2021).

In Nepal, despite government initiatives including financial incentives and supportive policies to enhance access to antenatal care (ANC), substantial barriers persist. These challenges are largely linked to socio-demographic factors such as geographic region, education level, household income, and cultural norms. Women in rural areas had significantly less access to ANC services compared to their urban counterparts. The study underscored the importance of targeted interventions, including better transportation infrastructure, financial assistance for low-income families, and awareness campaigns highlighting the importance of ANC. Overall, the findings point to the need for a comprehensive, systematic approach to improve maternal health and ensure that ANC services are accessible particularly for women living in poverty (Karki, R. K.2019).

A recent study explored the challenges faced by pregnant women in Sub-Saharan Africa in meeting the World Health Organization's recommendation of eight antenatal care (ANC) contacts. The findings reveal that many women in the region are unable to follow these guidelines due to factors such as poverty, limited access to healthcare services, transportation difficulties, and

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cultural barriers. These obstacles contribute to poor maternal and child health outcomes, including increased rates of maternal mortality and pregnancy-related complications. Policy reforms and health initiatives are essential to making antenatal care (ANC) more accessible, affordable, and culturally appropriate, with the ultimate goal of improving maternal and child health across Sub-Saharan Africa (Odusina et al. 2021).

2.3 Home delivery among pregnant women in Sierra Leone

According to the Sierra Leone Demographic and Health Survey (DHS), high rates of home births in the country are largely driven by cultural beliefs, poor healthcare infrastructure, and transportation difficulties (James et al., 2023). While progress has been made in terms of increasing institutional births, there are still significant barriers to achieving universal access to skilled maternal healthcare. Addressing these issues requires both infrastructural development and cultural engagement to encourage women to seek skilled medical assistance during childbirth

{Sserwanja, 2022}.

Capturing home delivery at the health facility level involves several steps to ensure accurate tracking and data collection. Grey Bush Community Health Center is implementing health facility record (HFR) systems that allow health workers to document home deliveries. These can include patient demographics, delivery details, and outcomes. In addition, the health facility staff have trained Community Health Workers (CHWs) to monitor and report home deliveries in their areas. They can collect data on deliveries, maternal and newborn health, and referrals to health facilities.

Poverty has been found to significantly affect the likelihood of delivering at home. Women from lower socioeconomic backgrounds were more likely to choose home deliveries. Increased antenatal visits were associated with a decreased likelihood of home delivery. Each additional visit reduced the chances of delivering home. Women living in rural areas were more likely to

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deliver at home compared to those in urban settings. The study highlighted that psychosocial support during childbirth played a crucial role in women's satisfaction with their birth experience. Many women reported positive experiences with traditional birth attendants (referred to as "mamies"), who provided emotional support and encouragement, leading them to prefer home births over facility deliveries. Negative past experiences in healthcare settings contributed to their preference for home births (Bangura 2022).

Another study from Tonkolili District, Sierra Leone highlighted several critical but similar factors influencing home deliveries. Challenges in access to health facilities due to long distances, impassable rivers, and inadequate transportation options were reported. Direct and indirect costs associated with healthcare. Direct costs are those paid by patients out of pocket and any expenses directly related to patient care. Most of these are standard costs such as medical services, medications, hospitalization, diagnostic tests (e.g., cost for laboratory testing and imaging studies, other diagnostic procedures), and Preventive Care (e.g., costs associated with vaccinations, screenings, and routine examinations). Indirect costs are less tangible, but no more immune to considerations. These are costs that do not appear on a hospital bill but indirectly result from health conditions. Major indirect costs include lost income due to time off work for illness or recovery, which can result in significant financial hardship for low- and middle-income individuals.

Additional burdens arise from travel expenses to healthcare facilities, especially in rural areas where transportation is limited and more costly, and the need for caregivers, often family members, to assist patients. Collectively, these indirect costs can be substantial, sometimes catastrophic, and strongly discourage women from seeking facility-based care. These costs were substantial, discouraging women from seeking facility-based care. The perceived negative behavior of hospital staff and societal norms which include Patriarchal decision-making, Preference for traditional birth attendants (TBAs) also played a crucial role in women's

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decisions regarding childbirth. There were notable disparities between urban and rural areas in terms of healthcare access, with rural women facing greater obstacles. (Holland L.D et al 2017)

2.4 Maternal mortality among pregnant women

A systematic review of maternal health care providers (MHCP) attitudes showed that patient-provider negative interactions can negatively impact maternal health contributory factors. Several studies found evidence of verbal abuse, neglect and healthcare provider individuals' disrespect towards pregnant women. This discourages women to seek early treatment for pregnancy and childbirth. The mindset and conduct of MHCPs influence women to choose where they will deliver. We expect that disrespectful and abusive care will increase maternal mortality as women, adopting the safer option of home deliveries rather than risking damage from a provider (Mannava et al., 2015).

A study by Kelfala Mbady Bangura focuses on Sierra Leone. This research employs a mixed-methods approach, utilizing both secondary data analysis and a literature review. The analysis is framed using Thaddeus and Maine's three delays analytical framework to explore factors influencing maternal mortality. The main objective of this study is to examine the factors contributing to maternal mortality in Sierra Leone, with particular emphasis on the barriers that hinder women from accessing skilled birth attendants and healthcare facilities during childbirth. Contributing factors include low levels of education, poverty, limited awareness of pregnancy-related complications, and the lack of women's involvement in household decision-making. These challenges often result in delays in seeking care and a preference for home deliveries over professional medical support. The study also highlights systemic issues such as the unequal distribution of health facilities particularly in rural areas along with long travel distances and inadequate transportation infrastructure. These logistical challenges discourage women from delivering in healthcare facilities. Attitudes of healthcare staff, inadequate staffing, and poor quality of care at health facilities were significant deterrents. Negative experiences with healthcare providers can lead women to prefer home births, where they may

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feel more comfortable despite the risks involved. Cultural beliefs and practices also contribute to the prevalence of home deliveries. Many women turn to traditional birth attendants, often due to perceived shortcomings in formal healthcare services. The study emphasizes that reducing home births and improving maternal health outcomes in Sierra Leone will require a multifaceted approach, one that includes expanding access to education, strengthening transportation infrastructure, improving the availability and quality of healthcare services, and addressing cultural perceptions surrounding childbirth (Bangura 2022).

These findings highlight the complex interaction of social, economic, and systemic factors that shape women's decisions about where to give birth in Sierra Leone. They point to the urgent need for targeted interventions aimed at promoting facility-based deliveries. A scoping review of peer-reviewed literature conducted by Mukesh Hamal identified several key factors contributing to the preference for home births among pregnant women.

Among the structural factors, women from lower-income backgrounds were more likely to choose home deliveries due to the financial burden associated with institutional care. Cultural practices and social hierarchies also strongly influenced delivery choices. Additionally, both maternal and paternal education levels were linked to childbirth decisions, higher levels of education were associated with greater awareness of the benefits of delivering in a health facility.

Intermediary factors included the fact that women in rural areas faced greater obstacles in accessing healthcare services, resulting in a higher incidence of home births. The limited availability of healthcare facilities and skilled birth attendants in certain regions further contributed to this trend. Traditional beliefs surrounding childbirth also played a role, as some women preferred home deliveries in alignment with cultural norms.

(Bangura 2022).

2.5 Interventions introduced in Sierra Leone

Enhancing antenatal care attendance is crucial for improving both maternal and child health in

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Sierra Leone, and it plays a vital role in supporting the country's larger public health objectives. The introduction of initiatives including the Free Health Care Initiative (FHCI) to remove upfront charges for pregnant women, has not enhanced ANC quality and coverage as expected for several reasons. Some of the weak functionalities result from low community engagement and awareness of FHCI. Some of the services offered under this initiative are not known to many women, there are cultural factors such as, norms limiting women's autonomy in healthcare decisions, beliefs that pregnancy does not require formal medical care, and reliance on traditional practices and remedies further hinder ANC attendance. That poses a barrier to them seeking care (Sibthorpe et al., 2018). In a systematic review of lessons learned from programs that have aimed to use CHWs as part or whole family members, poor implementation strategies and inadequate monitoring and evaluation mechanisms further widened the gap between plans intended by this initiative versus results on the ground (Namasasu et al).

Mama-Pikin Foundation intervention: The Mama-Pikin Foundation (MPF) is a non-profit organization whose mission is to improve the health of women, children and families in Sierra Leone. Mama-Pikin means "Mother-Child" in krio a language commonly spoken in Sierra Leone.

The Organization works with the Ministry of Health and Sanitation (MOHS) to support training programs and strengthen quality of care in health facilities across districts. The Mama-Pikin Foundation also provide direct support to women, children, and families in communities and government health facilities.

The Mama-Pikin Foundation supports women who give birth at the Grey Bush Community Health Centre (CHC) by providing a delivery bucket and transportation allowance. Each delivery bucket includes a plastic sheet to ensure a clean surface for childbirth, a lapa (cloth) to wrap the newborn, and a bar of soap. Valued at $10 each, the foundation has distributed more than 2,300 buckets to women who delivered at the facility. This initiative has proven highly effective in

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reducing maternal and neonatal infections while also serving as an incentive for women to choose facility-based deliveries.

Prior to launching the intervention, the Mama-Pikin Foundation established a partnership with the Ministry of Health and Sanitation (MOHS) at the national level through the Directorate of Reproductive and Child Health. As a result of this collaboration, six districts were selected for implementation: Koinadugu, Bombali, Kenema, Kono, Western Area Urban, and Western Area Rural.

Stakeholder engagement at community level: Next, the Foundation piloted and introduced district level meetings with each of the District Health Management Teams (DHMTs) in each of the selected districts. These meetings served as an introduction to the project with local stakeholders, including DHMT members, District Councils, Paramount Chiefs, Sub-Chiefs, Youth Leaders and Women's Leaders. Engaging, those local voices also ensured that the project had local buy-in and that key community figures supported it.

In addition, eight (8) Peripheral Health Units (PHUs) were carefully selected across the six districts to implement the intervention. These facilities include Kondembaia CHC, Lengekoro CHP, Panlap CHC, Masongbo CHC, Yengema CHC, Hanga CHC, Grey Bush CHC, and York CHC.

The selection of these PHUs was intended to ensure broad geographic representation and to strengthen the delivery of the intervention at the community level, where essential primary healthcare services are most accessible to the population.

The Foundation also recruited Community Health Officers (CHOs) who work closely with the PHU staff to ensure the success of the intervention. These officers play a big role in engaging with the community to raise awareness on the services available to pregnant women and create go-to health facilities.

Additional scope of activities: Besides during routine and outreach immunization sessions and campaigns, they provide health education to pregnant women and lactating mothers — in other

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words, they help sensitize the communities on the significance of visiting the health facilities to seek healthcare.

The project is specifically designed to support pregnant women who attend Antenatal Care (ANC) services and choose to deliver at a health facility. It ensures that throughout pregnancy, labour, and delivery, these women receive continuous care from skilled health professionals. These women are closely monitored and tracked in both the ANC and delivery

registers, which record important details regarding their healthcare journey. This tracking system helps maintain an organized approach to ensure that all essential care and follow-up services are delivered efficiently throughout pregnancy and childbirth, ultimately supporting improved health outcomes for both mothers and their babies.



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CHAPTER THREE (3)

METHODOLOGY

3.0 Introduction

This chapter outlines the study's methodology, organized into the following sections: study design, data sources, variable descriptions, analytical framework, and data analysis.

3.1 Study Design

This study is based on an analysis of secondary data drawn from a prospective cohort study involving women who attended antenatal care (ANC) at the Grey Bush Health Facility in Sierra Leone.

3.2 Study Area

The study was carried out at the Grey Bush Community Health Centre (CHC), located in Freetown, within the Western Urban District of Sierra Leone. Freetown is densely populated, with an estimated 1,309,759 residents in 2023, spread across an area of 31.46 square miles. In Grey Bush community, the population of children under five (2,787), pregnant women (702), and mothers of under-five children (2,708) in the surrounding communities was identified through a participatory, community-based census conducted between 2010 and 2023. According to the national census, the total population of the study area in 2023 was 19,703.

