2021

Exploring the Relationship Between Antenatal Care and Postnatal Care to Newborn Outcomes in Borno State, Northeastern Nigeria

Adebe Gabriel
Walden University

Walden University

College of Health Professions

This is to certify that the doctoral dissertation by

Adebe Gabriel Aondofa

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Sriya Krishnamoorthy, Committee Chairperson, Public Health Faculty
Dr. Steven Seifried, Committee Member, Public Health Faculty
Dr. Mehdi Agha, University Reviewer, Public Health Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2021

Abstract

Exploring the Relationship Between Antenatal Care and Postnatal Care to Newborn Outcomes in Borno State, Northeastern Nigeria

by

Adebe Gabriel Aondofa

MPH, University of Roehampton, London, 2017

BS, Federal University of Agriculture, Makurdi, 2010

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

August 2021

Abstract

Newborn outcomes (morbidity or mortality) have been on the increase in Borno State. This study explores the relationship between antenatal care (ANC) and postnatal care (PNC) and newborn outcomes among women in Mafa local government area, Borno State. Also examined were the relationships between transportation and newborn outcomes, women's knowledge of illness during pregnancy and ANC attendance, availability of staff/health workers, availability of supplies/equipment relations with ANC and PNC attendance. The three delays model was used as theoretical framework. The research will be useful for government and program-implementing partners to guide quality reproductive maternal newborn child adolescent health and nutrition program design to address increasing newborn outcomes in Borno State. A cross-sectional study of data from the village health worker (VHW) project implemented in Mafa LGA, Borno State from December 2019 through November 2020 was conducted. Coverage data including sociocultural, quality of care, accessibility to health facility to access health care services for 1,641 women aged 15-49 who participated in the VHW intervention. Logistic regression was applied to data. The study found statistically significant result between ANC and PNC with newborn outcomes ($p < 0.05$). Women who attended ANC while pregnant were 0.030 times less likely ($OR = 0.030$, 95% CI [0.020, 0.046], $p < 0.05$) to experience newborn outcomes than pregnant women who did not attend ANC. Innovative and effective ANC and PNC intervention programs, together with education/health promotion interventions and policies have the potentials to address the rising newborn outcomes for people of Borno State.

Exploring the Relationship Between Antenatal Care and Postnatal Care with Newborn Outcomes in Borno State, Northeastern Nigeria

by

Adebe Gabriel Aondofa

MPH, University of Roehampton, London, 2017

BS, Federal University of Agriculture, Makurdi, 2010

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

August 2021

Dedication

I dedicate this research to God for making it possible to achieve this huge dream, my family and all the public health professionals and epidemiologists out there fighting against all odds to help the world lead healthy lives.

More important, this research is dedicated to my late dad, who thought and built that resilience in me to dream and pursue anything that could ever be beneficial to man. To my family, especially my lovely wife Iveren Esther Adebe and my daughter Hadassah ('Nana', 'Haddy' – as I fondly call her) who stood by me, supporting and encouraging this dream to its success.

Lastly, to my faculty & supervisors – committee chair, Dr. Sriya Krishnamoorthy, my committee member – Dr. Steven Seifried, and my URR – Dr. Mehdi M. Agha. All of whom have guided, motivated and supported me through this journey to achieve this feat. I say a big thank you!

Acknowledgements

I want to sincerely acknowledge everybody that has supported me in one way or the other to achieve this dream, this would not have been possible without you. All the sleepless nights, sacrifices, and motivation you provided will never go unappreciated.

I want to sincerely thank my family, most especially my lovely mother and immediate family (lovely wife and daughter – Baby Haddy') who stood by me and supported this dream from the beginning to this point. I would not have achieved this without your love, care, and continuous motivation.

To my friend Ibrahim Juwara, with whom this dream was birthed, Women's Refugee Commission – who made funding for this dream possible, Dr. Susan Mshelia, who stood by me, always encouraging and believed in me that I could achieve this dream. I want to really appreciate you all and everyone that believed in me that I could achieve this dream.

To my faculty and supervisors – committee chair, Dr. Sriya Krishnamoorthy – always motivating and igniting that burning fire in me and making me see reasons why I started the journey in the first place, my committee member – Dr. Steven Seifried, and my URR – Dr. Mehdi M. Agha. All of whom have guided, motivated and supported me through this journey to achieve this feat - The Adebe's 'DREAM' - I say a big thank you!

Table of Contents

List of Tables

List of Figures

Chapter 1: Introdution to the Study

The high maternal, newborn, and child mortality rates are a significant public health issue, especially in Borno State, Northeastern Nigeria, among underserved populations (Office for the Coordination of Humanitarian Affairs [OCHA], 2019). In Borno State, 50% of health facilities are nonfunctional, with 39% destroyed, leaving only 18% of Borno's health centers providing integrated clinical health management services (International Peace Institute, 2019). Also, inadequate health workers, sociocultural practices/beliefs, socioeconomic factors, and quality maternal newborn and child care has been steadily decreasing due to the Boko Haram crises (United Nations High Commission for Refugees, 2019).

Evidence shows that there has been increased newborn mortality due to poor health infrastructure, inadequate antenatal care (ANC), and postnatal care (PNC) services caused by the Boko Haram crisis in Borno. The percentage of deliveries inside health facilities has increased since the last Demographic Health Survey; however, most of the deliveries in Borno still occur outside of health facilities (83% in 2013 and 73.8% in 2018; National Population Commission [NPC] and International Classification of Functioning Disability and health (ICF), 2019). According to the NPC and ICF (2019), the DHS's newborn and child health indicators DHS in 2018 reported that 31.2% of newborns had a postnatal checkup within 2 days of birth, compared with only 2.7% in 2013 in Borno State.

Most of the primary health facilities are located in rural communities where most displaced persons affected by the crises resides. This makes access to essential health services for particularly mothers difficult and almost nonexistent in some communities. Some rehabilitated or partially functional primary health facilities are located at a distance from where some community members reside, making access difficult. Transportation to these facilities is difficult as the crises have destroyed road infrastructures. The insecurity has also created fear among people in the communities preventing essential transportation services such as Keke napep, motor-bikes, and other forms of transportation to convey pregnant women and postnatal mothers to health facilities to access care.

Background

The Boko Haram crisis has affected the availability and quality of health care for pregnant women and postnatal mothers in a number of ways. The availability of supplies and equipment is low. Most functional health facilities do not always have supplies and equipment available to provide quality care for pregnant women and postnatal mothers. This contributes significantly to worsened health outcomes for mothers and newborns for people within the Borno state communities affected by the crises (UNHCR, 2019). Also, inadequately skilled health workers in the health facilities affect how maternal and newborn health services are provided to mothers in the affected communities. The Boko Haram crisis has seen displacement or relocation of health workers to other parts of the country where there are no crises, which has caused a severe shortage of skilled health workers available to provide quality health care services to the people. Most pregnant

women and postnatal mothers have reported that there are not enough workers to attend to them when they get to the health facility, causing them to wait for a more extended period before being attended to (International Peace Institute, 2019). Inadequate health workers to attend to sick women during emergency also causes complications and increased severity of illness for mothers and newborns, resulting in more severe complications or outcomes.

Much is not known about issues of poor maternal and newborn health outcomes in highly security compromised environments caused by war, disasters, and insurgency. The Boko Haram crisis has brought serious hardship on the people of Borno State, displacing millions and leaving them homeless. A significant percentage of this population are women and adolescents, putting newborn lives in serious danger among displaced persons and those from the community.

The worsened newborn outcome due to the insurgency is on the increase in Borno State. Limited access to quality maternal, newborn, and child health (MNCH) care services for people in Borno State is responsible for the worsened newborn outcomes (OCHA, 2019). Also, the Boko Haram crisis has destroyed most of the primary health facilities providing basic health services for displaced women and adolescents, endangering the lives of newborns resulting to increased morbidity and mortality (UNHCR, 2019).

Peer-reviewed journals, articles, and books that provided various information to support the research include the following:

- Tekelab et al. (2019) provided information on the impact of ANC by skilled

health workers on neonatal mortality sub-Saharan Africa.

- Nuamah et al. (2019) provided information on access and utilization of maternal healthcare in a rural district in the forest belt of Ghana.
- Mbuthia et al. (2019) provided strategies in addressing maternal and newborn mortality through the utilization of PNC services using mobile health technology.
- Banke-Thomas et al. (2017) provided information about different factors influencing maternal health services by adolescent mothers in low-and middle-income countries.
- NPC and ICF (2019) provided information on how the indicators of maternal and newborn mortality occurring in Borno State, northeastern Nigeria, and why it is an issue of public health concern.
- OCHA (2019) provided information (statistics) about limited primary health care service points (structures and skilled health workers) responsible for delivering maternal, newborn, and child health services.

Problem Statement

OCHA (2019) reported that the minimum standards for primary health centers, including MNCH services and associated personnel and equipment, have been set by Nigeria's federal government. These standards include accounts of equipment and personnel required for citizens' optimal treatment with a detailed consideration for women, children, and infants (Mercy Corps, 2018). However, the ongoing conflict in Borno state has created barriers to actualizing these standards. In 2019, 50% of the state's

health facilities were not functioning, with 39% being fully damaged and 27% being partially damaged (OCHA, 2019; UNHCR, 2019).

Besides, most of the infrastructure, including roads and other necessary social infrastructures to aid transportation to the functional health facilities, has been destroyed (Mercy Corps, 2018). This makes it difficult for pregnant women and postnatal mothers to be transported to health facilities where they can access services during an emergency. In some cases, pregnant women and postnatal mothers' transportation to health facilities where they can access maternal and newborn services is entirely not available. This is due to fear among people of the community caused by the communities' insecurity and make Keke napep, motor-bikes, and other means of transportation unavailable in the communities (OCHA, 2019).

More so, most functional health facilities lack the capacity in terms of supplies and equipment to provide the essential emergency obstetrics to pregnant women and post-natal mothers to save newborn lives. Government health facilities alone lack the capacity for supplies and equipment due to increased demand for services. Some programs implementing partners implementing MNCH programs support some health facilities with supplies and equipment to provide essential BEmONC services within the communities. However, only about 39% are still functional; 43% are not functional as either they are destroyed or cannot provide any services (International Peace Institute. 2019). This has caused most pregnant women to resort to traditional methods of care, causing more complications that lead to increased newborn outcomes in Borno State.

Another critical problem for people of Borno State affected by the crises is the

lack of adequate skilled staff to provide quality maternal and newborn services for significantly affected people in the community. More than 78% of functional health facilities in Borno State lack adequate skilled health workers to provide quality MNCH services for people within the affected communities (UNHCR, 2019). Most health workers lack the motivation to work in the health facilities within Borno State and live with the fear of working in unsecured communities affected by the crises. This significantly affects how health care is provided to pregnant women and newborns, limiting access to quality health care for these groups when needed leading to worsened newborn outcomes.

Inadequate supplies and equipment, lack of skilled health workers, lack of infrastructure to aid transportation of pregnant women and postnatal mothers to access health services at the health facilities further compound the problems for mothers and newborns. These have caused an increased demand for harmful traditional practices or forms of seeking care, resulting in more complications for pregnant women and newborns, further worsened the newborn outcomes. Low skilled health workers in Borno state are a significant concern that has affected pregnant women and newborns, and addressing the issue will help address poor ANC and PNC attendance for mothers and newborns to improve health outcomes.

OCHA (2019) reported that most pregnant women and postnatal mothers do not attend ANC and PNC services for several reasons that include lack of planned transportation. Also, lack of adequate supplies and equipment, inadequately skilled health workers, and unavailability of some services necessary to aid care for pregnant women

and newborns are the primary problem.

Purpose of the Study

This research explores the relationship between the worsening newborn morbidity and mortality with limited access to antenatal and post-natal care services in Borno state, northeastern Nigeria. The study will help guide policy development for the Borno State government and implementing partners in MNCH. It will also help address the increasing morbidity and mortality rate of newborns in the crisis-ravaged Borno State to save newborn lives and improve health outcomes among the targeted group/population (underserved population). Quality access to health care services, including ANC and PNC services, will reduce newborn morbidity and mortality through concerted efforts by the government stakeholders, implementing partners, and other stakeholders.

This study will also serve as a useful guide for government, international and local partners implementing a program in maternal, newborn, child health in developing and planning more effective and targeted programs; to help address issues affecting especially women, newborns, and children in the communities of Borno State affected by Boko Haram. Again, the study will serve as a guide in providing integrated health care interventions in Borno State to help understand which areas have affected pregnant women and newborns more to guide appropriate and efficient use of resources.

This study also aims to provide information for the Borno State government and implement partners of MNCH interventions with critical information regarding the use of innovative and strategic means of designing and planning intervention programs in crisis-affected regions. Innovation and effective strategies are critical for designing very

effective interventions that will address a myriad of pregnant women and newborns' issues in crises affected communities of Borno State. Moreover, the research study will serve as a reference point and rich source of information for other learning activities concerning maternal, newborn, and child health to better understand underlying issues of MNCH health insecure Borno State caused by the Boko Haram crisis.

Research Questions and Hypotheses

RQ1: Is there a relationship between ANC and PNC with newborn outcomes?

H_o1: There is no relationship between ANC and PNC with newborn outcomes.

H_A1: There is a relationship between antenatal care ANC and post-natal care PNC with newborn outcomes.

RQ2: Is there a relationship between planned transportation to ANC and PNC with newborn outcomes?

H_o2: There is no relationship between planned transportation to ANC and PNC with newborn outcomes.

H_A2: There is a relationship between planned transportation to ANC and PNC with newborn outcomes.

RQ3: What is the relationship between knowledge of illness during pregnancy with ANC attendance?

H_O3: There is no relationship between knowledge of illness during pregnancy with ANC attendance

H_A3: There is a relationship between knowledge of illness during pregnancy with ANC attendance.

RQ4: What is the relationship between the availability of supplies/equipment (drugs) and the utilization of ANC and PNC services?