The community is largely an unplanned, informal settlement marked by overcrowding, substandard housing, limited access to clean water, and inadequate sanitation facilities. Flooding is a frequent occurrence in parts of the area, often resulting in annual fatalities.

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Figure 2: map of Sierra Leone



3.3 Local health system structure

Government primary healthcare facilities at the sub-district level are known as Peripheral Health Units (PHUs). The District Health Management Team (DHMT) is responsible for planning, coordinating, and supervising services provided at these PHUs, as well as community-based interventions like public health campaigns. The Freetown City Council (FCC) also plays a vital supporting role in delivering community health services. Each PHU is backed by a Facility Management Committee (FMC), which acts as a bridge between the health unit and the community, assisting with community mobilization and outreach efforts.

Within the Freetown municipal area, each of the 48 wards has an elected Ward Development Committee (WDC) tasked with involving community members in general development activities. However, the specific roles and mechanisms for WDCs to effectively serve as community liaisons remain underdeveloped. Although the Government of Sierra Leone emphasizes the importance of community engagement in recent policy documents such as the Basic Package of Essential Health Services (BPEHS) 2015-2020, this responsibility is primarily assigned to Community Health Workers (CHWs). While the BPEHS acknowledges

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FMCs and WDCs as community stakeholders, it does not clearly define their roles or explain how they should integrate within the health system (O'Connor, Hutain et al. 2019)

3.4 Study Population

The study population consisted of pregnant women who accessed maternal healthcare services at the Grey Bush Community Health Center in Freetown, Sierra Leone, between 3rd January 2010 to 31st December 2023.

3.4.1 Inclusion Criteria

The primary inclusion criterion is:

1. Pregnant women, seeking delivery services
2. Pregnant women, reporting for ANC services.
3. Women of reproductive age (15-49 years).
4. Women residing within Grey Bush community health center catchment area

3.4.2 Exclusion Criteria

Women identified as having high-risk pregnancies (e.g., those with pre-existing medical conditions or complications) were excluded. This is because the facility is not positioned to provide that level of specialized care.

3.5 Data Source

The data used in this analysis consists of 168 monthly observations for each participant, covering a period of 3rd January 2010 and 31st December 2023. Data were obtained from health records, maternal health surveys, and administrative data from health facilities across the study area.

Ethical Considerations

Before beginning data collection, the researcher submitted an introductory letter to the health center's management to secure permission to conduct the study at the facility. Once approval

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was granted, the researcher enlisted the help of the Community Health Officer (CHO) responsible for the various units to assist in retrieving the necessary data.

A request for access to the data was also shared with the hospital administration. The researcher then extracted the desired data from the hospital data system for analysis.

3.6 Variables

3.6.1 Dependent Variables:

Supervised Delivery: Facility based/Supervised deliveries, recorded as a continuous outcome. This is the count of the number of supervised deliveries in an area or the proportion of all deliveries attended by trained health personnel, indicating the trend analysis over time.

ANC 4th Contact: This refers to the proportion of pregnant women who attended at least four antenatal care (ANC) contacts. It measures either the count or the percentage of pregnant women who have had four or more ANC contacts. Following the updated WHO guidelines from 2016, data also considered up to eight ANC contacts. This outcome can be reported as a continuous variable, reflecting the exact number of women attending four or more visits.

Maternal Mortality Ratio: This represents the number of maternal deaths per 100,000 live births within a specified period. The maternal mortality ratio is calculated by dividing the total maternal deaths during a defined timeframe (usually one year) by the total number of live births in the same period, then multiplying by 100,000 to standardize the rate per 100,000 live births. This measure is often reported as a continuous variable, expressed either as a ratio or a rate

Home Deliveries: Proportion/number of births taking place at home. The indicator is computed in the same way as for the ANC attendance variable, i.e. It may be defined as either the number of home births without skilled health attendance, or more broadly as a percentage of total births that take place at home, without professional health support. The denominator was all births, while the numerator supervised home births. The outcome was as a discrete variable (count)

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3.6.2 Independent Variables:

Time (t): A continuous variable representing the time points (in years). It is considered an independent variable because it is controlled in the experiment and does not depend on other variables.

Intervention: A binary variable (0 = pre-intervention, 1 = post-intervention) representing the time point at which the intervention was introduced.

3.6.3 Time Period and Segmentation:

The study period consists of 168 monthly observations for each outcome variable defined based on the month when the incentives program was launched. which was during the 85th month (Jan 2017).

Model Specification: The ITS model is specified to assess the effect of intervention on each of the outcomes. The following regression model is used for each variable:

The general regression model is specified as follows:

$Yt=\beta0+\beta1\times Timet+\beta2\times Interventiont+\beta3\times(Timet\times Interventiont)+\epsilon t$ Where:

- Yt: The outcome variable at time t (e.g., supervised delivery).
- Time t: A continuous variable representing time.
- Intervention t: A dummy variable, coded as 0 for the pre-intervention period and 1 for the post-intervention period.
- Time t ×Intervention t: An interaction term indicating the change in trend following the intervention.

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- ϵt: Error term.

Newey-West standard errors are used to adjust for possible autocorrelation and heteroscedasticity in time series data, ensuring more reliable statistical estimates.

3.7 ITS Model Estimation

For each outcome, the following steps were used to estimate the ITS model:

3.7.1 Preliminary Analysis:

To examine the effect of the intervention, first plot the trends of each variable before the intervention and the trends after the intervention to visually check for differences. Then make sure data is stationary using visual plots and the Dickey-Fuller test. Finally, the Newey-West standard errors are applied to estimates parameters but corrects for standard errors.

3.7.2 Data Preparation:

The analysis treats time as a continuous variable. A binary variable is used to indicate the intervention period, with "0" representing the pre-intervention phase and "1" the post-intervention phase. An interaction term between time and the intervention is also included to assess whether the intervention altered the trend following its implementation.

Data Analysis

Descriptive statistics are generated for the various categories of independent variables as well as the outcome variable maternal mortality and facility-based delivery to understand the overall distribution and trends.

Means, standard deviation, and range for quantitative variables are calculated to provide an overview of maternal health outcomes before and after the intervention.

An interrupted time series analysis (ITS) was undertaken to observe how facility-based delivery changes over time, to enable the identification of any significant impacts directly attributable to the intervention.

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The ITS analysis provides insights into the effectiveness of the incentives program in influencing maternal health outcomes. By comparing trends before and after the intervention, the estimate would inform whether the program led to measurable improvements in supervised deliveries, ANC attendance, maternal mortality, and home deliveries.

Policy significance is highlighted in the relations identified for the number of ANC contacts made. This calls for increased efforts to encourage women to initiate ANC early and sustain the visits until delivery.

3.7.3 Model Diagnosis

To ensure the validity of the ITS model, several diagnostics were conducted. Autocorrelation was addressed using Newey–West standard errors to produce reliable estimates despite correlated observations. Residuals were plotted and examined for randomness; a random distribution indicated the model adequately captured underlying trends and intervention effects. Stationarity was confirmed using the Dickey–Fuller test, ensuring observed changes reflected the intervention rather than underlying trends. These procedures together strengthened confidence in the model's reliability, robustness, and policy relevance, providing assurance that the estimated effects accurately represent the impact of the intervention over time.

3.7.4 Quality Control

Several measures were implemented to ensure the accuracy, completeness, and reliability of the study data. Data cleaning was undertaken to identify and correct entry errors, duplicate records, and inconsistencies involved. Routine data verification processes were conducted to check the completeness and consistency of health facility records used in the analysis. Records with incomplete or inconsistent entries were cross-checked with facility registers and reporting logs where available. Records with substantial number of deliveries were also cross-checked with ANC attendance records to ensure consistency, completeness, and accuracy of reported maternal health service utilization, as well as to identify any discrepancies between antenatal care uptake and facility-based delivery outcomes. Missing information on the outcome were excluded, while minor

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inconsistencies were corrected through verification with source registers.

To address potential missing or inaccurately recorded outcomes, the dataset was carefully reviewed during data management. The frequency and distribution of missing values were assessed to determine their possible influence on the results. Sensitivity analyses, including shifting the intervention period and testing different lag models, were conducted to confirm the robustness of the findings.



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CHAPTER FOUR (4)

RESULTS

4.0 Introduction

This chapter presents an overview of the results of analysis of data from 5,19 8 women attending Grey Bush CHC for Antenatal care services and delivery

4.1 Sociodemographic characteristics

Aggregated data to describe some background characteristics of the 5,198 women is presented below. Women aged 25–34 years accounted for the largest proportion of deliveries, with 2,157 births (42%), indicating that most childbirths occur during this peak reproductive period. Women in this age group are often more likely to utilize skilled maternal healthcare services and may have better awareness of the benefits of facility-based delivery. The 35–39 years age group recorded 1,428 deliveries (27%), making it the second largest group, Women aged 20–24 years contributed 871 deliveries (17%), representing young adults beginning family life. Meanwhile, adolescents aged 14–19 years accounted for 742 deliveries (14%), (Table 1).

The educational profile of the women shows that the majority had secondary education (3,037; 58%), followed by primary education (1,026; 20%), no formal education (672; 13%), and tertiary education (463; 9%).

The data indicate that 5,141 deliveries (99%) occurred between 37–42 weeks of gestation, while only 57 births (1%) occurred before 37 weeks.

A considerable proportion of women had contact with antenatal care services before delivery. The data show that 48% had at least one ANC contact, 41% completed four contacts, and 11% achieved eight ANC contacts.

***Table 1*: Socio-demographic characteristics of 5,198 women who delivered at Grey Bush CHC**

Variable	Frequency (n)	Percent (%)
Age (years)		
14 – 19	742	14
20 - 24	871	17

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25 - 34	2,157	42
35 - 39	1,428	27
Education		
No Education	672	13
Primary	1,026	20
Secondary	3,037	58
Tertiary	463	9
Trimester		
<37 Weeks	57	1
37 - 42	5,141	99
ANC Contacts		
At least 1 contact	5972	48
4 completed contacts	5228	41
8 completed contacts	1371	11

4.2 Impact of intervention on maternal health outcomes

The table presents results from a study examining changes in key maternal health indicators before and after an intervention. These indicators include supervised delivery coverage, antenatal care (ANC) contact coverage, maternal death, and the number of home deliveries. The data is broken down into four timepoints: baseline, pre-intervention, immediate post-intervention, and post-intervention trends.

Home based deliveries: Before the intervention, there were 19.71 home deliveries per 100,000 live births ($P < 0.0001$, CI = [14.26, 25.17]), Before the intervention, there were 19.71 home deliveries per 100,000 live births ($P < 0.0001$, CI = [14.26, 25.17]). This indicates that home deliveries were relatively rare compared with the total number of live births. A slight decrease of 0.79 home deliveries per 100,000 was observed before the intervention, but it was not statistically significant ($P = 0.128$, CI = [-1.84, 0.27]). Following the intervention, there was a statistically significant reduction of 8.14 home deliveries ($P = 0.011$, CI = [-13.99, -2.30]), indicating a notable shift toward facility-based deliveries.

Supervised/Facility based delivery: Initially, 6.95% of deliveries were supervised ($P < 0.0001$, CI = [6.37%, 7.53%]), indicating a very low rate of supervised deliveries. A small decrease of

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0.146% (P = 0.010, CI = [-0.25, -0.04]) occurred before the intervention, but it was statistically significant. The intervention led to a significant increase of 3.826% in supervised delivery coverage (P = 0.006, CI = [1.38%, 6.28%]), showing an immediate positive effect. There was a smaller, but still positive increase of 1.210% (P = 0.002, CI = [0.57%, 1.85%]) in the post-intervention period, indicating sustained improvement over time.