H_O4: There is no relationship between the availability of supplies/equipment (drugs) and ANC and PNC services utilization.

H_A4: There is a relationship between the availability of supplies/equipment (drugs) and the utilization of ANC and PNC services

RQ5: What is the relationship between the availability of staff/health workers and the utilization of ANC and PNC services?

H_o5: There is no association between ANC and PNC with newborn outcomes.

H_A5: There is an association between ANC and PNC with newborn outcomes.

Theoretical Framework for the Study

For this research study, I used the three-delay model that comprises various factors to address maternal and newborn emergency outcomes during pregnancy as a conceptual framework. This three-delay model explains different factors that include (a) Delay 1: deciding to seek care, (b) Delay 2: identifying and reaching (transportation to) health facility, and (c) Delay 3: receiving adequate and appropriate treatment (MacDonald et al., 2018). The conceptual framework, the three-delay model, describes the socioeconomic and cultural factors that affect these three delays' lengths. This conceptual framework explains that maternal and newborn morbidity and mortality was not due solely to a lack of economic and human resources but was a product of numerous linked factors (MacDonald et al., 2018).

Nature of the Study

The research consisted of an observational quantitative study to address the research question. I used a cross-sectional study design to evaluate secondary data about how ANC and PNC risk factors or exposures influence newborn mortality. Observational methods were used to describe associations that are already present at population (descriptive) or individual (analytical) level. Hajat (2011) added that although they form the mainstay of epidemiological studies, observational methods are prone to bias and confounding. These issues can be addressed using various means involving both the study design and statistical analysis. Interventional methods involve changing variables in one or more groups of people and comparing outcomes between those with the changed and unchanged variable. Interventional studies can more readily account for bias (such as through randomization) and confounding (such as through controlling) as seen in randomized, controlled trials (Hajat, 2011).

Definition

Antenatal care (ANC): The routine health check for all pregnant women presumed to be healthy without symptoms in order to diagnose complicating obstetrics conditions, as well as provide useful information about lifestyle, pregnancy behavior and delivery.

EmONC: emergency obstetric newborn care

Health workers/staff: Individuals or a group of people with special training and skills to provide quality health services to sick people by diagnosing and applying appropriate treatment or care.

Newborn Outcomes: The worsening state of newborn health, morbidity and mortality cause by controllable/preventable factors.

Postnatal care (PNC): The care given to individual mothers after birth up to 6 weeks to endure the needs of the baby and mother are met to ensure adequate health status of the baby.

RMNCAHN: Reproductive, Maternal, Newborn, Child, and Adolescent Health and Nutrition.

Supplies/Equipment: this refers to all the drugs, and tools/equipment needed to provide adequate emergency obstetrics newborn care (EmONC) at the health facility.

Transportation: transportation is the means to convey a pregnant or postnatal mother in to access the health facility for health care services from her home at any time she decides to seek health care or during emergency.

VHWs: Village Health Workers.

Assumptions

For this study, I used ethical procedures to access data from the RMNCAHN database as secondary data. I obtained ethical approval through the Internal Review Board (IRB)/Ethical Review Committee (ERC) from the Borno State Ministry of Health (BMoH) or Borno State Primary Health Care Development Agency (BoPHCDA) to access the RMNCAHN database to select targeted beneficiaries of a program implemented between December 2019 and November 2020 for the purpose of this study.

I also received ethical approval from the ERC of Borno State Ministry of Health because I intended to analyze secondary data from the RMNCAHN database owned by

the government. The RMNCAHN program used a set of questionnaires consisting of patient information, including socioeconomic and cultural data, accessibility of health facility, and quality of care to collect information from women of child bearing age who are internally displaced persons and community members for the RMNCAHN program.

Scope and Delimitation

This research study promotes positive social change for maternal and newborns affected during the crises to improve access to health services in Borno State communities. Primary health care facilities responsible for providing maternal, newborn, and child health services are destroyed. Through improved policies and intervention programs, maternal, newborn, and child health programs and interventions, the study provides evidence for improving social, cultural, and strengthen health systems to provide the needed services to address the rising newborn morbidity and mortality in Borno state. The research study also identifies targeted risk factors directly related to increased newborn mortality and provides evidence for government and stakeholders to review MNCH services' policies to design and implement effective intervention programs for MNCH.

The research study highlights factors that contribute to worsening newborn outcomes in Borno State. The Boko Haram crisis has caused more harm displacing over 2 million people who are mostly women. Sociocultural factors and ANC and PNC factors combined with social determinants of health to create a framework for addressing poor maternal and newborn health for displaced mothers who are at risk of losing their lives and newborns. The study will guide policymakers to review existing policies or develop

new policies that will help improve maternal and newborn outcomes. Improved policies will help displaced persons who are mostly women of childbearing age gain access to quality maternal, newborn, and child health in Borno State.

Limitations

The influx of IDPs has overwhelmingly stretched the Borno State primary healthcare system. Accessing data for the target population of pregnant women, who are a vulnerable population, required ethical procedures for a sensitive population. The ethical process including data confidentiality and integrity were sough and approval received to access participants record from the RMNCAHN program database. Both data confidentiality and integrity were used to access RMNCAHN database to select participants. Patients' information had to be coded to ensure data confidentiality and integrity required for IRB/ERC approval.

The insecurity situation in Borno State must have affected the way beneficiaries participated in the intervention leading to irregularities in the data. Also, data for the intervention was collected during COVID-19, making the intervention result to remote data collection. This may have affected the quality of data collected for the intervention used by this study.

Significance

The research study identified challenges and may strengthen health systems, socioeconomic and cultural practices affecting MNCH programs and interventions' effective delivery especially for health workers through capacity building. Findings from this research study will help build capacity of health workers and improve skills for

delivering quality MNCH services at health facilities to improve newborn health outcomes for MNCH in communities where the Boko Haram crises have destroyed most of the health service delivery systems in Borno State.

The study's findings may help guide interventions and program implementation for MNCH in Borno State through useful policy review or formulation to increase access to quality maternal and newborn health services in the increasing crisis in Borno State. Findings from the research study can help guide policies for government and interventions partners to provide strategic and innovative means of transportation for pregnant women and postnatal mothers and newborns to access quality PNC services necessary for newborn survival. For instance, Hirose et al. (2015) modelled travel time to health facilities among pregnant women using geographic information system (GIS) and observed that poor transportation causes adverse maternal and newborn outcomes. The Boko Haram crises have destroyed most roads, leading to limited or no access to MNCH services in some communities. Government and implementing partners design and implement interventions with innovative local transportation systems to address increasing transportation issues. It is critical for pregnant women and postnatal mothers to access available health facilities to provide quality MNCH services to help improve newborn outcomes in insecure Borno State.

The human resources for health is a critical area this research addressed, supporting the government to review existing policies and develop new policies to help address human resources for health in the Borno State. The Boko Haram crises have left a huge gap in skilled health workers, and it has contributed significantly to the worsening

newborn outcomes in the Borno State. A recent study by Olowokere et al. (2020) in southwestern Nigeria evaluated the utilization of skilled birth attendants by pregnant women and observed women who use skilled birth attendants are more likely to have positive newborn outcomes, especially in rural underserved communities in LMICs. Hence, this research will guide government and implementing partners and help address the issue of human resources for health through the task shifting and task sharing policies to effectively manage the increased shortage of skilled health workers in Borno State. Recruiting and training health workers to provide quality maternal and newborn health services will significantly improve newborn outcomes through provision of effective MNCH services.

Most pregnant women who are displaced seek traditional services, which are more available to address health issues, including traditional birth attendants (TBAs), local herbalists, and others due to inadequately skilled health workers to attend to their health needs. It is widespread as the Boko Haram crises have created an uncertain environment, leaving most skilled health workers scared and fleeing Borno State to seek work elsewhere more secured. This study identifies security issues useful for addressing security problems affecting delivery of quality MNCH services in Borno State. Findings from the study will help inform government and intervention partners design effective innovative interventions strategies using local security volunteer groups to help provide a secured environment and motivate skilled health workers to work in crises ravaged Borno State. Skilled health workers will always be available at health facilities to provide ANC

and PNC services for pregnant women and newborns to improve newborn outcomes in a well-secured environment, thereby improving newborn outcomes.

In addition, the research also revealed irregular availability of supplies and equipment at health facilities providing MNCH services for pregnant women and post-natal mothers. These findings will be used to inform government and implementing partners of MNCH services to effectively plan interventions in developing a robust logistics management information system (LMIS) to regularly collect and manage supplies/equipment at health facilities in Borno State. Available supplies/equipment encourage pregnant women and postnatal mothers to regularly schedule and attend at least four planned ANC and PNC services required for mothers and newborn survival (Allen et al., 2015).

Government and implementing partners design and implement interventions that will provide steady supplies and equipment used during obstetric emergencies at health facilities to provide ANC and PNC services in Borno state in the midst of increasing Boko Haram crises. Most studies identify the unavailability of supplies and equipment to provide BEmONC services for pregnant women and postnatal mothers as the primary cause of inadequate ANC and PNC attendance, leading to worsening maternal and newborn outcomes. This is evident in a study by Kanyangarara et al. (2018) that health facilities that provides EmONC and obstetric services in rural and underserved communities of LMICs to readily deliver obstetric services can address issues with newborn outcomes. Hence, the continued availability of supplies and hospital equipment

at the health facilities will address MNCH issues and improve newborn health outcomes amid the Boko Haram crises in Borno State.

Summary

Understanding the associated factors to increased newborn outcomes in Boko Haram ravaged Borno State is critical to addressing increasing newborn outcomes. Most of the destroyed primary health care facilities in Borno State provided health care services for displaced women, children, and adolescents (OCHA, 2019). Today, the situation has led to increased newborn outcomes for people in Borno State where insecurity looms. Maternal, newborn and child health services are limited on the face of shortage of health workers to provide quality care, inadequate supplies/equipment to provide quality emergency obstetrics and newborn care (EmONC) services, inadequate transportation to health facilities to access health services within communities of Borno State.

In Chapter 2, to understand the issues relating to increased newborn mortality in crises ravaged Borno state, I provide a review of the relevant literature after describing strategies used for the literature search. The chapter provides analysis of peer-reviewed literature to provide evidence of other studies related to worsening newborn outcomes caused by the risk factors.

Chapter 2: Literature Review

In Borno State, the Boko Haram crisis displaced over 2 million persons and destroyed most health facilities. With 39% of health facilities completely destroyed, 50% of the state's health facilities are nonfunctional. Only 18% of functional health facilities are left to cater to over 5 million population with over 2 million displaced persons in Borno State (OCHA, 2019). The Boko Haram crisis has caused the relocation of some health workers in Borno State, leaving a few health workers to provide health services. The crisis has caused worsening newborn outcomes as women of childbearing age could hardly access health services. Pregnant women in the community have limited access to health services in Borno State amid the crisis.

This study explores the relationship between various antenatal and postnatal factors responsible for worsening newborn outcomes in crisis situation causing limited health care services in Borno State. This study aims to develop a policy for government and partners implementing MNCH programs in the state. The study's findings will help guide implementing partners about risk factors for pregnant women and postnatal mothers in implementing quality MNCH intervention programs.

According to Tekelab et al. (2019), most health workers providing antenatal care do not have the required skills, and this lack of qualified health workers is responsible for the worsening newborn outcomes in sub-Saharan African. A cross-sectional study by Nuamah et al. (2019) sampled 720 pregnant women from five subdistricts in Ghana about maternal health care utilization and found that mothers' knowledge level of pregnancy emergencies and newborn danger signs was low. However, 83.6% of pregnant women

utilized skilled delivery; only 33.6% of mothers utilized postnatal care services. Another study by Banke-Thomas et al. (2017) evaluated adolescent mothers 15-19 years on the utilization of ANC, skilled-based attendants (SBA), and PNC services in Kenya; education level was a significant predictor of ANC attendance, and parity was significant for SBA and PNC. OCHA (2020) examined how reproductive, maternal, newborn, child, and adolescent health and nutrition (RMNCAH+N) services delivered since 2015 and identified factors influencing the implementation of these services in three governorates of Yemen. They found that attention to specific aspects of RMNCAH+N varies slightly by location and availability of qualified human resources.

This chapter will highlight the search strategies used to retrieved relevant literature for the study. It will also highlight the three-delay conceptual framework that addresses the various relationships between identified MNCH factors and newborn outcomes. In this literature review chapter, I will also review relevant literature about the relationship between factors including planned transportation for ANC and PNC services, knowledge of danger signs during pregnancy and postnatal mothers, and the relationship between the availability of supplies/equipment during ANC and PNC and newborn outcome. Also, relevant literature about home delivery and utilization of skilled birth attendants and the relationship between newborn outcome. The chapter closes with a summary and conclusion of the main findings in exploring useful and recent literature relevant to addressing the study's research questions.

Literature Search Strategy

I conducted an electronic search of four online databases: Medline, Pubmed, Google Scholar, and Walden University Library. Major search terms for locating and retrieving relevant literature for the study included "transportation system for antenatal care visit," "transportation system for post-natal care visits," "access and utilization of skilled birth attendants," "knowledge of illness during pregnancy," and "availability of supplies/equipment during ANC and PNC at the health facility." The search results included over 124 articles, but only 60 articles were relevant to answer the study research question and analyze it.

I applied a theory-driven approach, narrative synthesis, to synthesize the literature. Thematic content analysis delineated the different variables from the research questions for the study. These themes included transportation system, planned transportation for ANC, planned transportation for PNC, and knowledge of illness during pregnancy. Other themes for the literature review included the availability of supplies/equipment, supplies/equipment during ANC, and availability of supplies/equipment during PNC, home delivery/traditional birth attendant during delivery with the newborn outcome.

I retrieved and used only current peer-reviewed journals, articles, and other relevant literature published within the last 5 years. The only peer-reviewed journal articles, conference papers, and dissertations published between 2015 to 2020 used for the literature review. All the search terms used allowed me to retrieve ample resources in online articles, peer-reviewed journals, dissertations, and conferences recently published.

There were enough articles and peer-reviewed journals published to retrieve adequate resources recently published for the literature review used for the study.

Theoretical Foundation

The study used the three-delay model to explore and understand access, utilization, and decision making for ANC and PNC services for pregnant mothers and newborn outcomes. The three-delay model was first developed by Thaddeus and Maine in their 1994 article. In a seminar presentation, Barnes-Josiah et al. (1998) wrote "The 'Three Delays' as a Framework for Examining Maternal Mortality in Haiti." The authors in these articles moved the conversation about women's health away from individual behavior towards community and national challenges with poor access to health infrastructure. The authors posited that, while action on all three delays is essential to reduce maternal mortality in Haiti, the third delay, “receiving adequate and appropriate treatment” is perhaps the single most important: the benefits of obstetric care must be real. In TBA training and referrals, investments in family and community education or improved transportation networks are meaningless when women reach a hospital only to die from nonexistent or inadequate care. Haitian women will continue to underutilize existing, accessible medical centers if they perceive the services as incompetent, costly, unpleasant, or dangerous (Barnes-Josiah et al., 1998).

The study demonstrates evidence of philosophers using the three-delay model. Smith et al. (2011) used the three-delay model to evaluate the association between parents' beliefs about vaccinating children by using data from the 2009 National Immunization Survey. Sumankuuro (2018) stated that timely health service utilization

benefits might be known to some community members. Barriers, including low economic status, illiteracy, inadequate health education, sociocultural beliefs, poor road infrastructure, and difficulty accessing transport services during an emergency, alongside inadequate health facilities, caused delays among clients in many rural locations.

The three-delay model is critical in addressing the delays faced by pregnant women and post-natal mothers in rural communities of low-middle income counties (LMICs) where underserved populations abound. It helps to coordinate the families' efforts and communities to encourage them to seek care early. Also, it helps pregnant women and postnatal others identify and reach a desired and adequately equipped health facility to seek timely and quality health care from skilled health professionals (Sumankuuro, 2018; Sychareun et al., 2016; & Thaddeus & Maine, 1994).

The three-delay model is used by theorists, philosophers, and seminar presenters to demonstrate the cause of newborn outcomes. Theorists have used the three-delay model to develop theories concerning practices/behaviors that lead to newborn outcomes. Srivastava et al. (2015), in a systematic review of public health and science databases to understand reasons for 99% annual maternal death from developing countries, found that outcome-related determinants, including the mother and newborn status, access, cost, and reproductive history, influence perceived maternal satisfaction. The authors also found structural elements, including an excellent physical environment, cleanliness, and availability of adequate human resources, medicines, and supplies to influence maternal satisfaction and reduced newborn outcomes.

Theoretical Underpinnings

Different theories or conceptual frameworks are critical in research, policy, and clinical practices in assisting health professionals and development experts in understanding the effectiveness of strategy development and utilizing specific services provided to pregnant women and post-natal mothers. Different assumptions underpin theories, approaches, or concepts to inform policies and research findings that form a study's background, giving rise to new theories (Sumankuuro, 2018).

Feminist Theories

Feminist theories explore maternal health from a feminist perspective. That is, they draw upon core feminist principles, which seek to counter the dominant ideology of patriarchy, a system of society in which men hold power, and which affects women's freedom to decide on when, where, and from whom to seek and receive appropriate maternal health services (Amzat, 2015). In many countries, particularly in hard-to-reach LMICs, women continue to be deprived of their fundamental civil and maternal rights and privileges. Two relevant feminist theories, the theory of maternal engagement and the human rights-based approach to decision-making, take theoretical underpinnings to understand maternal and newborn outcomes in this study.

Theory of Maternal Engagement

The United Nations Population Fund, the World Bank, and the World Health Organization (WHO) sponsored the International Safe Motherhood Conference in Nairobi, Kenya, in February 1987 (Sumankuuro, 2018), following which increased attention was given to issues surrounding maternal engagement. The theory of maternal

engagement is premised on Rosenfield and Maine's (1985) argument that an increased focus on infants' health failed to address the horrific risks pregnancy posed to women in low- and middle-income countries. The maternal engagement theory is synonymous with family-centered care (Phillips, 2003) or patient-centered care theory (Caputi, 2013; Jimenez et al., 2010), and focuses on taking a systematic approach to nurse care of a pregnant woman and her family based on an understanding of the client (the pregnant woman) as an individual with specific needs (Sumakuuro, 2018).

Engaging women and family in the passionate discourse during pregnancy to childbirth was advanced by Douglas and Michaels (2004) in a book, *The New Monism*, which considers the journey in childbirth in the post-millennium era a "wicked exchange of wealth for human life." Consequently, the International Confederacy of Midwives (ICM) emphasizes family-centered maternity care as fundamental to good maternity care services (Sumakuuro, 2018).

Key Components of the Theory of Maternal Engagement

The theory of maternal engagement is a flexible approach for providing safe, high-quality healthcare adapted to the physical and physiological needs of the client (pregnant woman), the client's family, and the newly born offspring (Sumankuuro, 2018), and grounded on six primary principles (Petersen et al., 2004; Phillips, 1996):

1. Openness: Open communication is necessary to provide the highest quality of care.
2. Respect: Respect for pregnancy as a regular, healthy event in a woman's life. Kuo et al. (2012) added that pregnancy is a healthy life event rather than a

complicated condition. An intervention is needed for complications to be minimal.

3. Knowledge: It is necessary for women to be frontline decision-makers and equally necessary for healthcare providers to provide quality care (Zwelling & Phillips, 2001).
4. Atmosphere: Theorists have proposed that engaging with women enables them to choose the caregiver and place of birth that is most beneficial. Thus, a woman can decide on the healthcare providers and other advisers that she prefers (Zwelling & Phillips, 2001) and refuse routine procedures that may not be necessary for her well-being (Petersen et al., 2004).
5. Confidence: Giving the woman and family confidence in pregnancy management is essential to safe pregnancy and birth outcomes (Petersen et al., 2004).
6. Outcomes: The women and relatives would have participated in the decision-making process, which will increase their self-confidence. The care process will also validate their learning with real-life experiences. Subsequently, the nurse that engages a mother and the family in caregiving will also experience higher satisfaction in her profession (Zwelling & Phillips, 2001).

Application of the Theory of Maternal Engagement

A core component of the syllabus for training nurses and midwives is family-centered maternity care, where the primary mandate is to promote midwives-client/family interactions in preparation for safe delivery and consequently providing quick redress to

unexpected obstetric conditions (Perry et al., 2014; Petersen et al., 2004). Midwife home visits are often a core element of the engagement process. Theoretically, maternal engagement will also tune the family's minds to reduce adverse behavioral problems and unintentional injuries, depression, and other preventable causes of morbidities and mortalities (Jack et al., 2005; Sychareun et al., 2016). Some theorists conclude that close contact with pregnant women and their families during the antenatal period has the potential to positively influence pregnancy and childbirth outcomes (Jack et al., 2005; Petersen et al., 2004).

An improved maternal health outcome is required to achieve a nurse-client relationship enhanced by putting theory from the classroom into practice at the community level, leveraging active engagements with expectant mothers and the families for maternal health service utilization and management obstetric emergencies (Jack et al., 2005). Despite substantial evidence to support the use of nurse home visitation programs, many governments and agencies have failed to implement the strategy using both nurses and community level volunteers (Pedercini & Barney, 2010), at least partly because of the expense of such programs. Previous studies in low and middle-income countries on the effectiveness of skilled and village health workers' (VHWs’) interrelationships with clients and the families, notwithstanding, suggest this was partly due to lack of coordination between the nurses and the village volunteers (Jack et al., 2005; Petersen et al., 2004; Pollard, 2006), with difficulties emerging over their respective roles.

Challenges of Maternal Engagement Theory

According to Sumakuuro (2018, several other proponents of maternal engagement theory do not appear to have thought through the ideal blueprint for achieving maternal engagement in rural settings. Especially in low and middle-income countries where there are significant backlogs in nurses attending to the most basic maternal health issues (Thaddeus & Maine, 1994). That is, staffing levels are entirely insufficient to support its full implementation. Hygiene education under the model does not recognize other social and cultural barriers that inhibit service uptake at healthcare facilities.

The theory of maternal engagement has not also recognized that most maternal deaths occur in low and middle-income countries where fewer nurses and paraprofessionals are involved. It is simply not possible in many locations for existing staff to attend all pregnant women individually, including the public and other health facility admissions, in a reasonable timeframe (Lozano et al., 2012). Also, engaging with mothers in ways that increase their empowerment might mean that expectant mothers make decisions that appear contrary to health service delivery recommendations and international protocols and conventions, even where they have the requisite knowledge.

Likewise, the model fails to acknowledge the deeply held cultural beliefs that underpin women's disempowerment in many developing nations, particularly in sub-Saharan Africa. Changing these values will require profound cultural shifts that are unlikely to be achievable in the short term. For this reason, the theory is perceived as a Western-centric approach, and many of these health facility preferences may not necessarily be culturally appropriate in some locations in the less developed and

developing communities. Conversely, if a woman prefers to be delivered by a TBA because it is her personal preference, it should be accepted as a reasonable decision and fully supported.

On the whole, the three-delay model and the feminist theory connects in that the both theories demonstrate relationships as they both identify issues with delay in deciding, reaching and accessing health care. The Feminist theory addresses fundamental civil and maternal rights and privileges. Two relevant feminist theories, the theory of maternal engagement and the human rights-based approach to decision-making address issues with pregnant women not having the right to decide to seek health care. This is especially in cultures where women do not have sole rights to make decisions for themselves, they must consult their husbands to take any decisions. This causes delays in deciding to seek heal therefore, leading to increased newborn outcomes as the case in Borno state.

Literature Review Related to Key Variables and/or Concepts

Theoretical Framework – the Three Delay Model

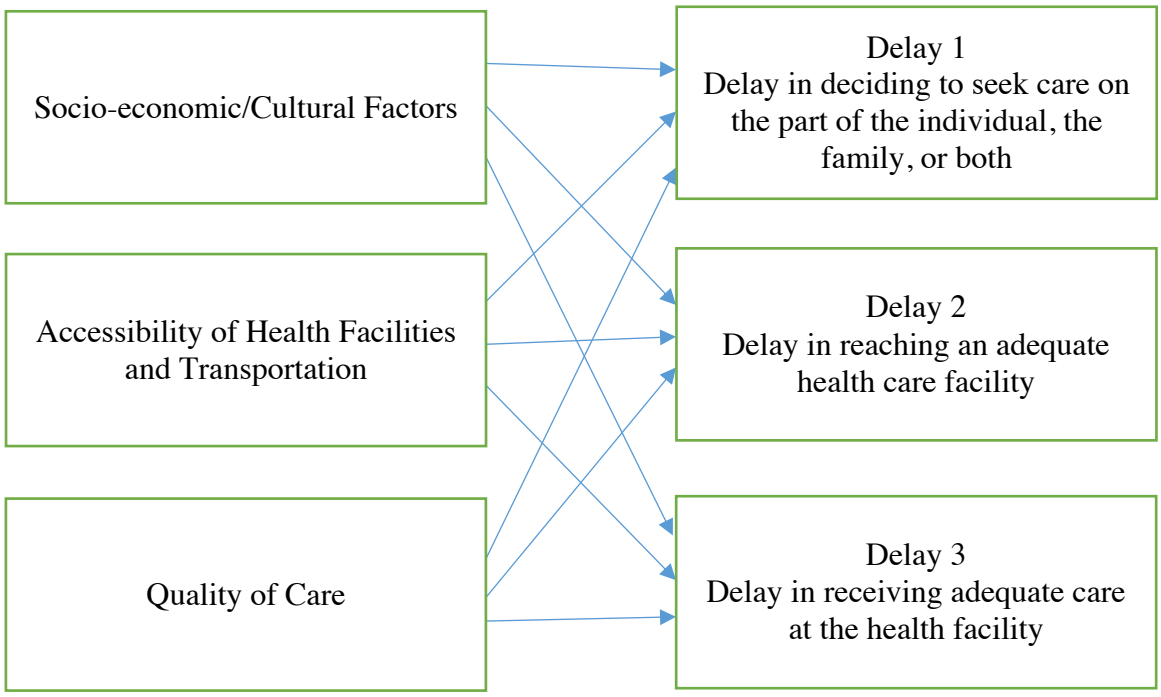
This three-delay model explains different factors that include (a) Delay 1: deciding to seek care, (b) Delay 2: identifying and reaching (transportation to) health facility, and (c) Delay 3; receiving adequate and appropriate treatment (MacDonald et al., 2018). The theoretical framework, the three-delay model, describes the socio-economic and cultural factors that affect these three delays' lengths. The conceptual framework - the three-delay model, explains that maternal and newborn morbidity and mortality was not

due solely to a lack of economic and human resources but was a product of numerous linked factors (MacDonald et al., 2018).

The three-delays model has been widely considered a comprehensive approach for examining barriers to seeking obstetric care and preventing maternal mortality. The model comprises the delay in deciding to seek appropriate care by individuals, family, or both (Delay 1), delay in reaching an adequate health care facility (delay 2), and delay in receiving adequate care reaching a facility (Delay 3) (Kachan et al., 2019). Three Delays, developed by Thaddeus and Maine (1994). These delays are (1) the delay in the decision to seek care, (2) the delay in reaching a health facility, and (3) the delay in receiving adequate care at a health facility. The three-delay model benefitted this research study. It helped understand increased newborn outcomes in Tamsu-Ngandua ward, Mafa LGA, Borno state, where the Boko Haram activities have destroyed infrastructures that help provide quality health care to displaced families, particularly women and children. The three-delays model is illustrated in Figure 1.