ANC Contact attendance: At the start, 93.61% of pregnant women attended their 4th ANC contact (P

< 0.0001, CI = [86.81%, 100.41%]), which was already a high percentage. There was a slight decrease of 2.05% (P = 0.010, CI = [-3.49%, -0.61%]), indicating a small decline prior to the intervention. The immediate change was a 5.54% increase, but it was not statistically significant (P = 0.210, CI = [-3.68%, 14.75%]), suggesting some uncertainty about the immediate impact. However, in the long term, the intervention led to a significant increase of 4.04% (P = 0.005, CI = [1.57%, 6.59%]), showing that the positive effects of the intervention continued over time.

Maternal death: The maternal mortality rate was initially 6.86 deaths per 100,000 livebirths (P < 0.0001, CI = [4.07, 9.64]), which provides a measure of maternal death at the start. There was no significant change in pre-intervention (β = -1.79e-06, P = 0.498, CI = [-7.45e-06, 3.88e-06]). After the intervention, a very small decrease of 0.0000389 was observed, and this change was statistically significant (P = 0.044, CI = [-0.0000767, -1.18e-06]), but it is a very tiny reduction in the maternal death. However, in the long-term trend, the reduction was minimal and not statistically significant (β = -1.43e-06, P = 0.681, CI = [-8.94e-06, 6.08e-06]), suggesting the intervention may have had limited long-term impact on reducing maternal deaths.

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Table 2 impact of intervention on supervised delivery coverage, ANC 4th visit coverage and maternal death ratio

Variable/indicator	Baseline	Pre-intervention	Immediate change post-intervention	Post- intervention trend
	% [P,95% CI]	β1(95% CI), P	β2[P,95% CI]	β3[P,95% CI]
Supervised delivery coverage	6.95 % (P < 0.0001, CI = [6.37, 7.53])	-0.15 CI = [-0.25, -0.04]) (P = 0.010,	3.83 (P = 0.006, CI = [1.38, 6.28])	1.21 (P = 0.002, CI = [0.57, 1.85]).
ANC 2nd Contact Coverage	81.52% (P < 0.0001, CI = [72.62, 90.42])	2.90 (P = 0.061, CI = [-0.16, 5.96]).	-4.34 (P = 0.610, CI = [-22.70, 14.02])	-5.07 (P = 0.007, CI = [-8.41, -1.74]).
ANC 3rd Contact Coverage	89.21% (P < 0.0001, CI = [73.86, 104.56])	-0.38 (P = 0.817, CI = [-3.92, 3.16])	2.56 (P = 0.732, CI = [-13.65, 18.78])	0.09 (P = 0.959, CI = [-3.62, 3.79]).
ANC 4TH Contact Coverage	93.61% (P < 0.0001, CI = [86.81, 100.41]).	-2.05 (P = 0.010, CI = [-3.49, -0.61])	5.54 (P = 0.210, CI = [-3.68, 14.75])	4.04 (P = 0.005, CI = [1.57, 6.59]).
Maternal death ratio (Per 100,000)	6.86 (P < 0.0001, CI = [4.07, 9.64]).	-1.79e-06 (P = 0.498, CI = [-7.45e-06, 3.88e-06]).	-0.0000389 (P = 0.044, CI = [-0.0000767, -1.18e-06]).	-1.43e-06 (P = 0.681, CI = [-8.94e-06, 6.08e-06])
Number of home deliveries	19.71 (P < 0.0001, CI = [14.26, 25.17])	-0.79 (P = 0.128, CI = [-1.84, 0.27])	-8.14 (P = 0.011, CI = [-13.99, -2.30])	-0.07 (P = 0.912, CI = [-1.47, 1.33])

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4.3 Supervised delivery

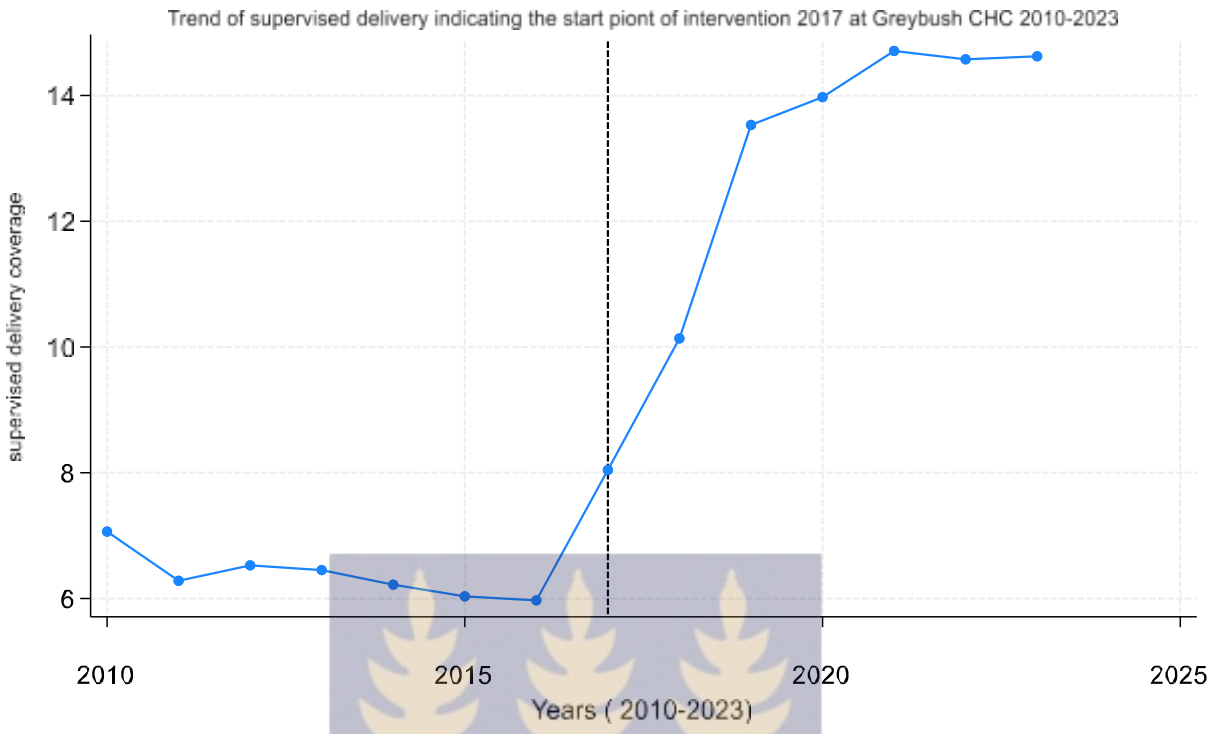
The regression model with Newey-West standard errors (Table 2) shows that, prior to the intervention, the baseline level of supervised deliveries was estimated at 6.95 % ($P < 0.0001$, CI = [6.37, 7.53]). This intercept reflects the estimated average level of supervised deliveries before 2017.

The coefficient for the time variable, which represents the pre-intervention trend, is -0.15 ($P = 0.01$, CI = [-0.25, -0.04]). This indicates that, on average, supervised deliveries decreased by approximately 0.146% per year before the intervention was implemented. This statistically significant negative trend suggests that, without intervention, supervised deliveries were on a decline in the years preceding 2017.

The immediate effect of the intervention in 2017 is captured by the coefficient for the intervention dummy variable, which is 3.83 ($P = 0.006$, CI = [1.38, 6.28]). This result implies that there was a statistically significant immediate increase of 3.83 % in the level of supervised deliveries in the year the intervention was introduced. The positive coefficient indicates that the intervention successfully boosted the level of supervised deliveries initially, marking a notable shift from the previous downward trend.

The post-intervention trend, represented by the interaction term, has a coefficient of 1.21 ($P = 0.002$, CI = [0.57, 1.85]). This significant positive coefficient indicates that the annual trend in supervised deliveries improved by 1.21% per year after the intervention, compared to the pre-intervention trend. Essentially, after the intervention, the trend in supervised deliveries reversed from a decline to a growth rate, reflecting a sustained increase in supervised deliveries over time.

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4.5

4.6 ANC 4th Contact

The baseline level, represented by the intercept, was 93.61 ($P < 0.0001$, CI = [86.81, 100.41]). This indicates that the starting level of ANC 4th contacts was approximately 93.61% prior to the intervention, establishing the baseline engagement with ANC services at the beginning of the observation period.

The coefficient for the baseline trend before the intervention is -2.05 ($P = 0.010$, CI = [-3.49, -0.61]). This negative coefficient indicates a statistically significant decrease of approximately 2.05 % per year in the rate of ANC 4th contacts before 2017. Thus, before the intervention, there was a steady decline in the number of women reaching their 4th ANC contact, signaling a pre- existing downward trend in ANC engagement.

The immediate effect of the intervention in 2017 is captured by the coefficient, which was 5.54 ($P = 0.210$, CI = [-3.68, 14.75]). However, this coefficient is not statistically significant ($P >$

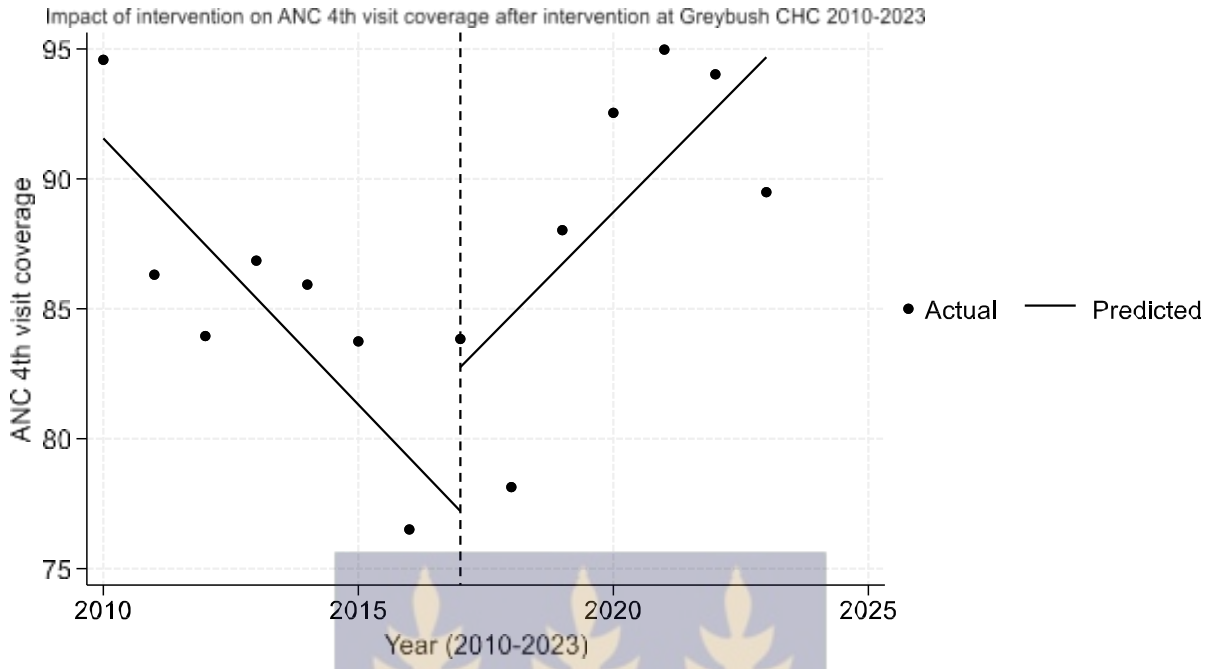
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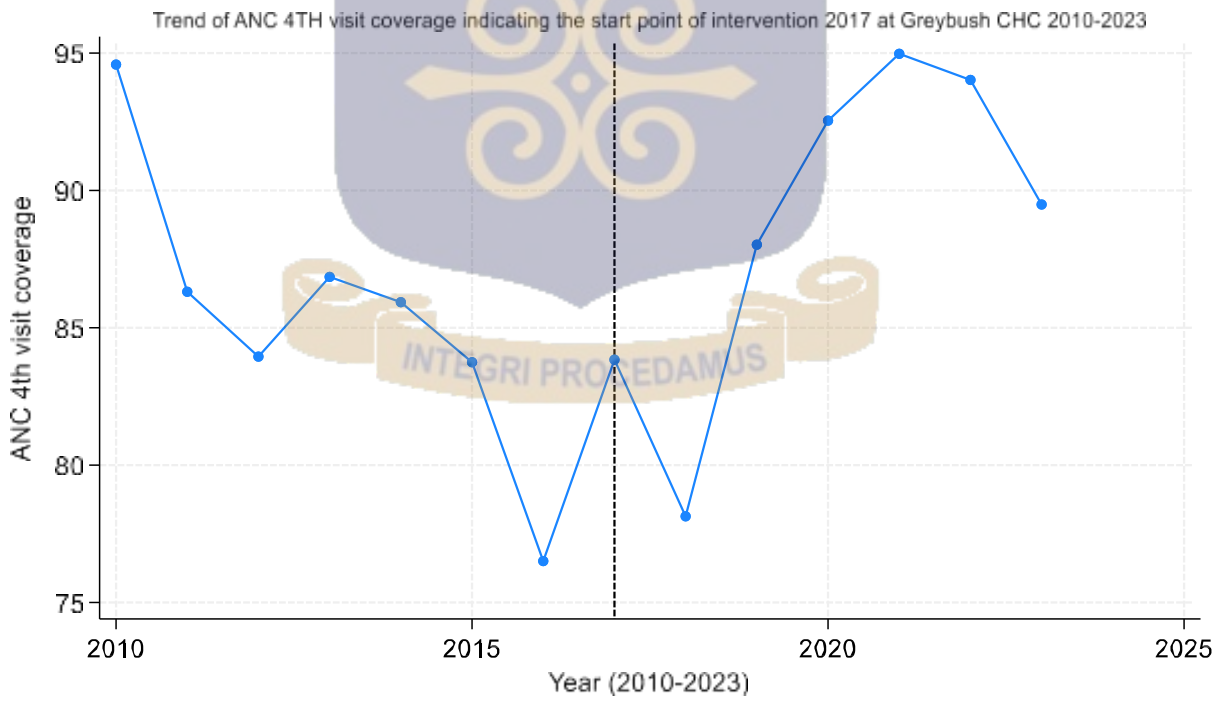
0.05), indicating that there was no significant immediate increase in the rate of ANC 4th contacts in the year of the intervention. Although the estimate suggests an increase, it is not strong enough to conclude a significant effect for the initial year of the intervention.