Figure 1

The Three Delays Model



The three delays model developed by Thadeus and Maine has been widely used and helps to identify community and health services factors associated with maternal and newborn deaths (Jesse et al., 2017). It is also useful for devising effective strategies used as preventive measures for avoiding maternal and newborn outcomes. No doubt, recording or auditing maternal and newborn deaths has significantly helped address maternal and newborn outcomes and developed useful maternal and newborn indicators.

The three delays model concept explains why, when, and how a delay occurs and what or who contributed to the delay. According to Thadeus and Maine (2004), a delay occurs. Perception about the delay seems to have significantly or partially contributed to

the care seeker's death if some action avoided the delay either by the caregiver or health professional.

Transportation Systems for ANC & PNC

The transportation system requires all the infrastructure that enables, supports, and aids a pregnant woman or post-natal mother to access care during an emergency quickly. It helps avoid death or fatality from developed emergencies during pregnancy or after birth (Hirose et al., 2015). According to Hirose et al. (2015), women's delay in reaching emergency obstetric and newborn care (EmONC) facilities contributes to a high burden of maternal and perinatal mortality and morbidity in low-income countries. BEmONC services are a set of life-saving functions such as administering antibiotics, oxytocic drugs, anticonvulsants, and manual removal procedures. In contrast, comprehensive EmONC (CEmONC) services additionally include blood transfusion and surgery. The period from the onset of signs and symptoms of complications to the receipt of EmONC is divided into three phases or "three delays."

Mgawadere et al. (2017) conducted a study to assess maternal mortality with the three delays proved positive with maternal and newborn outcomes showing strong association with three delays. They found that more than half of all women who died at the health facility had experienced more than one type of delay; deciding to seek care, reaching health facility, and receiving care at the health facility. Type 2 delay was responsible for type 2 delay - distance to the health facility resulting in transportation problems and constituted maternal death's main problems. Instituting a system that

thoroughly addresses the three delays is critical for avoiding maternal and newborn outcomes, especially in underserved communities of LMICs.

In a qualitative study by Jesse et al. (2017) to assess men's role in seeking maternal and newborn health, applying the three delays model. The study revealed a partner-focused dimension to the 3-delays model. Men reported taking ownership as decision-makers to provide transportation to and from the health facility and accompany their partners to the health facilities. No doubt, men can leverage their influence over resources available within the household and make effective decisions to support maternal and newborn care-seeking culture at the communities' health facilities. These could help ease challenges pregnant and post-natal mothers experience during and after childbirth to reduce/completely address newborn outcomes. Interventions should encourage men to be positively and proactively involved in maternal and newborn health to address increasing maternal and newborn outcomes.

Planned Transportation for ANC

Different scholars have argued that the increased rate of maternal and newborn outcomes is contributed significantly by women's delays in reaching emergency obstetric newborn care (EmONC) facilities, particularly in low-income countries due to lack of planned transportation. Hirose et al. (2015), in their study, modeled travel time to health facilities among pregnant women using Geographic Information System (GIS). They observed that difficulties in obtaining transportation explained some delays and caused maternal and newborn outcomes. Similarly, Chankham et al. (2017) argued that pregnant

women in Lao province who received free transportation support are more likely to utilize ANC services and delivery at the health facility.

A study that evaluated Uber-like expanded transport to access maternal and newborn health services system in rural Homa Bay, Kenya, Onono et al. (2019) found that women who receive these services are three times more likely to reach a health facility for delivery than those who did not. Indeed, it is evident that the availability of planned transportation to access maternal and newborn health services promote access to delivery and ANC services for pregnant women and reduce adverse outcomes for newborn health in rural areas, particularly in LMICs. Targeted interventions or policies should make available free transportation to enable poor pregnant women in rural areas to access maternal and newborn health services to reduce adverse newborn outcomes.

In another way, researchers have demonstrated that though sometimes there is the availability of planned transportation for pregnant women to access services, most mothers do not access services at the health facility for antenatal care services and delivery within their communities. Higher rates of newborn mortality have been associated with inappropriate antenatal care services due to long-distance to the health facility access to ANC services caused by lack of transportation, particularly in developing countries (Ali et al., 2018; Kante et al., 2015; & Hirose et al., 2015).

Conversely, a study by Gebre et al. (2015) to assess the birth preparedness and complication readiness (BPCR) among pregnant women in rural Duguna Fango District in Wolayta Zone in Ethiopia found that women with arranged transportation to health facility have more tendencies to deliver at the health facility. Planned/arranged

transportation services should be made available and accessible for pregnant women in rural communities of LMICs to attend ANC services and deliver at the health facility. Proper awareness and sensitization about when, where, and how these services are accessed in the communities should be made known to families with pregnant women in rural communities to access maternal and newborn services available at the health facilities.

Again, researchers have observed the importance of birth preparedness that included arranged transportation services to access maternal and newborn health services within rural communities. A lack of arranged transportation contributes significantly to increased newborn outcomes. Poor and neglected road infrastructures in rural communities have made the provision of alternative transport services to access health care services difficult (Atuoye et al., 2015). In a study conducted in rural Ghana to assess transportation barriers to accessing maternal and child health services, Atuoye et al. (2015) identified lack of vehicular movement as a factor affecting the positive impact of the implemented Community-based Health Planning and Services (CHPS) project. Pervin et al. (2018), in a cross-sectional study to determine birth preparedness and complication readiness among pregnant women, stated that women with arranged transport had higher odds of four or more ANC attendance and delivery with skilled attendants than women who are not well prepared. The use of innovative community transport services could help pregnant women access ANC services and utilize skilled birth attendant services in communities with a high poverty rate and neglected or poor road infrastructures. Community-based health interventions should use innovative transportation services to

promote effective services for maternal and newborn health and reduce newborn outcomes.

Proper health infrastructures in the slums where most underserved populations reside have the potential of avoiding maternal and newborn outcomes. A study by Thakur and Singhal (2016) to explore different factors including socio-economic and cultural factors associated with ANC utilization revealed inadequate coverage and utilization of ANC services in rural communities due to inadequate transportation facilities, distance to health facilities, cultural beliefs, and lack of knowledge about menstrual health services. Improved health infrastructures and continuous health education about the benefits of ANC services in the community enhanced communities and families encouraged to utilize available services.

Planned Transportation for PNC

Planned transportation for post-natal care could be defined as an arrangement of vehicular means (car, motorbikes, Keke-napep, among others) to convey post-natal mothers' access to health care for newborns and mothers the first six weeks of delivery. Researchers have proven that post-natal care is critical for newborn survival, and access to a skilled and trained health worker is critical and increases newborn survival chances. Birth preparedness and complication readiness are essential factors for pregnant women and after delivery to address newborn outcomes, especially in rural communities in LMICs where poor road infrastructures and low skilled birth attendants are available.

A qualitative study by Vellakkal et al. (2017) stated that the lack of availability of arranged transportation services makes it difficult for pregnant women and post-natal

mothers to access health care for newborns in underserved communities and causes increased newborn outcomes. Another study by Thomas and Rankinb (2015) conducted among pre-and post-natal women in rural developing economies of sub-Saharan Kenya in Africa assessed the high infant mortality rate using the mobile app. They found that lack of arranged transportation due to long distance from homes to health facilities was among the reasons mothers deliver at home and are not attended to by a skilled health worker within the first 3 days to 6 weeks of birth.

Engaging and training TBAs and equipping them with the necessary tools to attend to mothers and babies could be a temporal solution to address transportation issues with mothers who reside far from health facilities. Interventions with robust referral systems and engaging community members volunteer groups for emergency transport system should be established to reduce newborn outcomes. There are no many research studies in planned/arranged transportation for PNC visits during the postpartum period, and future studies should look deep into this issue.

Knowledge of Illness During Pregnancy

Danger signs are common among pregnant women and post-natal mothers, and proper knowledge of danger signs among pregnant women, newborns, and post-natal mothers is critical for newborns' survival. Different danger signs occur at different stages of pregnancy and after delivery. Early detection of these danger signs helps mothers access health the necessary health care and prevent newborn outcomes. Rahman et al. (2018), in a quantitative cross-sectional study, evaluated how women in Bangladesh, accompanied by their husbands, receive maternal and newborn health services from

trained health providers. They found that 25% of women accompanied by their husbands are more likely to identify three or more danger-signs related to birth and postpartum periods.

Another cross-sectional study by Oguntunde et al. (2019) assessed men's knowledge of danger signs during pregnancy and obstetric care continuum to support their wives access ANC and PNC services in Northern Nigeria. They found that overall knowledge of danger signs during pregnancy and postpartum period was poor among married men and their wives. There is insufficient knowledge of danger signs among both married men and their wives in LMICs, which contributes significantly to the increased newborn outcomes among LMICs. Government and program implementing partners should increase knowledge and awareness about danger signs during pregnancy and the postpartum period and encourage seeking appropriate health services from skilled health workers during ANC and PNC to reduce newborn outcomes.

Research has proven a relationship between birth preparedness practices and knowledge of danger signs during pregnancy. Access to ANC and PNC services are elements of birth preparedness and complication control that improve pregnant women's knowledge of danger signs. Encouraging pregnant women to access ANC services within the community improves their knowledge of danger signs. Masoi and Kibusi (2019), in a quasi-experimental study, tested the effectiveness of an interactive mobile alert messaging system on improving knowledge of danger signs during birth preparedness and complications readiness practice using intervention and control groups. There was a

significant difference between the groups; the intervention group showed more understanding of danger signs than the control group.

In another study, Bitew et al. (2016) evaluated birth preparedness and complication readiness plan among pregnant women in resource-limited settings in northwest Ethiopia; they found a common understanding of at least three danger signs during pregnancy, delivery, and postpartum period among pregnant women. Increased access to ANC services by skilled health workers can improve knowledge of birth preparedness and complications among pregnant women in a resource-limited environment. Effective communication involving partners to deliver quality and appropriate messaging during ANC visits will help improve knowledge of danger signs during pregnancy, delivery, and postpartum periods among pregnant women, thereby reducing newborn outcomes.

Researchers also identified standard-essential newborn care practices as a significant contributor to newborn outcomes. Most newborn deaths usually occur within the first 24 hours of delivery, with 75% occurring during the early neonatal period with a low prevalence of essential newborn practices being responsible for low ANC visits and poor knowledge of danger signs during pregnancy (Chichiabellu et al., 2018; Nigatu et al., 2015; Dhital et al., 2019; & Bogale & Markos, 2015).

Another study to assess the practice of birth preparedness and complications in the underserved community found an association between lack of birth preparedness and complication readiness and insufficient knowledge of danger signs during pregnancy and delivery among pregnant women. The practical and harmonized working relationship

between government, implementing partners, health workers relating to maternal, newborn, and child health improves birth preparedness and complication readiness practices. Government, policymakers, and program implementation to develop targeted programs on birth preparedness and readiness complications to address poor knowledge of danger signs during pregnancy, delivery, and postpartum period to reduce newborn outcomes.

Similarly, Ekwochi et al. (2015) evaluated knowledge of danger signs and health-seeking practices using nine WHO-recognized danger signs among pregnant women in south-eastern Nigeria. They found poor knowledge of pregnant mothers with less than WHO recommended danger signs to be responsible for most newborn outcomes. A study by Nigatu et al. (2015) assessed the level of mother's knowledge about neonatal danger signs and identified factors associated with good mothers' knowledge. They found mothers with knowledge of at least three danger signs, with both father and mother's higher education level and access to social media such as television to be associated with good knowledge of neonatal danger signs.

Effective promotion of birth preparedness and awareness creation of complication serves as an excellent strategy for ANC attendance, utilization of skill birth attendants, and address other barriers during emergencies. Counseling on danger signs and over four ANC visits effectively improves knowledge of danger signs during pregnancy among pregnant women. Practical strategies for awareness creation of birth preparedness include early ANC attendance, attending ANC at least four times. Urgent need to strengthen expectant mothers' teaching and training across all maternal sociodemographic variables

on these danger signs and the most appropriate measures to take when they occur. Government and implementing partners in MNCH should strengthen strategic programs to improve training, education, and promotion of pregnant mothers about danger signs.

Availability of Supply/Equipment

Encouraging access to adequate ANC and PNC health services for pregnant women during delivery and postpartum mothers requires the availability of all supplies (drugs)/equipment required for efficient essential emergency obstetrics services (BEmONC). Several research studies have confirmed the effectiveness of supply/equipment availability to encourage up-take of maternal, newborn, and child health services, especially in underserved communities of LMICs. McClure et al. (2015) stated that the high rate of stillbirth in LMICs was due to inadequate or unavailability of equipment and supplies to conduct cesarean sections and obstructed labor for pregnant women with complications in underserved populations.

Availability of Supplies/Equipment during ANC

Kadia et al. (2020), in their retrospective study, evaluated the functionality and quality of emergency obstetrics and neonatal care (EmONC) and found that, though most of the health facilities performed cesarean sections, only a few had the complete equipment to carry out the required signal functions for EmONC. Similarly, Mubiri et al. (2020) investigated the extent to which mothers bypassed their nearest facility to health facilities with appropriate care and complete equipment for delivery. A significant proportion of women who participated in the study did not deliver in the nearest health facility due to lack of/unavailability of some equipment for safe delivery. Though

pregnant women stretched themselves for quality delivery at health facilities with the right equipment, properly equipping nearby health facilities for women will encourage seeking quality EmONC services within the community with less stress and prevent newborn outcomes. The government should partner with implementing partners to equip health facilities within the community better to provide quality EmONC services to avoid newborn outcomes.

Kanyangarara and Chou (2017) developed a data-driven approach to estimating coverage for a sub-set antenatal care intervention using a five-step process for syphilis detection and treatment. Hypertensive disorders, and pre-eclampsia, were found to be computed by linking household and health facility surveys. Another study conducted by Gebrehiwot et al. (2015) evaluated the association of the health extension program (HEP) to improve utilization of maternal health services in northern Ethiopia using quarterly ANC and PNC attendance at health posts and health care centers. They found that ANC and PNC utilization for consultations increased at health posts and delivery care at health centers for the HEP interventions.