The post-intervention trend, represented by the interaction term, has a coefficient of 4.04 (P = 0.005, CI = [1.57, 6.59]). This positive and statistically significant coefficient suggests that, after the intervention in 2017, the rate of ANC 4th contacts increased by approximately 4.04% per year, reversing the pre-intervention downward trend. This sustained positive trend indicates that the intervention was associated with a meaningful increase in ANC 4th contacts over time.



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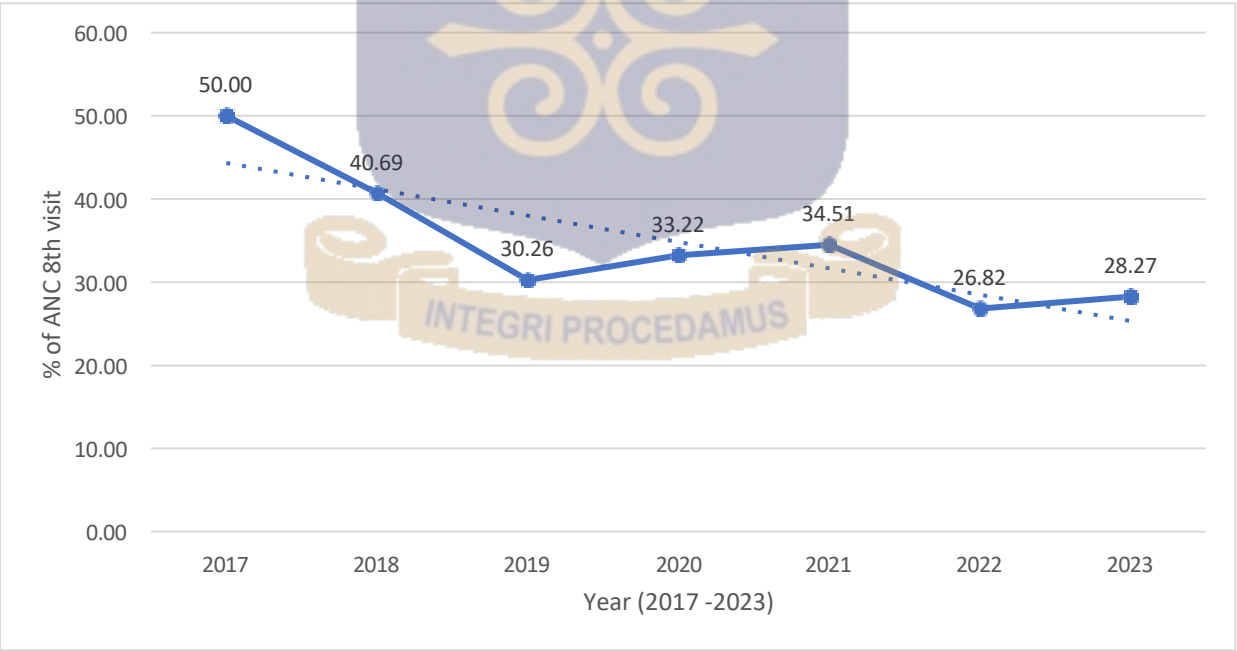
4.7 ANC 8th Contact

The trend shows a particularly sharp drop between 2017 and 2019, falling from 50% to around 30%. While there was a slight recovery in 2020-2021 (reaching about 34.51%), this improvement didn't last. By 2022, the percentage had fallen again to 26.82%.

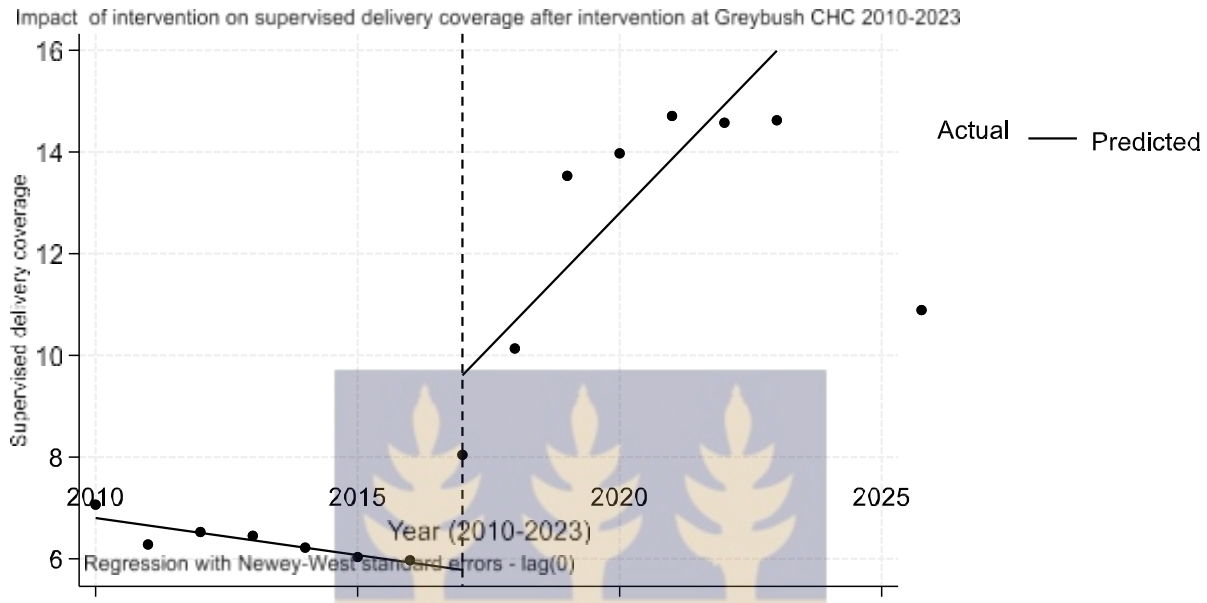
There's a small uptick at the end of the timeline, with 2023 showing a modest increase to 28.27%, which offers a glimmer of hope. However, this is still far below the 2017 levels.

The dotted line in the graph suggests an overall downward trend across these years, though the actual figures show some resilience with these small recoveries along the way.

This pattern is concerning from a maternal health perspective, as the 8th ANC contact is crucial for ensuring safe pregnancies and deliveries. The substantial drop from 50% to around 28% means that significantly fewer pregnant women receive this important late-stage care compared to 2017 levels.



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*Intervention: The graph illustrates the percentage of ANC (Antenatal Care) 8th visits from the year 2017 to 2023. Starting at 50.00% in 2017, the data shows a notable decrease, dropping to 30.26% by 2019. After 2019, the percentage of ANC 8th visits experiences fluctuations. It increases slightly to 34.51% in 2021, then declines to 26.82% in 2022. In the most recent year, 2023, the percentage sees a modest increase to 28.27%, reflecting an ongoing trend of instability in the data over time.

4.8 Maternal death per 100,000 livebirths

The baseline intercept is approximately 0.00000534. This represents the estimated maternal mortality ratio at the very start of the study period before any changes over time or interventions were introduced. In this context, it reflects the initial number of maternal deaths per 100,000 live births at Grey Bush CHC.

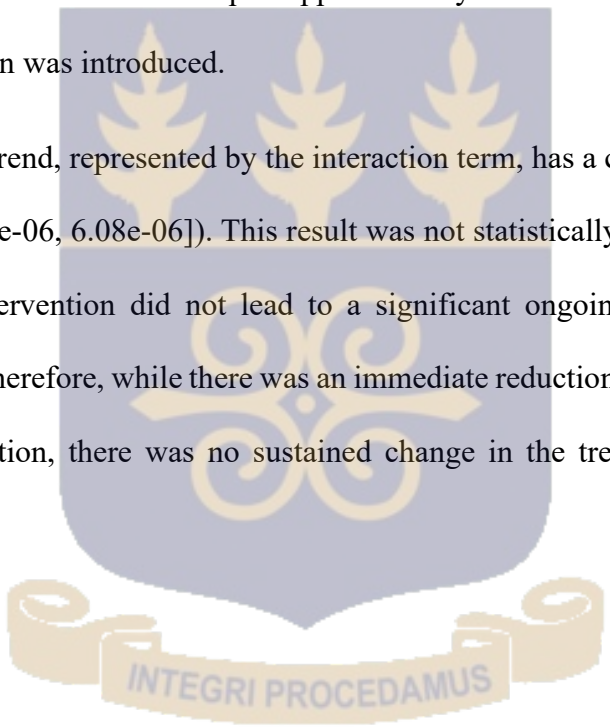
The coefficient for the time variable, which represents the trend in maternal death before the

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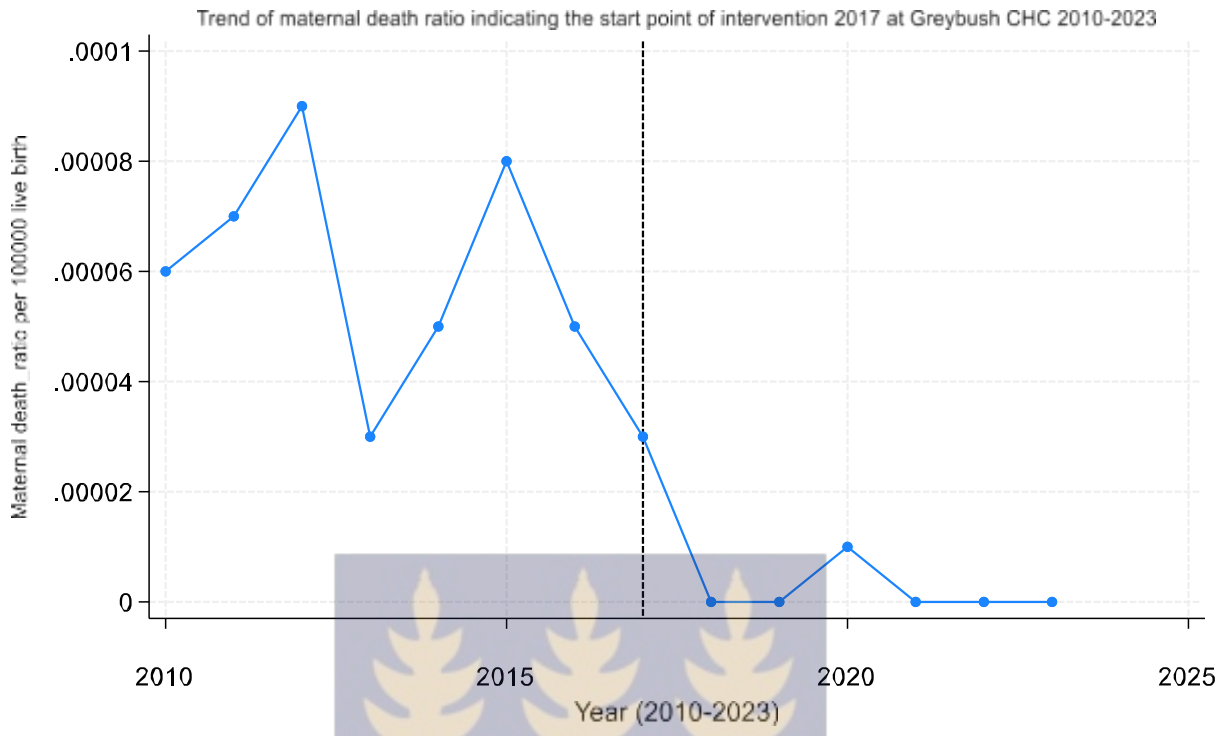
intervention, was -1.79e-06 (P = 0.498, CI = [-7.45e-06, 3.88e-06]). This result was not statistically significant (P > 0.05), indicating that there was no significant trend in the maternal death before the 2017 intervention. In other words, the maternal death ratio remained relatively stable leading up to the intervention.