Indeed, a robust predictive model can be used to estimate the coverage of pre-eclampsia coverage performed relatively better during ANC visits as well as properly planned and targeted interventions. Government and development partners implementing targeted intervention programs should equip health facilities with appropriate equipment to increase demand for ANC and PNC services to address maternal and newborn issues in the community.

Evidence has suggested that life-saving intervention reaching maternal and newborns is responsible for their survival. In a study, Allen et al. (2015) explored the association between the increased number of contacts focusing on ANC behavior and iron supplementation, and syphilis prevention care uptake. The study revealed increased contacts with pregnant mothers associated with uterotonics supplies and prophylactic uterotonics use during pregnancy. Different researchers examined supply-side determinants of maternal service utilization in rural communities at health sub-centers among professional health workers.

Lower demand for maternal services provided by auxiliary nurse midwife (ANM) due to inadequate supplies and equipment for ANC compared to services offered by a permanent ANM due to availability of obstetric drugs, weighing scales, and blood pressure equipment (Singh, 2016; N'Gbichi et al., 2019; Wilunda et al., 2015; Chou et al., 2019). The availability of maternal services at health service centers in rural communities encourage the utilization of ANC services. Targeted intervention by implementing actors and government to increase access for pregnant women with maternal health services during pregnancy.

Availability of Supplies/Equipment during PNC

Different studies have evaluated the quality of postpartum care to improve service delivery. A study by LeFevre et al. (2018) suggested that, though there was the availability of drugs and commodities at assessed health facilities, however, water and electricity to perform caesarian sections were majorly not available. Research proves that adherence to essential best practices (EBPs) is essential for quality maternal and newborn

care in a resource-limited environment. In a cross-sectional study that compared the quality of intrapartum and immediate postpartum care across different levels of primary health care facilities in resource-limited settings in African nations; compliance to all four pause points was insufficient specifically to hand hygiene practices such as hand gloves for vaginal examination, even though thermal management of newborns practices was high (Billah et al., 2018; Millogo et al., 2019; & Shah et al., 2015).

In another study that evaluated the obstetric service availability and readiness in LMICs, Kanyangarara et al. (2018) found that only a few health facilities were entirely ready to offer EmONC and provided obstetric services. Prioritizing and upgrading health facilities in rural and underserved communities of LMICs to readily deliver obstetric services can address issues with newborn outcomes. Improvement interventions should be prioritized by implementing maternal and newborn health partners to upgrade existing facilities to provide quality MNCH services that will help address the issue.

Similarly, research has confirmed that access to quality emergency obstetrics care (EmOC) is key to reducing maternal and newborn morbidity and mortality. In a cross-sectional study, Wilunda et al. (2015) established the availability of maternal and neonatal health care services at the various units for utilization and quality. They found several gaps in the availability of essential infrastructure in terms of equipment, drugs, supplies, and staff to provide adequate maternal and neonatal care at the health centers. In the same way, Khan et al. (2018); Hill et al. (2015); Wilunda et al. (2015) in a study examined health professionals characteristics, and provision of MNH services influenced

competencies, they found that professionals working in health facilities with higher use of regular deliveries had better competencies than their counterparts.

Health professionals had higher competency in newborn vignettes if they worked in health facilities that provided more specialized newborn care services and emergency obstetric care. Exposure to a higher number of obstetric cases in the workplace is directly related to health workers' competency. Periodic skill-based and drill-based in-service training for MNH professionals in high-use neighboring health facilities could be a feasible intervention to improve their knowledge and skill in obstetric and neonatal care.

Home Delivery/Traditional Birth Attendant During Pregnancy

Research has proven that skilled attendants/skilled healthcare workers encourage the utilization of maternal health services and improve newborn outcomes among underserved communities. Sukoco and Suparmi (2017), in their research, evaluated the utilization of maternity waiting homes by pregnant women among women in sub-district Selaru and found only a few pregnant women utilized maternity waiting homes for delivery. In another study using the sequential mixed method by Olowokere et al. (2020) in south-western Nigeria evaluated the utilization of skilled birth attendants by pregnant women, it was observed that women who do not utilize skilled birth attendants experience complications during childbirth. No doubt, the use of skilled birth attendants is critical for newborn outcomes, especially in rural underserved communities in LMICs. Targeted programs by implementing partners and policies by the government should deliberately encourage skilled birth attendants to improve newborn outcomes.

Intervention in areas of skilled health providers in LMICs is critical for newborn survival. Egharevba et al. (2017) evaluated different factors influencing pregnant women's choice of delivery location among women who attended the ANC services and immunization clinic in south-eastern Nigeria in a cross-sectional study. They found that delivery with skilled-birth attendants was significant and associated with encouraging pregnant women to use ANC services to detect danger signs. Also, in another community-based cluster randomized controlled trial (RCT),

Hoque et al. (2018) evaluated the impact and operational assessment of safe motherhood and newborn health promotion package in three sub-districts of Chandpur in Bangladesh. Coverage of crucial interventions, including ANC, PNC, health facility, and skilled health providers, were critical factors for neonatal survival. Health care intervention in ANC, PNC, skilled health providers is significant for improving maternal and newborn outcomes. More targeted interventions in LMICs for MNCH should focus on quality ANC, PNC, and skilled health workforce delivery to achieve positive newborn outcomes.

Again, research has proven the importance of using mHealth to improve maternal and child health outcomes in LMICs. A secondary review was conducted by Kabongo et al. (2019) to evaluate mHealth interventions for health care providers and pregnant women and new mothers. Findings revealed that although perceived skill and knowledge improvement among health workers, encouragement, perceived service satisfaction, and improved self-efficacy were factors that motivated the use of health centers to deliver MNCH services and uptake of MNCH services, respectively. Begashaw et al. (2017), in a

cross-sectional study, assessed birth preparedness and complication readiness among pregnant mothers attending ANC in South West Ethiopia. They found that most women with birth preparedness were more ready to use skilled birth attendant during delivery.

Another study to evaluate factors affecting birth preparedness and complication readiness among pregnant women in LMICs, Kenya, in a descriptive cross-sectional study. The type of health facility attended by pregnant women and availability of skilled health workers were associated with birth preparedness and decision to use skilled birth attendant during delivery (Joyce et al., 2018; Acharya et al., 2015; Moinuddin et al., 2017; & Islam et al., 2018). Birth preparedness is critical in utilizing MNCH services at health facilities with skilled birth attendants for pregnant women during delivery in LMICs. Increased intervention to provide training and availability of skilled health workers in health facilities in rural communities of LMICs will improve maternal and newborn outcomes.

Research has shown that some demographic factors, including the need for care and education, determine using skilled birth attendants among pregnant mothers during delivery. In their study, Dickson et al. (2018) assessed the association between demographic characteristics and skilled providers' choice by pregnant women in Ghana. They found that education was critical for pregnant women deciding to use skilled health workers during delivery. Also, ANC and skilled attendant during ANC among pregnant women in LMICs proved useful for neonatal survival, as pregnant mothers who used ANC services and skilled attendants had more likelihood of newborn survival (Arunda et al., 2016; Johnson et al. 2015; Sarker et al. 2015; & Sumankuuro et al. 2017).

Research has proven the association of frequent ANC visits, husband's participation in ANC, utilization of MNCH services, and institutional delivery to neonatal survival. Chaurasiya et al. (2019), in a cross-sectional study, examined factors associated with institutional delivery. Though fewer than 30% of over 300 pregnant women participated in the study delivered at the health facility, the rest had no birth preparedness and complication readiness plan. Another cross-sectional study by Tantu et al. (2018) evaluated the level of the husband's involvement with birth preparedness among pregnant women in LMICs. Husbands who attended ANC with their wives showed more readiness and preparedness for birth and are more likely to deliver at a health facility with skilled attendants than husbands who did not.

Evaluating reasons for increased TBAs in LMICs with limited access to resources in a cross-sectional study revealed huge gaps. Pregnant women with more than 3 ANC visits and utilized MNCH services at the health facilities showed more tendencies to delivered using skilled attendants than pregnant women with less than 3 ANC visits (Atuoye et al., 2017; Banke-Thomas et al., 2016; & Nuamah et al., 2019). It is observed that frequent ANC visits, planned pregnancy, frequent contact with skilled health workers are critical factors that influence pregnant women to deliver their babies at the health facility. More targeted intervention to encourage MNCH services, particularly in resource-limited settings of LMICs, will encourage delivery at health facilities and skilled birth attendants.

Summary and Conclusions

Most of the literature reviewed for this study used cross-sectional and systematic methodologies, and only a few used the cohort methodology with their various strengths and weaknesses. The systematic review has its strength in a broad overview of the issue that provides insight into existing research trends and allows to narrow down concepts and factors. However, it lacks theoretical grounding and does not correct bias in the original studies with a high dependence on the original studies' quality of methods. The cohort study quantifies changes in different perspectives in terms of birth readiness and complications preparedness plan. However, usually do not have sample size calculated to compare temporal changes that provide ANC services for pregnant mothers and newborns.

The cross-sectional methods usually have large sample sizes. Large-scale intervention helps analyze various risk factors to identify delays in accessing the quality of health care services for pregnant mothers and newborns. It also makes for a broad overview of the issue; gives insight into existing research trends that narrow down concepts and factors. The socioecological framework used provided evidence for action at different levels, including policy and ecological development. The cross-sectional method has its limitation, like the data, and makes it difficult to evaluate the intervention tools' efficacy.

For future research, it is recommended that the nature of research reviewed mostly uses cross-sectional study. Data for the study should be made to be easy to evaluate pregnant mothers' efficiency accessing ANC and PNC services at health

facilities within rural communities. Cohort studies should consider the need for pregnant mothers to access both ANC and PNC service to measure complication readiness and preparedness during child and after childbirth.

Delays in deciding to access care interlinks with accessing the health centers, where health services could be accessed. These factors invariably affect health outcomes for mothers and newborns. In northeast Nigeria, Borno State, where the Boko Haram crisis has destroyed most health infrastructures, with only 18% to cater to over 5 million people, with over 2 million people displaced, provides scenarios of lack of planned transportation to access ANC and PNC services for women. Inadequate health workers to provide services, inadequate/unavailability of supplies/equipment to provide critical care as needed. This research fills the gap in these areas, especially with limited research in planned transportation in crises ravaged environment, and will provide extensive knowledge of the situation in northeast Nigeria, Borno State.

The three delays model contextualizes the socio-cultural factors that are associated with maternal and newborn deaths. In a retrospective mixed-method study by Sk et al. (2019), they used facility-based and community-based approaches to explored different factors associated with maternal and newborn death. They found that type 1 delay; delay in seeking care, and type 2 delay; delay in reaching a first-level health facility were the two most significant contributors to maternal and newborn health. Women staying at a long distance from the health facility reported higher type 2 delays than their counterparts. The study also revealed that women in Muslim communities were

more likely to experience type 2 and type 1 delay. These delays are attributed to their cultural beliefs causing increased maternal and newborn outcomes.

Other factors, including recognition of danger signs, knowledge and attitude towards seeking medical care, financial constraints, and arranging (planned) transportation, were the three delays model (Sk et al., 2019; Jesse et al., 2017; & Mgawadere et al. 2017). Interventions should target addressing all three delays, specifically type 1 and type 2 delays, which pose significant contributors to maternal and newborn outcomes. Also, interventions and government policies should strengthen the effectiveness and functionality of referral networks, create more awareness and demand for maternal and newborn services, and increase coverage of health care.

Chapter 3: Research Method

This research study explores the different factors of ANC and PNC associated with the worsening newborn outcomes in Borno State, northeast Nigeria. The Boko Haram crisis has put enough strain on the state's health system, mostly as most primary health care infrastructures responsible for providing maternal, newborn, and child health services destroyed. This chapter will address the methodology used for the study to include quantitative study design, sampling, and sampling techniques used to select participants in the targeted population in collecting data for the study. Since the study is a secondary quantitative study, in this chapter I will describe how data were collected and how participants were recruited for data collection.

Research Design and Rationale

The aim of this research was to explore ANC and PNC relationship with newborn outcomes using independent variables including ANC, PNC, transportation means for ANC and PNC, availability of supplies/equipment to provide EmONC services, as well as availability of skilled health workers. Covariates for this study included age and parity/birth experience, with newborn outcomes as the dependent variable.

I conducted a quantitative observational study to address the research questions. Using a cross-sectional study design, I evaluated secondary data about how ANC and PNC risk factors or exposures influence newborn morbidity or mortality. Observational methods were used to describe associations already present at the population (descriptive) or individual (analytical) level. Hajat (2011) added that although they form the mainstay of epidemiological studies, observational methods are prone to bias and confounding.

The study target population included people in Tamsu-Ngandua ward, Mafa LGA of Borno State who benefited from the VHW intervention implemented from December 2019 – November 2020.

Phenomenon of Investigation

This study will build on the positivism paradigm of scientific research that takes on the systematic quest for knowledge, making assumptions about how the world operates. According to Park et al. (2020), positivism relies on the hypothetical-deductive method to verify a priori hypotheses stated quantitatively with functional relationships established between causal and explanatory factors. It creates a connection between independent variables and (outcomes) dependent variables. Conversely, positivist research, however, does not always rely on quantitative methods. For example, an experimental study examining the effects of intervention through qualitative analysis fits within the positivist paradigm.

One primary goal of positivist inquiry is to generate explanatory associations or causal relationships that ultimately lead to predicting and controlling the phenomena in question. The positive paradigm of science's philosophies guides how science is conducted by shaping core elements, including ontology (i.e., how reality is viewed; Park et al., 2020). Epistemology explains how the nature of knowledge is conceived; axiology explains the research role of the process and values (Park et al., 2020). Whereas methodology explains how the paradigm defines processes associated with conducting science, rigor describes how criteria justify the paradigm's quality of research (Park et al., 2020).

For this research, I also used the hypothetical-deductive method, which is a circular process that begins with theory from the literature to (a) build testable hypotheses, (b) design an experiment through operationalizing variables (i.e., identifying variables to manipulate and measure through group assignments), and (c) conduct an empirical study based on experimentation (Park et al., 2020). Findings from this research will help inform theory that promotes positive social change and contributes to the literature, thereby completing the theory's circular process: hypothesis, operationalizing variables, experimentation, and approach. This empirical research will strengthen the underlying theory of improving newborn outcomes through improved socioeconomic and cultural practices, accessibility of health facilities, and improved quality of care.

I examined the association of the independent variables ANC and PNC with the dependent variable newborn morbidity or mortality (outcome). Different measures of the independent variables were tested to determine the odds of newborn morbidity or mortality. ANC and PNC variables influence risk factors that include socioeconomic and cultural characteristics, accessibility of health facilities, and quality of care.

The socioeconomic and cultural characteristics consist of variables including age and parity (experiences from previous pregnancies). I measured these factors using various levels of measurement; age was measured using interval measurement. Also, I measured parity using the ordinal level of measurement. Accessibility of health facility variables includes a transportation system. These variables were measured using various levels of measurements. The transportation system was used at two levels to measure planned transportation for ANC visits and PNC visits. Both will use a dichotomous

measure (Yes or No) defined as “is there planned transportation for prenatal visits?” and “is there planned transportation for postnatal visits?”"

Cultural factor variables include knowledge of illness during pregnancy, the experience of ANC and PNC, knowledge of the severity of disease during pregnancy, and the use of TBAs. Quality of care factor variables includes staff/health workers' availability and equipment availability (drugs, cards, diagnostic/test equipment).

Age and parity factors were used as covariates for this study. Different age categories (15-19, 20-24, and 25-49 years) and parity; women with more than one child (no child, and one or more than one child) to measure the newborn outcome's odds occurring in the household. The study explored how the different age categories attending ANC or PNC are associated with the newborn outcome's odds. Besides, parity of mothers; that is, mothers with the first experience of childbirth and those who have one or more children ANC and PNC behavior is associated with the odds of experiencing newborn outcomes.

The dependent variable is the increasing newborn outcomes among households in Tamsu-Ngandua, Mafa LGA of Borno State. What factors of ANC and PNC are associated with increasing newborn outcomes, especially in areas with limited MNCH services? Increased morbidity and mortality of newborns cause by the poor infrastructure to provide health services to pregnant women, and post-natal mothers contribute to newborn outcomes. I investigated the various independent factors to determine the association with the newborn outcome among pregnant women in the targeted community.

Methodology

The study is a quantitative cross-sectional study using secondary data to explore the association between ANC and PNC health services with newborn outcomes. Volunteers from the community (VHWs) who are females who read and write, were recruited from communities where the intervention took place and trained on collecting data from participants. Data tools were developed to suit the program's purpose, and VHWs were trained on the tools to collect household and community level data for the program. The program's data were from December 2019 through November 2020 in Tamsu-Ngandua Ward, Mafa LGA of Borno State. Data collected for the project were stored in the RMNCAHN database; ethical approval was received to access, retrieve and analyze data for the study.

Population

Borno State, the northeastern region of Nigeria, is known to be one of the most affected states during the Boko Haram crisis in northeast Nigeria. With a population of over 5 million people, the situations have displaced over 1.3 million known internally displaced persons (IDPs). They are currently taking hostage in Maiduguri, the Borno State capital (OCHA, 2019). The International Organization of Migration (IOM, 2018) reported that 80% of displaced individuals and returnees in northeast Nigeria are women and children. The study was conducted in the Mafa local government area, located in the central region of Borno State, housing many internally displaced persons (IDPs). Women of childbearing age (WCBA), including adolescents, ages 15-49, who have experienced childbirth, are pregnant, and are displaced or living in communities affected by the Boko

Haram crisis are the target population for this study. A total of 43,106 women of child bearing age (WCBA) (15-49 years) benefited from the intervention program in Tamsu-Ngandua, Mafa LGA.

Sampling and Sampling Procedures

The study sampled IDPs and community members in Mafa LGA, Tamsu-Ngandua ward within the age of 15-49, who are beneficiaries of the reproductive, maternal, newborn, child, adolescent health nutrition (RMNCAHN) program to participate in this study. The study accessed the RMNCAHN program database to retrieve and analyze secondary data of beneficiaries of the RMNCAHN program implemented in the Tamsun-Gandua ward, Mafa LGA of Borno State. The accessed beneficiaries' data in the RMNCAHN database to include socioeconomic and cultural data, accessibility of health facilities, and quality of care. The RMNCAHN program trained volunteers from the community on data collection tools and processes, collected data using a questionnaire, and stored it in the RMNCAHN program database.

Purposive random sampling selected only pregnant women and women with childbearing experience, who are IDPs and community members of the Tamsu-Ngandua ward, Mafa LGA, where the RMNCAHN project was implemented. Women who do not have any childbearing experience and are outside the targeted age of 15-49 years will not be selected for the study, even though they participated in the RMNCAHN project and are from the community.

Procedures for Recruitment, Participation, and Data Collection

The study sampled 1,674 women who were pregnant, delivered babies, and were referred for PNC services who participated in the program from December 2019 through November 2020 from the RMNCAHN database to participate in the study. Women who served as beneficiaries and are within the age 15-49 years, but did not receive any ANC, PNC, or referred for any emergency were excluded from the study. The study sought and received ethical approval from the Borno State Ministry of Health to access data from the RMNCAHN database.

Instrumentation and Operationalization of Constructs

The intervention developed and operationalized instrumentation used for collecting data for the RMNCAHN program and standardized the tools. However, it was developed and tested to ensure a standard data collection method for collecting quality data and measuring targeted data points or indicators for the project. Data tools were standardized through adapting and different stakeholders reviewing the tools for efficiency and effectiveness. Volunteers (VHWs) from the community were recruited through a process using standardized selection criteria to select married women within the community who can read and write to collect accurate data and reduce bias, thereby improving internal validity. Data tools developed to collect data for did not include some demographic variables such as mother's education level and mother's occupation.

Data Analysis Plan

Data for this study was retrieved from the RMNCAHN database after all ethical permission was received to understand how data were collected and accessed datasets

required for the study. Independent variables for the study include age, parity, planned transportation for ANC and PNC, availability of skilled health workers, knowledge of illness during pregnancy, availability of supplies/equipment during ANC and PNC visits. Age and parity were used as a covariate to understand the association with newborn outcomes. Table 1 provides details of dependent and independent variables and their measures.

Table 1

Independent Variables (ANC and PNC) Risk Factors, Measures, and Levels of Measurement

Variables	Measures	Level of measurement
Socioeconomic Factors		
Age	15-19, 20-49	Interval/Categorical
Parity (experiences from previous pregnancies)	None, one or more than one	Ordinal
Accessibility of Health Facility		
Planned transportation for ANC	Yes, No	Dichotomous/ Nominal
Planned transportation for ANC	Yes, No	Dichotomous/Nominal
Cultural		
Knowledge of illness during pregnancy (Recognition)	Don't Know, Low, Average, High, Very High	Ordinal
Skilled health workers	Never, Not Sure, Sometimes, Always	Ordinal
Quality of Care		
Availability of supplies/equipment (drugs, cards, diagnostic/test equipment)	Never, Not Sure, Sometimes, Always	Ordinal
Dependent Variable		
Newborn outcome (morbidity or mortality)	Yes, No	Nominal

Statistical Analysis and Test

Logistic Regression analytical technique will determine how much dependent outcome variable (newborn mortality) regress on independent variables (ANC & PNC) risk factor variables, including socio-economic and cultural characteristics, accessibility of health facility, and quality of care. Odd ratio tests with various measures will test the association between independent variables and the dependent variable, newborn outcome.

Threat to the Validity

This research study used secondary data from the RMNCAHN (VHW) project. The RMNCAHN project selected participants, who are women of childbearing age 15-49 years in Tamsu-Ngandua ward, Mafa LGA of Borno State. The Boko Haram crisis displaced people from the community and health infrastructures that cause limited access to health services. Most of the community women are displaced persons and fall under the ages 15-49 years who are beneficiaries of the program. Though these participants were randomly selected as beneficiaries, the focus could be more on pregnant women recruited by the program to intervention to access available services. The research study will select all women between the ages of 15-49 years who benefited from the VHW intervention to analyze and balance the effect of bias selection for fair result presentation.

Data tools were standardized through adapting and different stakeholders reviewing the tools for efficiency and effectiveness. Volunteers (VHWs) from the community were recruited through a process using standardized selection criteria to select married women within the community who can read and write to collect accurate data and reduce bias, thereby improving internal validity. Data tools developed to collect

data for did not include some demographic variables such as mother's education level and mother's occupation. Also, volunteers from the community recruited as VHWs were trained on the developed tools for data collection and reporting to collect accurate data. All of the training on standardized data collection and reporting tools, recruitment of VHWs using standardized criteria help address any threats regarding construct or statistical conclusion bias and validity.

Ethical Procedures

The ethical procedures for accessing participants to collect data for the RMNCAHN project was sought by the VHW project in Borno State through the Borno State Ministry of Health. The RMNCAHN program submitted a research protocol containing all the approaches and methods of dealing with participants and how data will be handled, stating confidentiality and data integrity. The program also sought ethical approval of consent forms and assent forms to protect participants as they have the right to grant or refuse interviews during data collection. All of the research proposal, consent, and assent forms were submitted and received approval from the ethical review Committee (ERC) of the Borno State Ministry of Health before implementing the project.

Data collected for the program was stored/archived in a password secured database and inaccessible to the third party randomly, ensuring data integrity and confidentiality of participants' information. Only authorized staff who participated in the project have access to this data. This research study will seek permission to access and analyze data from the RMNCAHN database through the Borno State Ministry of Health (BMoH) or Borno State Primary Health Care Development Agency (BSPHCDA)

responsible for implementing the project. The IRB process sought permission to access data in the archived RMNCAHN database as secondary data analysis for this study and was granted permission on 17th February 2021.

The ethical process, including data confidentiality and integrity was applied as part of the ethical requirement for the study. Both data confidentiality and integrity were used to access the RMNCAHN database to select participants. Patients' information will be coded to ensure data confidentiality and integrity needed for IRB/ERC approval.

Summary

This research adopted a quantitative cross-sectional design using secondary data from the RMNCAHN project in Borno State to explore ANC and PNC services' association with newborn outcomes in Boko Haram ravaged Borno State. The Borno State has over 2 million displaced persons due to the Boko Haram crisis, with limited access to health services for pregnant women and post-natal mothers. Delay in reaching the facility, delay in deciding to receive care, and delay in receiving care all form part of ANC and PNC mothers' issues, leading to increasing newborn outcomes. Poor access to planned transportation, inadequately skilled staff, unavailability of supplies and equipment to provide quality health services to mothers, and insufficient knowledge of illness during pregnancy are caused by the Boko Haram crisis' increased newborn outcomes. The next chapter will analyze associations, using the Logistic Regression model to determine the odds of the different independent factors associated with newborn outcomes.

Chapter 4: Results

In this study, I explored the relationship between ANC and PNC services and newborn outcomes in the Tamsu-Ngandua ward of Mafa LGA in Borno State, Northeastern Nigeria. The study explored married women ages 15-49 years that benefited from the RMNCAHN project implemented by Borno State Primary Health Care Development Agency in partnership with Women Refugee Commission and other consortium partners from December 2019 through November 2020 in Borno State. This chapter provides detailed descriptive statistics of the various respondents' characteristics with detailed findings—the relationship between the different independent and dependent variables and the study's questions. The study's multiple hypotheses show whether there is enough evidence to reject or not reject the relationship between ANC and PNC with newborn outcomes, the relationship between ANC and newborn outcome, and the relationship between quality of care for pregnant women and newborn outcomes.

To understand the relationship between ANC and PNC services with newborn outcomes, I developed several research questions and their associated hypotheses:

RQ1: Is there a relationship between ANC and PNC with the newborn outcome?

H_o1: There is no relationship between ANC and PNC with newborn outcomes.

H_A1: There is a relationship between ANC and PNC with newborn outcomes.

RQ2: Is there a relationship between planned transportation to antenatal care (ANC) and post-natal care (PNC) and newborn outcome?

H_o2: There is no relationship between planned transportation to ANC and PNC and newborn outcome.

H_A2: There is a relationship between planned transportation to ANC and PNC and newborn outcome.

RQ3: What is the relationship between knowledge of illness during pregnancy with ANC attendance?

H_O3: There is no relationship between knowledge of illness during pregnancy with ANC attendance.

H_A3: There is a relationship between knowledge of illness during pregnancy with ANC attendance.

RQ4: What is the relationship between the availability of supplies/equipment (drugs) and the utilization of ANC and PNC services?

H_O4: There is no relationship between the availability of supplies/equipment (drugs) and ANC and PNC services utilization.

H_A4: There is a relationship between the availability of supplies/equipment (drugs) and the utilization of ANC and PNC services.

RQ5: What is the relationship between staff/health workers' availability and the utilization of ANC and PNC services?

H_o5: There is no relationship between the availability of staff/health workers and utilization of ANC and PNC services.

H_A5: There is a relationship between the availability of staff/health workers and utilization of ANC and PNC services.

Data Collection

Data were accessed from the RMNCAHN database for secondary data analysis after Walden University IRB approval was granted (03-08-21-0984120). The Ethical Review Committee from the Borno State Ministry of Health permitted access to the RMNCAHN database for the research study after carefully reviewing the application and data use act. Application to access the RMNCAHN database contained only fields/variables required for the study and declaration to code participants' information as data confidentiality where possible.