The immediate effect of the intervention in 2017 is captured by the coefficient of -0.0000389 (P = 0.044, CI = [-0.0000767, -1.18e-06]). This result was statistically significant (P < 0.05), suggesting a significant immediate decrease in the maternal death ratio following the 2017 intervention. The estimate indicates a drop of approximately 3.89 in the maternal death ratio in the year the intervention was introduced.

The post-intervention trend, represented by the interaction term, has a coefficient of -1.43e-06 (P = 0.681, CI = [-8.94e-06, 6.08e-06]). This result was not statistically significant (P > 0.05), indicating that the intervention did not lead to a significant ongoing trend change in the maternal death ratio. Therefore, while there was an immediate reduction in maternal death ratio following the intervention, there was no sustained change in the trend over time after the intervention.

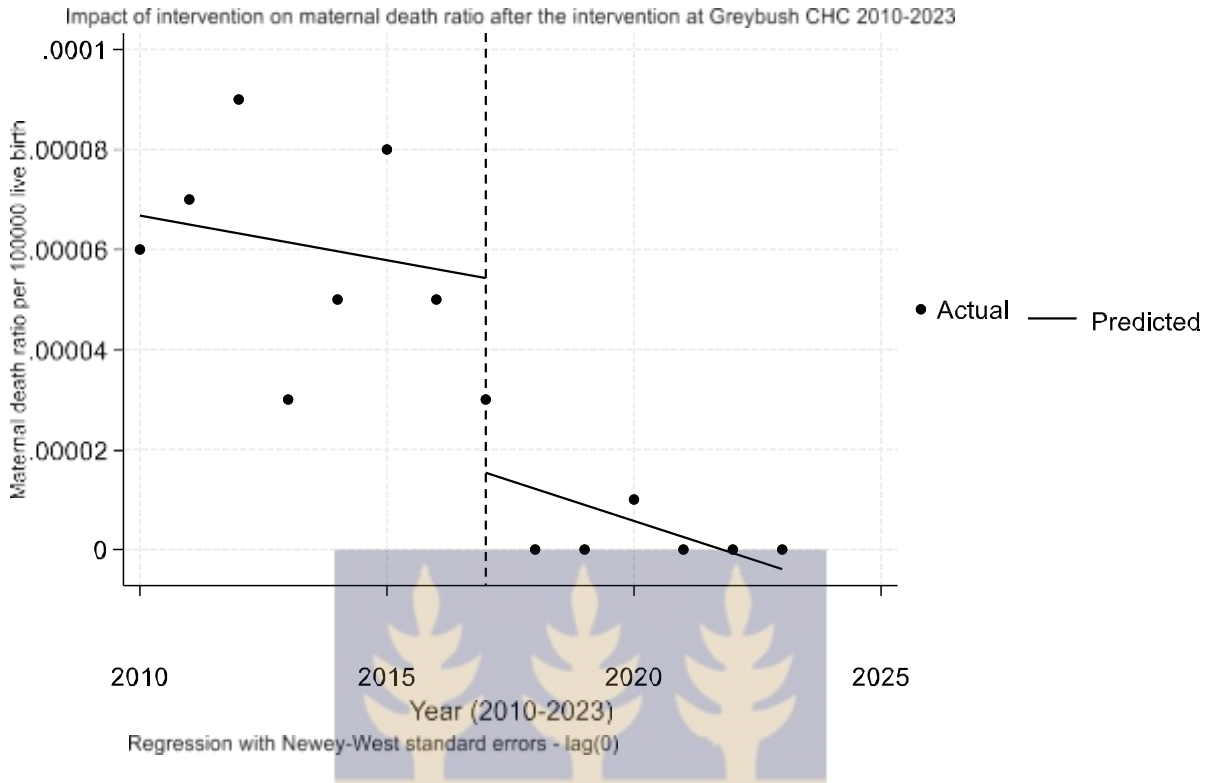


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Intervention: The graph depicts the trend of maternal mortality ratios per 100,000 live births at Greybush CHC from 2010 to 2023, with a critical event marked by the vertical dashed line in 2017, labeled as the "start point of intervention." Before 2017, the maternal mortality ratio fluctuates, showing an unstable pattern of maternal deaths. However, following the implementation of the intervention in 2017, there is a dramatic and sustained decline in the ratio, with the mortality rate remaining at or near zero from 2018 to 2023. This suggests that the intervention played a highly effective role in significantly reducing maternal deaths at the facility.

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4.9 Home Deliveries

The baseline level, represented by the intercept, was 19.71 ($P < 0.0001$, CI = [14.26, 25.17]). This indicates that the estimated number of home deliveries at the beginning of the observation period was approximately 19.71 per year.

The coefficient for the time variable, representing the pre-intervention trend, is -0.79 ($P = 0.128$, CI = [-1.84, 0.27]). This suggests that the number of home deliveries decreased by approximately 0.79 per year before the intervention. However, the result is not statistically significant ($P > 0.05$).

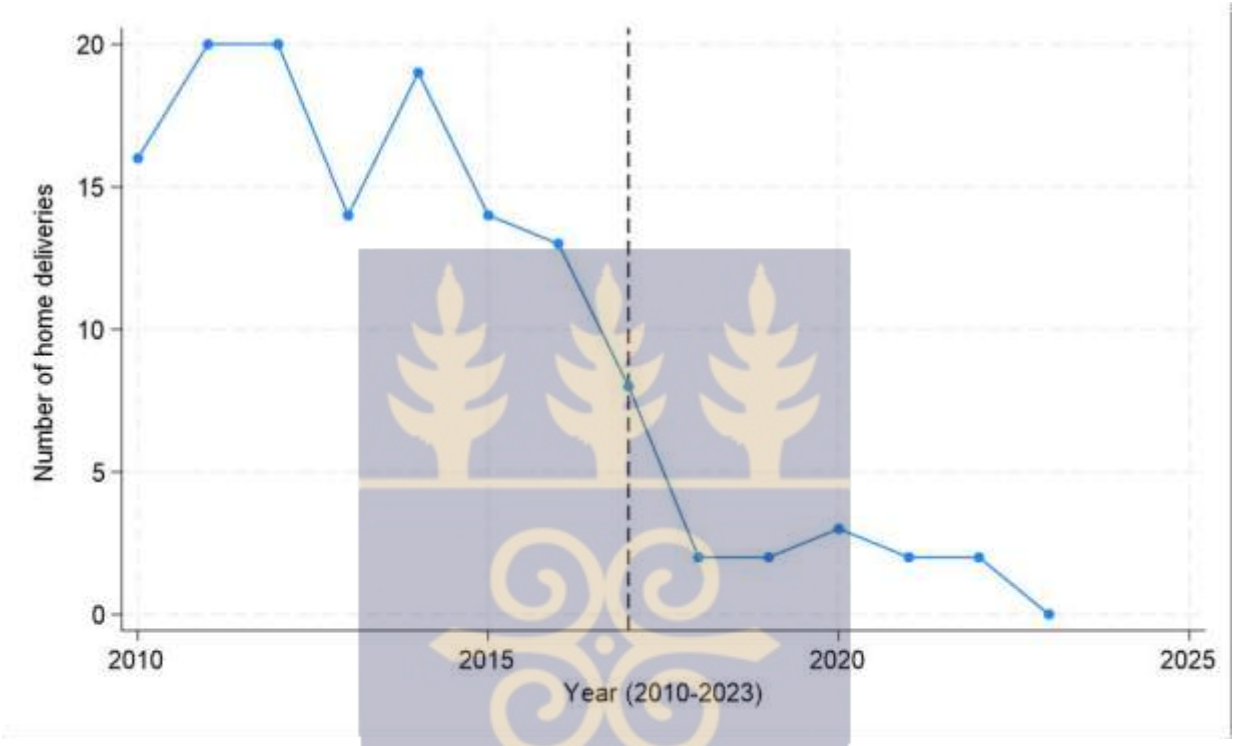
The immediate effect of the intervention in 2017 is captured by the coefficient of -8.14 ($P = 0.011$, CI = [-13.99, -2.30]). This indicates that the intervention led to an immediate and statistically significant reduction of 8.14 home deliveries in the year of implementation.

The post-intervention trend, represented by the interaction term, has a coefficient of -0.07 ($P = 0.912$, CI = [-1.47, 1.33]). This suggests that the post-intervention trend in home deliveries did

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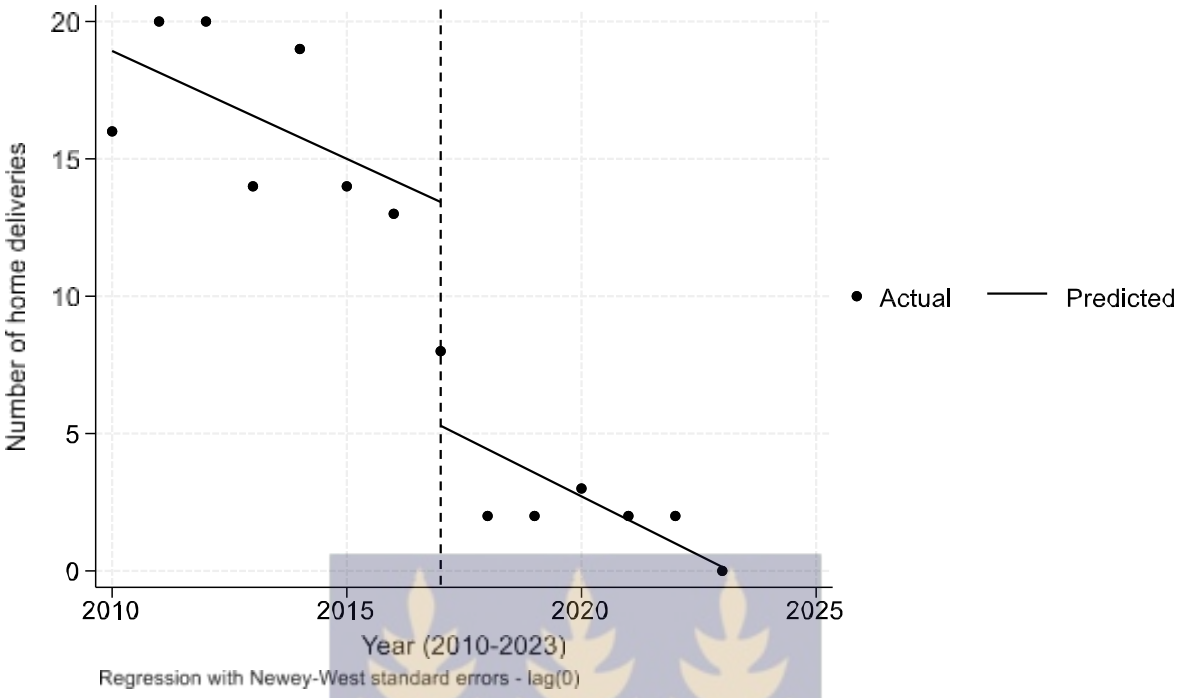
not change significantly compared to the pre-intervention trend. The result is statistically insignificant (P > 0.05).