Data for the study were accessed only for women who participated in the RMNCAHN intervention as beneficiaries in Tamsu-Ngandua ward, Mafa LGA, Borno State. These women were pregnant, attended ANC services, delivered and attended PNC services during the RMNCAHN intervention to be eligible to participate in the study as the target population. A detailed study methodology, sampling, and sampling techniques have been documented in this study and explained in Chapter 3.

Descriptive Statistics

Total participants for the study (N = 1,614) have different age, parity, socio-cultural, and quality of care variables. Women ages 15-19 constituted 1,131 respondents (70.1%), and women ages 20-49 years made up 483 of the respondents (29.9%; see Table 2). Parity/birth experience had a nominal measure: none and one/more children. Women who responded none were 414 (25.7%); women who responded one/more children were 1,200 (74.3%) total respondents. Also, women who attended three or more ANC services (ANC 3+) used dichotomous measure of 'Yes' or 'No,' with respondents of ‘No’ been

642(39.8%), those who responded ‘Yes’ to having attended ANC (3+) as 972(60.2%). Women who did not participate in PNC at least three times were 780(48.3%), who responded 'Yes' with 834(51.7%).

For emergency transport services (ETS), both ANC and PNC had only 16 respondents for ETS. While respondents’ ETS for ANC made up 1.0%, ETS for PNC had just one respondent making 0.1%. The majority of 1597 was missing data making up a massive 98.9%. Women who delivered in the health facility numbered 912 (56.5%), whereas 702 (43.5%) did not give birth at the HF. For the outcome variables, 1614 women responded to whether their newborns had any mortality or morbidity outcome. Of this total, 812 (50.3%) said their newborns did not experience any outcome (morbidity or mortality), 802 (49.7%) responded they experienced newborn outcome (morbidity or mortality).

Table 2

Descriptive Statistics for Independent and Dependent Variables

Characteristics	Frequency	%
Age		
15-19	1131	70.1
20-49	483	29.9
Parity/birth experience		
None	414	25.7
One or more	1200	74.3
ANC (3+)		
No	642	39.8
Yes	972	60.2
PNC (3+)		
No	780	48.3
Yes	834	51.7
ETS for ANC/PNC		
ETS for ANC	16	1.0
ETS for PNC	1	0.1
Missing	1597	98.9
HF delivery		
No	702	43.5
Yes	912	56.5
Availability of supplies/equipment		
Always	207	12.8
Never	530	32.8
Not sure	166	10.3
Sometimes	711	44.1
Availability of skilled health workers		
Always	106	6.6
Never	476	29.5
Not sure	69	4.3
Sometimes	963	59.7
Knowledge of illness during pregnancy		
Average	594	36.8
Don’t know	145	9.0
High	210	13.0
Low	298	18.5
Very high	367	22.7
Newborn outcome		
No	812	50.3
Yes	802	49.7

Results

Binary logistics regression statistical technique was applied to perform analysis responding to the various research questions. The dependent variable, newborn outcomes, is a binary categorical variable, which meets the binary logistics regression's first assumption. Again, all the observations used for the study are independent of each other, a condition that meets the second assumption for using binary logistics regression. Also, there is little or no multicollinearity between the various continuous predictors (IVs) used for the study. Therefore, all of these assumptions are met for the study. Hence, the binary logistics regression statistical technique was more appropriate for analyzing the data for the study.

RQ1 Results

The binary logistic regression analysis result showed that ANC and PNC were found to be statistically significant ($p < 0.05$), Table 3) in the regression model. Specifically, women who attended ANC while pregnant (which is reference category) were 0.030 times less likely ($OR = 0.030$, 95% CI [0.020, 0.046], $p < 0.05$, see Table 3) to experience newborn outcomes than pregnant women who did not attend ANC. Similarly, women who attended and received PNC services within six weeks after delivery (which is reference category) were 0.109 times less likely ($OR = 0.109$, 95% CI [0.070, 0.151], $p < 0.05$, Table 3) to experience newborn outcomes than women who did not attend and received PNC services.

Other results showed statistically significant ($p < 0.05$) for women aged 20-49 and were 0.217 less likely ($OR = 0.217$, 95%CI [0.167, 0.280], $p < 0.05$, Table 3) to experience newborn outcomes compared to women age 15-19 in Mafa, Borno State. Again, the result was statistically significant ($p < 0.05$) for women with one/more parity/birth experiences and were 574.804 times more likely ($OR = 574.804$, 95% CI [181.862, 1816.767], $p < 0.05$) to experience newborn outcomes compared to women with no birth experience.

In conclusion, RQ1 state there is a relationship between ANC and PNC services with newborn outcomes or not; I reject the null hypothesis, and instead did not reject the alternative hypothesis and concluded that there is a statistically significant relationship between ANC and PNC services with newborn outcomes among women in Mafa LGA, Borno State, Northeast Nigeria controlling for age and parity/birth experience.

Table 3

Binary Logistics Regression for Newborn Outcomes (Dependent Variable) With ANC, PNC, ETS, for ANC/PNC (IVs) While Controlling for Age & Parity/Birth Experience

Variables	*B*	SE	Exp(*B*)/OR	*P-Value*	95% CI for Exp(B)	
					Lower	Upper
Age (Reference: 20-49)	-1.529	0.131	0.217	0.000	0.167	0.280
Parity/birth experience (Reference: One/more children)	6.354	0.587	574.804	0.000	181.862	1816.767
ANC 3+ (Reference: Yes)	-3.509	0.217	0.030	0.000	0.020	0.046
PNC 3+ (Reference: Yes)	-2.212	0.163	0.109	0.000	0.079	0.151

RQ2 Results

Logistics regression analysis for RQ2 was not conducted as there was no significant data to analyze to produce meaningful inference. Missingness of data for the ETS transportation variable was (1597)98.9%. ETS for ANC showed very little significance 16(1.0%), and ETS for PNC 1(0.1%). Hence, using the deletion method in handling missing data, there was no significant data to analyze to draw any reasonable conclusion.

RQ3 Results

The binary logistics regression analysis analyzed knowledge of illness during pregnancy using the ordinal level of measure including "Don't Know, Low, High, Very High." The binary regression analysis results for RQ3 showed knowledge of illness

during pregnancy when they attended ANC3+ is statistically significant ($P<0.05$), Table 4) in the regression model. Women with very high knowledge of illness during pregnancy (as a reference category) were 132.184 times more likely (OR = 132.184, 95% CI [68.178, 256.281], $p < 0.05$, see Table 4) to attend ANC 3+ services compared to their counterparts with other knowledge levels while controlling for age, parity/birth experience. Again, results showed statistically significant for pregnant women with average knowledge of illness during pregnancy and were 7.925 times more likely (OR = 7.925, 95% CI [4.336, 14.485], $p < 0.05$, see Table 4) to attend ANC 3+ services compared to their counterpart with other knowledge levels while controlling for age and parity/birth experience. The result showed no statistically significant result for other illness knowledge during pregnancy among pregnant women to attend ANC 3+ services, including those with high and low knowledge.

Other result showed statistically significant ($p<0.05$) for women age 20-49, but were 0.135 times less likely (OR = 0.135, 95% CI [0.081, 0.225], $p < 0.05$, Table 4) to attend ANC 3+ services compared to their counterpart 15-19. The result was not statistically significant for women with one/more children but were more likely (OR = 177808, 95% CI [0.000, 0.000], $p > 0.05$, Table 4) to attend ANC 3+ services compared to their counterparts with no child in Tamsun-Ngandua, Mafa LGA Borno State.

In conclusion, for RQ3, which states a relationship between knowledge of illness during pregnancy with ANC attendance or not, I did reject the null hypothesis. Instead, I did not reject the alternative hypothesis and conclude a statistically significant relationship between knowledge of illness during pregnancy and ANC attendance among

women in Mafa LGA, Borno State, Northeast Nigeria, controlling for age and parity/birth experience.

Table 4

Binary Logistics Regression for ANC 3+ Attendance (Dependent Variable) with (IV) Knowledge of Illness During Pregnancy

Variables	*B*	SE	Exp(*B*)/OR	*P-Value*	95% CI for Exp(B)	
					Lower	Upper
Age (Reference: 20-49)	-2.005	0.262	0.135	0.000	0.081	0.225
Parity/birth experience (Reference: One/more children)	18.996	1742.433	177808580	0.991	0.000	-
Knowledge of illness during pregnancy (Reference: Very high)	-	-	-	0.000	-	-
Don't know	4.884	0.338	132.184	0.000	68.178	256.281
Low	21.095	2824.363	1.450	0.994	0.000	-
Average	2.070	0.308	7.925	0.000	4.336	14.485
High	22.350	2113.987	5.086	0.992	0.000	-

Note. Variable(s) entered on step 1: Knowledge of Illness During Pregnancy, Age, Parity/Pregnancy Experience.

RQ4 Results

The binary logistics regression analysis performed on the availability of supplies/equipment at health facilities measured the utilization of ANC and PNC services using ordinal level measures, including "Never, Not Sure, Sometimes, Always.". The

results showed no statistically significant ($p > 0.05$) for the availability of supplies/equipment and ANC attendance while controlling for age and parity/birth experience. Similarly, data showed no statistically significant (($p>0.05$) for other measures for the availability of supplies/equipment with ANC services utilization among women in Mafa, Borno State, while controlling for age and parity/birth experience.

Other results showed statistically significant ($p<0.05$) for women age 20-49 for ANC service utilization and availability of supplies/equipment. The result showed women 20-49 were 4.333 times more likely (OR = 4.333, 95%CI [2.135, 8.794], $p < 0.05$, Table 5) to utilize ANC services with available supplies/equipment compared to their counterparts' women 15-19. Also, the result was not statistically significant ($p > 0.05$) for women with one/more children and are 0.359 times less likely to utilize ANC services with available supplies/equipment compared to their counterparts with no child.

Similarly, results showed no statistically significant ($p > 0.05$) for the availability of supplies/equipment for PNC attendance while controlling for age and parity/birth experience. Similarly, data showed no statistically significant ($p > 0.05$) for all other measures for the availability of supplies/equipment with PNC services utilization among women in Mafa, Borno State, while controlling for age and parity/birth experience.

In conclusion, I will not reject the null hypotheses, but instead, reject the alternative hypothesis and conclude that there is no statistically significant relationship between the availability of supplies/equipment with ANC and PNC service utilization among women in Mafa LGA, Borno State, Northeast Nigeria while controlling for age and parity/birth experience.

Table 5

Binary Logistics Regression for ANC 3+ Service Utilization (Dependent Variable) with Availability of Supplies/Equipment (IV)

Variables	*B*	SE	Exp(*B*)/OR	*P-Value*	95% CI for Exp(B)	
					Lower	Upper
Age (Reference: 20-49)	1.466	0.361	4.333	0.000	2.135	8.794
Parity/Birth Experience (Reference: One/More Children)	-1.025	2925.739	0.359	1.000	0.000	-
Availability of Supplies/Equipment (Reference: Always)	-	-	-	1.000	-	-
Never	0.097	3505.475	1.102	1.000	0.000	-
Not Sure	-43.165	2461.379	0.000	0.986	0.000	-
Sometimes	-22.260	1759.537	0.000	0.990	0.000	-

Note. Variable (s) entered on step 1: Availability of Supplies/Equipment, Age, Parity/Pregnancy Experience.

Table 6

Binary Logistics Regression for PNC 3+ Service Utilization (Dependent Variable) with Availability of Supplies/Equipment (IV)

Variables	*B*	SE	Exp(*B*)/OR	*P-Value*	95% CI for Exp(B)	
					Lower	Upper
Age (Reference: 20-49)	-36.934	1588.859	0.000	0.981	0.000	-
Parity/Birth Experience (Reference: One/More Children)	22.553	2870.991	6.232	0.994	0.000	-
Availability of Supplies/Equipment (Reference: Always)	-	-	-	1.000	-	-
Never	-0.331	3946.226	0.718	1.000	0.000	-
Not Sure	-38.701	1588.859	0.000	0.981	0.000	-
Sometimes	-17.250	1124.226	0.000	0.988	0.000	-

Note. Variable (s) entered on step 1: Availability of Supplies/Equipment, Age, Parity/Pregnancy Experience.

RQ5 Results

The binary logistics regression analyzed the availability of health workers at health facilities to measure utilization of ANC and PNC services using the ordinal level of measure including "Never, Not Sure, Sometimes, Always.". The results showed no statistically significant (p>0.001) results for health workers' availability for ANC

attendance while controlling for age and parity/birth experience. Similarly, data showed no statistically significant ((p>0.001) for other ordinal measures for the availability of health workers with ANC services utilization among women in Mafa, Borno State, while controlling for age and parity/birth experience.

Similarly, results showed no statistically significant ($p > 0.05$) results for health workers' availability for PNC attendance while controlling for age and parity/birth experience. Similarly, data showed no statistically significant (($p > 0.05$) for all other measures for the availability of health workers with PNC services utilization among women in Mafa, Borno State while controlling for age and parity/birth experience. For age, results showed statistically significant ($p < 0.001$) results for women age 20-49 for PNC service utilization and availability of supplies/equipment. Result showed women 20-49 were 0.102 times less likely (OR = 0.102, 95%CI [utilization1], $p < 0.001$, Table 8) to utilize PNC services. The result showed no statistically significant ($p > 0.05$) results for women with one/more children. However, they were 3.117 times more likely to utilize PNC services with available health workers compared to their counterparts with no child.

In conclusion, I will not reject the null hypotheses, but instead reject the alternative hypothesis and conclude that there is no statistically significant relationship between the availability of health workers with ANC and PNC service utilization among women in Mafa LGA, Borno State, Northeast Nigeria, while controlling for age and parity/birth experience.