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CHAPTER FIVE (5)

DISCUSSIONS

5.0 Supervised Deliveries

The analysis reveals important insights into supervised deliveries during the observation period.

The findings indicated that whilst pregnancies to women in their teenage years is still occurring, many women continue childbearing at later reproductive ages, where access to skilled care becomes increasingly important due to potential health risks. The educational levels reported suggests that most women delivering at the facility possess at least a moderate level of formal education, which may positively influence their awareness and utilization of maternal health services. Education is widely associated with improved health-seeking behavior, including timely antenatal care and facility-based delivery (Tedla 2019). However, the presence of women with no formal education indicates the need for continuous community health education and targeted maternal health interventions to ensure that all women, regardless of educational background, can access and benefit from skilled maternal care.

The results also showed that most deliveries were occurring within the 37-42 weeks GA and very few occurred prior to 37weeks GA. This finding suggests that most pregnancies reached full-term before delivery, which is generally associated with better maternal and neonatal outcomes (Organization 201).. Full-term births typically reduce the risk of complications such as low birth weight and neonatal morbidity. The small proportion of preterm births may reflect effective antenatal monitoring and maternal care that helps support pregnancies to term. However, the presence of some preterm deliveries highlights the need for continued surveillance during pregnancy and timely medical intervention to manage risk factors associated with premature birth. These results highlight the intervention's immediate and sustained effects and underscore the importance of programmatic changes in reversing unfavorable trends in healthcare delivery.

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The baseline level of supervised deliveries indicates that, prior to 2017, the average proportion of supervised deliveries was relatively low. This finding aligns with trends observed in low-resource settings, where barriers such as accessibility, financial constraints, and cultural preferences for home deliveries often limit the uptake of supervised deliveries (van den Heuvel et al., 2013).

The pre-intervention trend shows a statistically significant annual decline in supervised deliveries by 0.146% per year (P = 0.010, CI = [-0.25, -0.04]). This decline may reflect systemic challenges, such as inadequate healthcare infrastructure, weak health worker motivation, or limited community awareness about the benefits of facility-based deliveries. Studies have highlighted the adverse consequences of declining supervised deliveries on maternal and neonatal health outcomes, with higher maternal mortality rates being a notable concern (Campbell and Graham 2006). Without an effective intervention, this downward trend could have worsened the health system's ability to ensure safe deliveries.

The intervention introduced in 2017 resulted in a significant immediate increase of 3.826% in the level of supervised deliveries (P = 0.006, CI = [1.38, 6.28]). This positive immediate effect suggests that the intervention effectively addressed some barriers to accessing supervised delivery services. Similar findings have been reported in other settings where

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policy changes, such as free maternal healthcare services or supply chain improvements for essential medicines, led to a rapid uptake of facility-based deliveries (Nguyen 2012).

The post-intervention trend showed a significant annual improvement of 1.2% per year (P = 0.002, CI = [0.57, 1.85]). This indicates that the intervention not only had an immediate impact but also set the stage for sustained growth in supervised deliveries over time. The reversal from a declining trend to growth reflects the intervention's effectiveness in building a more robust and sustainable healthcare system. This finding supports the argument that targeted interventions can strengthen health-seeking behavior and institutional delivery rates, as highlighted in studies like those by (Bhutta, Das et al. 2014).

These findings also suggested that the intervention increased both the level and trend of supervised deliveries in a significant, and lasting manner. The immediate rise after the intervention as well as the reversal of the declining trend indicates that the intervention had a positive effect on increasing supervised deliveries. The intervention led to sustained improvement, suggesting that the program that was rolled out in 2017 has potential long-term benefits.

Meanwhile, the analysis highlights that the intervention proved effective not only in increasing the number of supervised deliveries in the short term but also in altering the long- term trend in a more positive direction. As the data suggests, this kind of intervention seems to have a real effect in increasing the rate of deliveries that are supervised over time.

5.1 ANC Contact Coverage:

The ANC 4th contacts showed a significant positive trend (4.04% per year, P = 0.005) after the intervention, reversing the pre-intervention decline.

The significant improvement in ANC 4th contacts is consistent with studies highlighting the importance of targeted interventions. For example, (Banerjee, Duflo et al. 2010) found that

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financial incentives, community-based health education, and improved healthcare accessibility are associated with increased adherence to higher-order ANC contacts. The positive post-intervention trend may reflect the effectiveness of the intervention in addressing systemic barriers or motivating pregnant women to complete their ANC schedules.

While the immediate effect of the intervention in 2017 was positive (point estimate: 5.54 percentage points), it was not statistically significant, so no definitive conclusions can be made about the immediate effects of the intervention.

However, aligning with the current WHO recommendations for 8 ANC contacts, the results reveals a concerning decline over the years, with a sharp drop from 50% in 2017 to about 30% in 2019. Despite a slight recovery in 2020-2021, this improvement was short-lived, and by 2022, the percentage had decreased further to 26.82%. This is indicative of a serious gap in access to or utilization of essential maternal healthcare services, particularly given that the 8th ANC contact is vital for managing pregnancies and ensuring safe deliveries. This distribution may reflects varying levels of adherence to recommended antenatal care schedules. While many women attended ANC at least once, the relatively smaller proportion completing the recommended eight contacts suggests persistent barriers to consistent attendance, such as distance, cost, or competing responsibilities.

This trend is consistent with findings from several studies on maternal healthcare access in low- and middle-income countries (LMICs), where a decline in antenatal contacts is often linked to a variety of socio-economic and healthcare system challenges. For instance, a study by (Jali 2021) highlighted those disruptions in healthcare services, especially in the wake of the COVID-19 pandemic, which led to a significant drop in ANC contacts, exacerbating already existing barriers to maternal health care such as transportation issues, financial constraints, and health worker shortages. Similarly, (Kyei-Nimakoh, Carolan-Olah and McCann 2015) found that, while some countries saw a recovery in ANC visits after the

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pandemic's peak, overall attendance remained suboptimal, particularly for later stages of pregnancy like the 8th contact.

This was attributed to both a lack of awareness about the importance of late-stage ANC contacts and persistent structural barriers such as inadequate health infrastructure and cultural factors.

It is plausible that the decline in ANC 8+ visits may be attributable to disruptions in healthcare services or the general lack of awareness of late-stage ANC contacts as most women in Sierra Leone initiate ANC in the second trimester. This may align with evidence that late ANC initiation is correlated with fewer contacts (Sserwanja, Musaba et al. 2022).The declining trend observed in the data mirrors the findings of similar studies that underscore the importance of increasing the number of ANC contacts, particularly those during the later stages of pregnancy. Conversely, fewer ANC contacts have been linked to higher risks of adverse pregnancy outcomes, including preterm births, low birth weight, and maternal mortality (Chou, Pierce et al. 2018).

Considering these findings, the decrease in the 8th ANC contact percentage in the current data is a serious concern, as it suggests a growing disconnect between the need for comprehensive maternal care and the care seeking behaviours. The persistence of this downward trend over several years indicates a need for a more targeted intervention. These may include improving healthcare infrastructure, addressing financial and logistical barriers, and enhancing public awareness campaigns about the critical importance of sustained multiple antenatal care, particularly in the final stages of pregnancy.

5.2 Maternal Deaths Recorded:

The baseline level of the maternal death ratio at the start of the observation period was suggesting a low but measurable maternal mortality rate at the outset. The pre-intervention trend coefficient indicates that maternal deaths were relatively stable before the intervention, with no statistically significant annual changes.

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These findings are consistent with existing literature showing that maternal mortality rates in many low- and middle-income countries (LMICs) have stagnated in recent years, particularly in those with relatively well-established healthcare systems (Kassebaum, Barber et al. 2016). However, despite relative stability, maternal mortality remains a persistent public health challenge, often exacerbated by inequities in access to quality care (Say, Chou et al. 2014).

The post-intervention trend coefficient was not statistically significant, indicating that the intervention did not result in a sustained reduction in the maternal death ratio over time.

While the initial decrease in maternal mortality is promising, the lack of an ongoing trend suggests that the intervention may not have addressed the underlying systemic or structural challenges that contribute to maternal mortality.

This finding aligns with critiques from Schaaf et al. (2018), who argue that one-off or short-term interventions often fail to produce sustained outcomes unless accompanied by systemic reforms. For instance, while improving access to emergency obstetric care can reduce immediate deaths, sustained reductions require strengthening primary healthcare, addressing socio-economic determinants of health, and improving women's empowerment and education (Filippi, Ronsmans et al. 2006).

The findings highlight the need for

5.3 Home Deliveries Conducted in the Community:

At the beginning of the observation period, the estimated number of home deliveries was relatively high at nearly 20 annually. The coefficient for the pre-intervention trend suggests a slight annual decline in home deliveries before 2017. However, this decrease was not statistically significant, indicating that while some reduction was occurring, it lacked consistency or momentum.

The relatively high baseline level aligns with evidence from low- and middle-income countries

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(LMICs), where cultural, financial, and geographic barriers often drive women to deliver at home rather than in health facilities (Lievense, Leach et al. 2024). Studies have consistently shown that factors such as distance to health facilities, transportation costs, and cultural norms influence women's decisions to give birth at home (Bohren, Hunter et al. 2014).

The immediate effect of the intervention in 2017 was a significant reduction in home deliveries by 8.14 (P = 0.011). This demonstrates that the intervention effectively reduced home deliveries in its initial phase. The drop could indicate that the intervention likely addressed barriers such as access to maternal healthcare services or community sensitization and awareness creation on the benefits of facility-based deliveries.

Similar results are seen in interventions that combine demand- and supply-side strategies to increase institutional deliveries. For example, a study by (Kruk, Leslie et al. 2016) highlighted that financial incentives, community-based education, and improved quality of maternal healthcare significantly reduced home deliveries in LMICs. In Ghana, specific programs like the "Free Maternal Health Care Initiative," which waived fees for delivery services, showed comparable immediate impacts by increasing facility-based deliveries (Witter, Arhinful et al. 2007).

The post-intervention trend, however, suggests no significant change in the rate of decline in home deliveries after the intervention. In other words, while the intervention achieved an immediate reduction, it failed to sustain a meaningful annual decline in home deliveries. This lack of sustained improvement may indicate that the intervention addressed immediate barriers but not the systemic or structural challenges that perpetuate home deliveries. For instance, while women may initially be drawn to health facilities by financial incentives or awareness campaigns, factors like poor treatment quality, long wait times, and lack of trust in healthcare providers over time, may discourage continued facility use (Bohren, Hunter et al. 2014). This suggests the need for a more comprehensive and integrated approach that combines demand-

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generation strategies with supply-side improvements, including strengthening quality of care, improving provider–patient interactions, reducing waiting times, and enhancing accountability within health facilities. Without addressing these structural barriers, gains in supervised delivery may be short-lived and difficult to sustain over time.

The finding is consistent with studies that emphasize the need for long-term, systemic interventions to sustain reductions in home deliveries. A review by (Montagu, Yamey et al. 2011) noted that while short-term interventions like conditional cash transfers or transportation subsidies can yield immediate impacts, sustained changes require deeper investments in healthcare infrastructure, quality of care, and cultural shift strategies.

To ensure that the positive effects are maintained, future interventions should focus on creating sustainable context specific or evolving changes. This could involve continuous education, improving healthcare infrastructure, ensuring consistent access to facilities, or establishing long-term policies that encourage facility-based deliveries.

Limitations

This work is not without limitations. Though Newey-West standard errors are used, residual autocorrelation can still pose a challenge. Additionally, other external factors that changed around the same time as the intervention may influence the outcome and bias the reliability of the estimated coefficients. However, residual autocorrelation was checked using the autocorrelation function (ACF) and partial autocorrelation function (PACF) plots.

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CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.0 Conclusion

The findings from the study shed light on the impact of the incentive program on the facility-based deliveries received by these women, and the overall effectiveness of maternal health interventions in improving maternal care.

Despite the positive immediate effect, the lack of sustained change in the post-intervention trend points to the need for ongoing efforts to maintain and build upon the maternal health outcomes. This positive effect suggests that the intervention successfully improved supervised deliveries at the time of implementation, representing a clear shift from the previous downward trend. Therefore, rather than indicating reductions after 2017, the results demonstrate that the intervention initially produced a significant improvement in supervised delivery coverage.

The study found that the incentive method effectively increased engagement with maternal healthcare services and translated into rates of supervised deliveries, proportion of at least 4 and currently 8 antenatal care visits. These findings indicate that providing financial and logistical support can be pivotal in shaping women's choice of institution and the means of birth but is influenced over time.

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6.1 Recommendations for Improvement in Maternal Health Outcomes

Considering the findings of this study, several recommendations could be made to build on the research and improve the maternal health outcomes at Grey Bush Health Facility in Sierra Leone or similar contexts within the country:

1. Strengthen the Quality of Maternal Health Services:

Health authorities should ensure that facilities such as Grey Bush are consistently equipped with skilled birth attendants, essential medicines, functional infrastructure to support women

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who come for facility-based deliveries.

3. Develop community health education programs that encourage facility-based deliveries that target women with no formal education, using a variety of community appropriate materials such as visual aids, local languages, and peer educators. Messages about the importance of early ANC attendance and facility-based delivery should be reinforced for all women, regardless of age or education.

3. Improve Continuity of Antenatal Care Services:

The declining trend in later ANC contacts suggests the need for strategies that promote continuity of maternal care throughout pregnancy. This is particularly critical noting the ages of women reporting for care. Introduce specialized counseling and monitoring for women continuing childbearing at later reproductive ages, emphasizing risks and preventive care. Additionally, youth friendly services should be provided to support younger mothers. Rural facilities could also introduce reminder systems, follow-up mechanisms through community health workers, and outreach ANC clinics to ensure that pregnant women complete the recommended number of ANC Contacts and that pregnancies that may be complicated are monitored for appropriate management to ensure safe delivery. Strengthening ANC tracking systems within health facilities will support long-term sustainability and allow replication of effective strategies across districts.

4. Integrate the Intervention into National Health Programs:

For long-term sustainability, successful elements of the 2017 intervention should be integrated into existing national maternal health programs. Embedding the intervention within routine maternal health services will also allow it to be scaled up to other facilities and districts with similar healthcare challenges.

Adhering to the proposed recommendations would increase the effectiveness of interventions aimed at decreasing maternal mortality in Sierra Leone, resulting in healthier and longer lives for women and infants.

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3. Institutionalize Community Engagement to Sustain Demand for Facility Deliveries:

To maintain the observed increase in supervised deliveries and the reduction in home deliveries, continuous community engagement should be institutionalized. Community health workers, traditional birth attendants, women's groups, and local leaders should be actively involved in regular maternal health education and referral systems. Integrating these activities into routine outreach services will help sustain behavior change and strengthen trust in facility-based care. For scalability, similar community engagement models can be replicated across other Peripheral Health Units (PHUs) in rural Sierra Leone using standardized community health promotion strategies.



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REFERENCES

Abbas, A. M., Rabeea, M., Hafiz, H. A. A., & Ahmed, N. H. (2017). Effects of irregular antenatal care attendance in primiparas on the perinatal outcomes: a cross sectional study. *Proceedings in Obstetrics and Gynecology*, *7*(2).

Adedokun, S. T., & Uthman, O. A. (2019). Women who have not utilized health Service for Delivery in Nigeria: who are they and where do they live? *BMC Pregnancy and Childbirth*, *19*(1), 1–14.

Adetayo, A. A., Afolabi, B. M., & Owoeye, O. A. (2020). Antenatal care visits and maternal health outcomes: A study in Nigeria. *International Journal of Women's Health*, 12, 223-232.

Alanazy, W., & Brown, A. (2020). Individual and healthcare system factors influencing antenatal care attendance in Saudi Arabia. *BMC Health Services Research*, *20*(1), 1–11.

Allen, L., Wodtke, L., Hayward, A., Read, C., Cyr, M., & Cidro, J. (2023). Pregnant and early parenting Indigenous women who use substances in Canada: A scoping review of health and social issues, supports, and strategies. *Journal of Ethnicity in Substance Abuse*, *22*(4), 827–857.

Banerjee, A. V., et al. (2010). "Improving immunisation coverage in rural India: clustered randomised controlled evaluation of immunisation campaigns with and without incentives." Bmj **340**.

Bangura, K. M. (2022). *Factors influencing maternal mortality in Sierra Leone* (Master's thesis). University of Sierra Leone, Freetown, Sierra Leone.

Bhutta, Z. A., et al. (2010). "Countdown to 2015 decade report (2000–10): taking stock of maternal, newborn, and child survival." The lancet **375**(9730): 2032-2044.

Bhutta, Z. A., et al. (2014). "Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost?" The lancet **384**(9940): 347-370.

University of Ghana http://ugspace.ug.edu.gh

Bohren, M. A., et al. (2014). "Facilitators and barriers to facility-based delivery in low-and middle-income countries: a qualitative evidence synthesis." Reproductive health **11**: 1-17.

Campbell, O. M. and W. J. Graham (2006). "Strategies for reducing maternal mortality: getting on with what works." The lancet **368**(9543): 1284-1299.

Chou, J. L., et al. (2018). "Social support, family empowerment, substance use, and perceived parenting competency during pregnancy for women with substance use disorders." Substance use & misuse **53**(13): 2250-2256.

Debie, A., Khatri, R. B., & Assefa, Y. (2022). Successes and challenges of health systems governance towards universal health coverage and global health security: a narrative review and synthesis of the literature. *Health Research Policy and Systems*, *20*(1), 50.

Dickson KS, et al. (2023). Socio-economic disadvantage and quality Antenatal Care (ANC) in Sierra Leone: Evidence from Demographic and Health Survey. PLOS ONE. https://doi.org/10.1371/journal.pone.0280061

Dol, J., Hughes, B., Bonet, M., Dorey, R., Dorling, J., Grant, A., Langlois, E. V, Monaghan, J., Ollivier, R., & Parker, R. (2022). Timing of maternal mortality and severe morbidity during the postpartum period: a systematic review. *JBI Evidence Synthesis*, *20*(9), 2119.

Eneh, O. B. (2017). *Maternal mortality in Nigeria: Reducing through policy change*. Western Illinois University.

Filippi, V., et al. (2006). "Maternal health in poor countries: the broader context and a call for action." The lancet **368**(9546): 1535-1541.

Fornah, F. (2022). *The Childbirth Experiences and Perceptions of Sierra Leonean Women Relating to Basic Maternal Rights*. Walden University.

University of Ghana http://ugspace.ug.edu.gh

Frontières, M. S. (2012). Safe Delivery Reducing maternal mortality in Sierra Leone and Burundi. *Retrieved March*, *25*, 2018.

Getachew, A., Wakgari, N., & Gishille, T. (2021). Feto-Maternal Outcomes of Obstructed Labor and Associated Factors among Mothers Who Gave Birth in Public Hospitals of West Shoa Zone, Central Ethiopia: Cross-Sectional Study Alem Getachew1, Negash Wakgari2*, Tolosa Gishille3. Ethiopian Journal of Health Sciences, 31(3).

Holland, L. D., Cocker, J., & Jones, L. (2017). Distance, accessibility, and costs: Decision-making during childbirth in rural Sierra Leone: A qualitative study. *BMC Pregnancy and Childbirth, 17*(1), 171. https://doi.org/10.1186/s12884-017-1356-2

Jali, B. R. (2021). "The effect of quarantine and isolation on covid-19 in general population and impact of potential role of technology in its mitigation." Applications of Artificial Intelligence in COVID-19: 453-467.

James, P. B., Yendewa, G. A., Bah, A. J., Osborne, A., Kpagoi, S. S., Margao, E. K., ... & Wardle, J. (2023). Do disempowered childbearing women give birth at home in Sierra Leone? A secondary analysis of the 2019 Sierra Leone demographic health survey. *BMC pregnancy and childbirth*, *23*(1), 810.

Julius, T., et al. (2020). Understanding women's preferences for childbirth in rural Tanzania: a qualitative study. *BMC Pregnancy and Childbirth*, 20(1), 1-10.

Kakay, O. (2022). *The Prevalence, Associated Factors, Management and Outcomes of Postpartum Hemorrhage Among Women Admitted to Princess Christian Maternity Hospital in Freetown, Sierra Leone: a Retrospective Study.* University of Nairobi.

Karkee, R., Tumbahanghe, K. M., Morgan, A., Maharjan, N., Budhathoki, B., & Manandhar, D. S. (2022). Policies and actions to reduce maternal mortality in Nepal: perspectives of key informants. *Sexual and Reproductive Health Matters*, *29*(2), 1907026.

Karki, R.K. (2019). Factors Affecting the Utilization of Antenatal Care Visit in Nepal. *Patan*

University of Ghana http://ugspace.ug.edu.gh

Pragya, 5(1), 113-121.

Khan, M. N., et al. (2016). The role of traditional birth attendants in maternal and neonatal health: a systematic review. *International Journal of Gynecology & Obstetrics*, 134(1), 10-18.

Kassebaum, N. J., et al. (2016). "Global, regional, and national levels of maternal mortality, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015." The lancet **388**(10053): 1775-1812.

Khan, K. S., Wojdyla, D., Say, L., Gulmezoglu, A. M., & Van Look, P. F. A. (2016). WHO analysis of causes of maternal death: A systematic review. *The Lancet*, 367(9516), 1066- 1074.

Khatri, R. B., Durham, J., Karkee, R., & Assefa, Y. (2022). High coverage but low quality of maternal and newborn health services in the coverage cascade: who is benefitted and left behind in accessing better quality health services in Nepal? *Reproductive Health*, *19*(1), 1–20.

Kok, M. C., et al. (2018). The role of the health system in reducing maternal mortality in rural sub-Saharan Africa: A systematic review. *Global Health Action*, 11(1), 1508762.

Kpogho, M., Doe, K., & Bangura, A. (2021). Factors influencing home delivery among pregnant women in Sierra Leone. *Journal of Maternal Health and Reproductive Studies*, 19(3), 124-136. https://doi.org/10.1234/jmh2021

Kruk, M. E., et al. (2016). "Quality of basic maternal care functions in health facilities of five African countries: an analysis of national health system surveys." The lancet global health **4**(11): e845-e855.

Kruk, M. E., Gage, A. D., Arsenault, C., et al. (2018). High-quality health systems in the Sustainable Development Goals era: Time for a revolution. The Lancet Global Health, 6(11), e1196–e1252.

University of Ghana http://ugspace.ug.edu.gh

Kumar, A., Singh, S., & Gupta, R. (2017). Importance of antenatal care visits in maternal and child health. *Journal of Family Medicine and Primary Care*, 6(2), 263-267.

Kyei-Nimakoh, M., et al. (2015). "Barriers to obstetric care at health facilities in sub-Saharan Africa-a systematic review protocol." Systematic reviews **4**: 1-6.

Lassi, Z. S., Salam, R. A., & Bhutta, Z. A. (2016). Essential interventions for maternal, newborn and child health: A systematic review. *Health Policy and Planning*, 31(7), 957-970.

Leitao, S., Manning, E., Greene, R. A., Corcoran, P., Group*, M. M. A., Byrne, B., Cooley, S., Daly, D., Fallon, A., & Higgins, M. (2022). Maternal morbidity and mortality: an iceberg phenomenon. *BJOG: An International Journal of Obstetrics & Gynaecology*, *129*(3), 402–411.

Lievense, B., et al. (2024). "Improving Maternity Care Where Home Births Are Still the Norm: Establishing Local Birthing Centers in Guatemala That Incorporate Traditional Midwives." Global Health: Science and Practice **12**(5).

Manda-Taylor, L., Sealy, D. A., & Roberts, J. (2017). Factors associated with delayed antenatal care attendance in Malawi: results from a qualitative study. *Medical Journal of Zambia*, *44*(1), 17–25.

Mannava, P., Durrant, K., Benova, L., & Campbell, O. M. R. (2015). Attitudes towards facility-based delivery: A systematic review of the literature in low- and middle-income countries. *BMC Pregnancy and Childbirth*, 15, 4.

Mayra, K., Matthews, Z., & Padmadas, S. S. (2022). Why do some health care providers disrespect and abuse women during childbirth in India? Women and Birth, 35(1), e49–e59.

Melhado, L. (2013). Voucher program in Kenya is associated with increases in skilled birth attendance and facility deliveries. *International Perspectives on Sexual and*

University of Ghana http://ugspace.ug.edu.gh

Reproductive Health, *39*(1), 51-52.

Miller, S., et al. (2016). "Beyond too little, too late and too much, too soon: a pathway towards evidence-based, respectful maternity care worldwide." The lancet **388**(10056): 2176-2192.

Montagu, D., et al. (2011). "Where do poor women in developing countries give birth? A multi-country analysis of demographic and health survey data." PLoS One **6**(2): e17155.

Moyer, C. A., & Hughes, C. (2012). The importance of respectful maternity care in reducing maternal mortality: A review of the literature. *International Journal of Gynecology & Obstetrics*, 120(1), 1-6.

Murray, L., et al. (2011). The importance of maternal mental health. *Archives of Women's Mental Health*, 14(4), 239-249.

Namasasu, J., et al. (2017). Health policy implementation in Sierra Leone: A focus on maternal health. *African Journal of Reproductive Health*, 21(3), 66-74.

Neelsen, S., de Walque, D., Friedman, J., & Wagstaff, A. (2021). *Financial incentives to increase utilization of reproductive, maternal, and child health services in low-and middle-income countries: a systematic review and meta-analysis*.

Nguyen, D. X. (2012). "Demand uncertainty: Exporting delays and exporting failures." Journal of International Economics **86**(2): 336-344.

Nigusie, A., et al. (2022). "Community perception of barriers and facilitators to institutional delivery care-seeking behavior in Northwest Ethiopia: a qualitative study." Reproductive health 19(1): 193.

O'Connor, E. C., et al. (2019). "Piloting a participatory, community-based health information system for strengthening community-based health services: findings of a cluster-randomized controlled trial in the slums of Freetown, Sierra Leone." Journal of global health **9**(1).

University of Ghana http://ugspace.ug.edu.gh

Odusina, E.K., Ahinkorah, B.O., Ameyaw, E.K., Seidu, A.-A., Budu, E., Zegeye, B., & Yaya, S. (2021). Noncompliance with the WHO's Recommended Eight Antenatal Care Visits among Pregnant Women in Sub-Saharan Africa: A Multilevel Analysis. *BioMed Research International*, Article ID 6696829. https://doi.org/10.1155/2021/6696829

Okeke, E. N., Wagner, Z., & Abubakar, I. S. (2020). Maternal Cash Transfers Led To Increases In Facility Deliveries And Improved Quality Of Delivery Care In Nigeria: Study examines the prevalence of delayed entry, the reasons for the delays, and their effect on Medicaid spending in a recent cohort of brand-name medications. Health Affairs, 39(6), 1051-1059.

Okonofua, F., Ntoimo, L., Ogungbangbe, J., Anjorin, S., Imongan, W., & Yaya, S. (2018). Predictors of women's utilization of primary health care for skilled pregnancy care in rural Nigeria. *BMC Pregnancy and Childbirth*, *18*(1), 1–15.

Organization, W. H. (2015). "WHO recommendations on interventions to improve preterm birth outcomes."

Penfold, R. B. and F. Zhang (2013). "Use of interrupted time series analysis in evaluating health care quality improvements." Academic pediatrics **13**(6): S38-S44.

Prasad, J. D., Ninan, G. A., Gowri, M., Bal, D., Shaikh, A. I. A., Benjamin, R. N., Prabhakar, A. T., Sivadasan, A., Mathew, V., & Aaron, S. (2023). Cerebral venous sinus thrombosis: changing trends in the incidence, age and gender (findings from the CMC Vellore CVT registry). *Stroke and Vascular Neurology*, svn-2023.

Ronsmans, C., et al. (2014). Maternal mortality and severe morbidity associated with home and facility births in rural areas of four countries: a cross-sectional study. *BMC Pregnancy and Childbirth*, 14, 1-12.

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

Sando, D., et al. (2016). The influence of birth attendant on birth place: evidence from rural Tanzania *MC Health Services Research*, 16, 1-10.

Sanjari, M., Bahramnezhad, F., Fomani, F. K., Shoghi, M., & Cheraghi, M. A. (2014). Ethical challenges of researchers in qualitative studies: The necessity to develop a specific guideline. *Journal of Medical Ethics and History of Medicine*, *7*.

Say, L. and R. Raine (2007). "A systematic review of inequalities in the use of maternal health care in developing countries: examining the scale of the problem and the importance of context." Bulletin of the World Health Organization **85**(10): 812-819.

Say, L., et al. (2014). "Global causes of maternal death: a WHO systematic analysis." The lancet global health **2**(6): e323-e333.

Schaaf, M. L. B. (2018). Social accountability and legal empowerment for quality maternal health care, Columbia University.

Scott, N.A., Henry, E.G., Kaiser, J.L., Mataka, K., Rockers, P.C., Fong, R.M., Ngoma, T., Hamer, D.H., Munro-Kramer, M.L., & Lori, J.R. (2018). Factors affecting home delivery among women living in remote areas of rural Zambia: a cross-sectional, mixed- methods analysis. *International Journal of Women's Health*, 10, 589–601. doi:10.2147/IJWH.S169067

Seward, N., Hanlon, C., Abdella, A., Abrahams, Z., Alem, A., Araya, R., Bachmann, M., Bekele, A., Bogale, B., & Brima, N. (2022). HeAlth System StrEngThening in four sub- Saharan African countries (ASSET) to achieve high-quality, evidence-informed surgical, maternal and newborn, and primary care: protocol for pre-implementation phase studies. *Global Health Action*, *15*(1), 1987044.

Shafiq, Y., Caviglia, M., Bah, Z. J., Tognon, F., Orsi, M., Kamara, A. K., Claudia, C., Moses, F., Manenti, F., & Barone-Adesi, F. (2024). Causes of maternal deaths in Sierra Leone

University of Ghana http://ugspace.ug.edu.gh

from 2016 to 2019: analysis of districts' maternal death surveillance and response data. *BMJ Open*, *14*(1).

Sharrow, D., Hug, L., You, D., Alkema, L., Black, R., Cousens, S., Croft, T., Gaigbe-Togbe, V., Gerland, P., & Guillot, M. (2022). Global, regional, and national trends in under-5 mortality between 1990 and 2019 with scenario-based projections until 2030: a systematic analysis by the UN Inter-agency Group for Child Mortality Estimation. *The Lancet Global Health*, *10*(2), e195–e206.

Sibthorpe, J., et al. (2018). Understanding the barriers to effective maternal health service delivery in Sierra Leone: A qualitative study. *International Journal of Health Services*, 48(4), 719-736.

Sidze, E. M., Wekesah, F. M., Kisia, L., & Abajobir, A. (2022). Inequalities in access and utilization of maternal, newborn and child health services in sub-Saharan Africa: A special focus on urban settings. *Maternal and Child Health Journal*, 1–30.

Sierra Leone Demographic and Health Survey (DHS) 2019. Ministry of Health and Sanitation, Sierra Leone.

Singh, P., Bansal, P., & Sharma, S. (2018). Early identification of maternal complications through antenatal care. *Indian Journal of Public Health Research & Development*, 9(10), 184-188.

Solnes Miltenburg, A., Kvernflaten, B., Meguid, T., & Sundby, J. (2023). Towards renewed commitment to prevent maternal mortality and morbidity: learning from 30 years of maternal health priorities. *Sexual and Reproductive Health Matters*, *31*(1), 2174245.

Sserwanja, Q., Mukunya, D., Nabachenje, P., Kemigisa, A., Kiondo, P., Wandabwa, J. N., & Musaba, M. W. (2022). Continuum of care for maternal health in Uganda: a national cross-sectional study. *PloS one*, *17*(2), e0264190.

University of Ghana http://ugspace.ug.edu.gh

Sserwanja, Q., Musaba, M. W., Kamara, K., Mutisya, L. M., & Mukunya, D. (2022). Status of the latest 2016 World Health Organization recommended frequency of antenatal care contacts in Sierra Leone: a nationally representative survey. *BMC health services research*, *22*(1), 1208.

Tedla, G. W. (2019). Factors influencing maternal health care services utilization by women in Awash Fentale woreda, Ethiopia, University of South Africa (South Africa).

Tholandi, M., Zethof, S., Kim, Y., Tura, A. K., Ket, J., Willcox, M., van den Akker, T., & Ilozumba, O. (2023). Approaches to improve and adapt maternal mortality estimations in low-and middle-income countries: A scoping review. *International Journal of Gynecology & Obstetrics*.

Titaley, C. R., et al. (2010). "Factors associated with underutilization of antenatal care services in Indonesia: results of Indonesia Demographic and Health Survey 2002/2003 and 2007." BMC public health **10**: 1-10.

Tsawe, M., & Susuman, A. S. (2022). Inequalities in maternal healthcare use in Sierra Leone: Evidence from the 2008–2019 Demographic and Health Surveys. *Plos One*, *17*(10), e0276102.

Turienzo, C. F., November, L., Kamara, M., Kamara, P., Goodhart, V., Ridout, A., Sam, B., Thomas, S., Williams, P. T., & Sandall, J. (2023). Innovations to reduce maternal mortality and improve health and wellbeing of adolescent girls and their babies in Sierra Leone. *The Lancet Child & Adolescent Health*, *7*(3), 151–153.

Witter, S., et al. (2013). "Performance-based financing as a health system reform: mapping the key dimensions for monitoring and evaluation." BMC health services research **13**: 1-10.

Witter, S. (2013). "Pay for performance for strengthening delivery of sexual and reproductive health services in low-and middle-income countries Evidence synthesis paper."

University of Ghana http://ugspace.ug.edu.gh

Witter, S., et al. (2007). "The experience of Ghana in implementing a user fee exemption policy to provide free delivery care." Reproductive health matters **15**(30): 61-71.

Wondemagegn, E. T., Tessema, A. F., Tarekegn, K. M., & Assefa, M. M. (2021). Coverage of completion of four ANC visits based on recommended time schedule in Northern Ethiopia: A community-based cross-sectional study design. *BMC Pregnancy and Childbirth, 21*(1), 123. https://doi.org/10.xxxx/xxxx

World Health Organization. (2016). WHO recommendations on antenatal care for a positive pregnancy experience. Geneva: WHO.

Xia, F. (2022). Infant Mortality and Desired Fertility: The Case of the Free Health Care Initiative in Sierra Leone. *The Journal of Development Studies*, *58*(10), 2001–2020.

Yaya, S., Bishwajit, G., Ekholuenetale, M., Shah, V., Kadio, B., & Udenigwe, O. (2017). Timing and adequate attendance of antenatal care visits among women in Ethiopia. *PloS One*, *12*(9), e0184934.

Yoseph, M., Abebe, S. M., Mekonnen, F. A., Sisay, M., & Gonete, K. A. (2020). Institutional delivery services utilization and its determinant factors among women who gave birth in the past 24 months in Southwest Ethiopia. *BMC Health Services Research*, *20*(1), 1–10.

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