Table 7

Binary Logistics Regression for ANC 3+ Service Utilization (Dependent Variable) with Availability of Skilled Health Workers (IV)

Variables	*B*	SE	Exp(*B*)/OR	*P-Value*	95% CI for Exp(B)	
					Lower	Upper
Age (Reference: 20-49)	37.069	3110.499	1.256	0.990	0.000	-
Parity/Birth Experience (Reference: One/More Children)	-16.663	3645.674	0.000	0.996	0.000	-
Availability of Skilled Health Workers (Reference: Always)	-	-	-	1.000	-	-
Never	18.449	3215.823	102888723	0.995	0.000	-
Not Sure	-41.015	3110.499	0.000	0.989	0.000	-
Sometimes	-18.140	2284.064	0.000	0.994	0.000	-

a. Variable(s) entered on step 1: Availability of Skilled Health Workers, Age, Parity/Pregnancy Experience.

Table 8

Binary Logistics Regression for PNC 3+ Service Utilization (Dependent Variable) with Availability of Skilled Health Workers (IV)

Variables	*B*	SE	Exp(*B*)/OR	*P-Value*	95% CI for Exp(B)	
					Lower	Upper
Age (Reference: 20-49)	-2.278	0.198	0.102	0.000	0.069	0.151
Parity/Birth Experience (Reference: One/More Children)	21.860	1908.266	3.117	0.991	0.000	-
Availability of Skilled Health Workers (Reference: Always)	-	-	-	1.000	-	-
Never	17.635	3244.939	45598391.3	0.996	0.000	-
Not Sure	-20.406	1819.219	0.000	0.991	0.000	-
Sometimes	-20.894	4604.480	0.000	0.996	0.000	-

a. Variable(s) entered on step 1: Availability of Skilled Health Workers, Age, Parity/Pregnancy Experience.

Summary

The result found ANC and PNC as statistically significant predictors of newborn outcomes in the study. Hence, I rejected the null hypothesis and did not reject the alternative hypothesis and concluded there is a significant relationship between ANC and PNC with newborn outcomes. Huge data missingness of 98.9% for ETS could not allow for any meaningful data analysis and inference to determine how the transportation system predicts newborn outcomes among women in Mafa, Borno State. Furthermore,

the result found knowledge of illness during pregnancy as a statistically significant predictor of ANC attendance among pregnant women in Mafa, Borno State, after controlling for age and parity/birth experience. I rejected the null hypothesis and did not reject the alternative hypothesis and concluded that there is a significant relationship between knowledge of illness during pregnancy and ANC service utilization.

More so, results to predicts ANC and PNC services utilization for the availability of supplies/equipment and availability of health workers were not statistically significant for women in Mafa, Borno State while controlling for age and parity/birth experience. Therefore, I did not reject the null hypothesis. Instead, I rejected the alternative hypothesis and concluded there is no statistically significant relationship between the availability of supplies/equipment with ANC and PNC service utilization. Likewise, the result was not statistically significant for the availability of health workers' utilization of ANC and PNC service utilization. Therefore, I did not reject the null hypothesis but rejected the alternative hypothesis and concluded that there is no statistically significant relationship between staff/health workers' availability with ANC and PNC service utilization.

Chapter 5 will prevent broader interpretations of the findings for the study as it compares to existing work. Also, chapter 5 will present the study's limitations, recommendations that can be taken from the findings together with the implications for social change, and a general conclusion.

Chapter 5: Discussions, Recommendations, & Conclusion

There have been worsening newborn outcomes due to poor health infrastructures, including primary health care facilities, inadequate health workers to provide quality health care services, inadequate supplies/equipment to provide quality maternal, newborn, and child services caused by the Boko Haram crisis in Borno State. This situation has created a solution to the increasingly poor health outcomes, especially for internally displaced women and newborns and those within the communities. The study explored the relationship between ANC and PNC with newborn products to address issues with worsening newborn outcomes among women and newborns in Tamsu-Ngandua ward, Mafa LGA of Borno State. For this study, I used a quantitative approach to analyze secondary data from the VHW project implemented in Mafa LGA, Borno State.

The results showed ANC and PNC to be statistically significant predictors of newborn outcomes in the study. Hence, I rejected the null hypothesis and did not reject the alternative hypothesis, and concluded that there is a significant relationship between ANC and PNC with newborn outcomes. Huge data missingness of 98.9% for ETS could not allow for any meaningful data analysis and inference to determine how the transportation system predicts newborn outcomes among women in Mafa LGA, Borno State. Furthermore, knowledge of illness during pregnancy was found to be statistically significant in ANC attendance among pregnant women in Mafa, Borno State after controlling for age and parity/birth experience. Moreover, results to predicts ANC and PNC services utilization for the availability of supplies/equipment and health workers'

availability were not statistically significant for newborn outcomes in Mafa, Borno State while controlling for age and parity/birth experience. Similarly, the result was not statistically significant for the availability of health workers utilization of ANC and PNC service utilization.

Interpretation of the Findings

Most findings from this research study have proven to be similar to results from other research studies. The hypothesis test for the first RQ has shown a statistically significant relationship between ANC and PNC services with newborn outcomes among women in Mafa LGA, Borno State. Findings from the study showed that women who attended ANC and PNC services were 0.030 and 0.109 times less likely to experience any newborn outcomes, respectively, while controlling for age and parity/birth experience. This study's findings confirm the results from other studies and have comprehensive knowledge of other disciplines in different studies. Different research studies have shown that ANC and PNC attendance were strongly related to newborn survival. Arunda et al. (2016), in a lesson, proved that women who attended ANC and PNC were more likely to have their newborns survive. Similarly, Johnson et al. (2015), in a cross-sectional study, evaluated different factors that promoted newborn outcomes and found that ANC and PNC attendance is strongly related to newborn survival.

Furthermore, the result showed statistically significant ANC and PNC attendance among women aged 20-49, and women in this age group are 0.217 times less likely to experience any newborn outcomes than women aged 15-19. This is true as different studies have confirmed that women with higher age tend to have more experience and

understand ways to avoid newborn outcomes through proper care and adherence to best ANC and PNC practices necessary for improved newborn health. Again, by experience, women 20-49 have ample knowledge of ANC and PNC service utilization benefits compared to their counterparts, women aged 15-19. The study results showed statistical significance for ANC and PNC attendance among women with one/more children; however, it revealed higher odds of experiencing newborn outcomes. Of course, this is true.

The three-delays model used for the study explains how women decide to access health services at health facilities within their communities. The findings relate to the 3-Delays conceptual framework, especially for delays two and three that highlight reaching health facility for care and accessing health care at the health facility, respectively. The first delay corresponds more to parity/birth experience findings as women with birth experience could decide to seek health care during pregnancy quickly compared to women with no birth experience since they have experienced childbirth and understand associated dangers.

For RQ2, the result did not show any statistically significant findings for transportation and newborn outcomes among women in Borno State. Though data for emergency transportation were not completely available during this study and had 98.9% missingness. However, other research has proven transportation for ANC and PNC services to be related to newborn outcomes. Hirose et al. (2015) evaluated women's delay in reaching (EmONC) facilities contribute to a high burden of maternal and perinatal mortality and morbidity in low-income countries. Also, Vellakkal et al. (2017) revealed

how the lack of availability of arranged transportation services makes it difficult for pregnant women and postnatal mothers to access health care for newborns in underserved communities and causes increased newborn outcomes.

For RQ3, the result showed a statistically significant relationship between knowledge of illness during pregnancy and ANC attendance among pregnant women in Mafa LGA, Borno State, while controlling for age and parity/birth experience. This is in confirmation with findings from other research studies that have proven that knowledge of illness during pregnancy is strongly related to pregnant women's ANC attendance. For example, Rahman et al. (2018), in a quantitative cross-sectional study, evaluated how women who received maternal and newborn health services from trained health providers are more likely to identify three or more danger signs related to birth and postpartum periods in Bangladesh.

Again, Masoi and Kibusi (2019), in a quasi-experimental study, tested the effectiveness of an interactive mobile alert messaging system on improving knowledge of danger signs during birth preparedness and complications readiness practice using intervention and control groups; they found a significant difference between the groups as the intervention group showed more understanding of danger signs than the control group. Furthermore, results from my study showed statistically significant for women aged 20-49 with very high knowledge of illness during pregnancy, but are less likely to attend ANC services than women aged 15-19. The result also showed women with birth experience have very high knowledge of illness during pregnancy. They are more likely to attend ANC services, even though the result was not statistically significant for this

group compared to women with no birth experience. Similarly, the result was statistically significant for women with average knowledge of illness during pregnancy. Women with average knowledge were 7.925 times more likely to attend ANC services than women with low and high knowledge of illness during pregnancy. Women with no knowledge of illness during pregnancy were 132.184 times more likely to attend ANC services than women with some levels of knowledge of illness during pregnancy.

Although the result was not statistically significant for women with high knowledge of illness during pregnancy, these women were 5.086 times more likely to attend ANC services than women with other levels of knowledge of illness during pregnancy. Overall, the result shows women with no knowledge of illness during pregnancy or average to very high knowledge of illness during pregnancy were more likely to attend ANC than women with low knowledge of illness during pregnancy. Different research studies have shown women with high knowledge of illness during pregnancy have more likelihood to attend ANC services than women with low knowledge of illness during pregnancy. Ekwochi et al. (2015) evaluated knowledge of danger signs and health-seeking practices using nine WHO-recognized danger signs among pregnant women in southeastern Nigeria and discovered that poor knowledge of pregnant mothers with less than WHO recommended danger signs to be responsible for the worsening newborn outcomes.

This relates to the sociocultural and demographic factors enshrined in the three-delay model used in this study. The first delay, which highlights deciding to seek health care, conforms with the tendency to attend ANC services among women with high

knowledge of illness during pregnancy. Also, Delay 2, which describes women reaching for health care when they know they are ill during pregnancy, conforms with how women who are ill during pregnancy reach for health care and eventually access health care services at the community's health facilities.

For RQ4, the result did not show a statistically significant relationship between the availability of supplies/equipment with ANC and PNC services utilization among pregnant women in Mafa LGA, Borno State, while controlling for age and parity/birth experience. This study shows statistically significant results for only women aged 20-49, who were 4.333 times more likely to utilize ANC services than women 15-19 in Mafa LGA, Borno State. Also, the result was not statistically significant for women with birth experience and were 0.359 times less likely to utilize ANC services compared to women 15-19 when there is available supplies/equipment in Mafa LGA, Borno State. Also, availability of supplies/equipment took on an ordinal measure of analysis, including “Never, Not Sure, Sometimes, and Always." This was not statistically significant for any level of measurement. However, only women who responded supplies/equipment are never available were 1.102 times more likely to utilize ANC services.

This result is not in agreement with other research as it contradicts findings from other research studies. Findings from other research studies have proven that the availability of supplies/equipment at health facilities encourages pregnant women to utilize ANC services. For instance, McClure et al. (2015) stated that the high rate of stillbirth in LMICs was due to inadequate or unavailability of equipment and supplies to conduct cesarean sections and obstructed labor for pregnant women with complications

in underserved populations. Additionally, Allen et al. (2015) explained the availability of maternal services at health service centers in rural communities encourages the utilization of ANC services.

Similarly, results showed no statistically significant findings for the availability of supplies/equipment with PNC service utilization; only women with birth experience were 6.232 times more likely to utilize PNC services than women with no birth experience result was not statistically significant. This agrees with other research study findings that proved that women with birth experience are more likely to utilize PNC services. For instance, Wilunda et al. (2015), in a study to evaluate the availability of maternal and neonatal health care services at the various units for utilization and quality, found several gaps in the availability of essential infrastructure in terms of equipment, drugs, supplies, and staff to provide adequate maternal and neonatal care at the health centers. This further supported the finding as even in normal circumstances, only women that have given birth utilize post-natal services, and PNC services are meant for postpartum mothers within 6 weeks of delivery.

Conversely, this evidence contradicts findings from this research. This could probably be due to none provision of supplies/equipment provided by the intervention period at the time of the study. Again, some pregnant women could have used available supplies/equipment provided by other existing interventions or government provisions to nearby primary health facilities. This finding aligns with the third delay of the three-delay model that highlights accessing health care services at the health facilities. Lack of available supplies/equipment could significantly affect the quality of care and how

women in the community access health care services at the health facilities within the communities causing newborn outcomes.

For RQ5, the study's findings showed no statistically significant relationship with the availability of health workers and the utilization of ANC and PNC services among women in Mafa LGA, Borno State, while controlling for age parity/birth experience. However, the study's findings showed no statistically significant results for the availability of staff/health workers and utilization of ANC services for women aged 20-49, but women of this age group were 1.256 times more likely to utilize ANC services compared to women aged 15-19. Also, the study's findings did not show statistically significant results for staff/health workers' availability and utilization of ANC services for women with the birth experience. They were less likely to utilize ANC services compared to women with no birth experience.

This finding contradicts findings from other research studies as results from other research studies have proven a relationship between healthcare availability and utilization of ANC and PNC services. For instance, Arunda et al. (2016), in a lesson, evaluated ANC and skilled attendants during ANC among pregnant women in LMICs that proved helpful for neonatal survival, as pregnant mothers who used ANC services and skilled attendants had more likelihood of newborn survival. Also, Tantu et al. (2018) examined 300 pregnant women delivered at the health facility in a study; only fewer than 30% experienced newborn outcomes as they had no birth preparedness and complication readiness plan.

Similarly, the study's findings showed statistically significant results for women aged 20-49, but these women were 0.102 times less likely to utilize PNC services than women aged 15-19 in Mafa LGA, Borno State. Again, the result showed no statistically significant result for women with the birth experience; however, the study's findings showed they were 3.117 times more likely to utilize PNC services compared to women with no birth experience. In normal circumstances, this finding is factual as only women who give birth can attend PNC services. The result did not conform with other findings that proved health workers' availability and encourages post-natal mothers' utilization of PNC services. For instance, Hoque et al. (2018) evaluated the impact and operational assessment of safe motherhood and newborn health promotion package in three sub-districts of Chandpur in Bangladesh. Coverage of crucial interventions, including ANC, PNC, health facility, and skilled health providers, were critical factors for neonatal survival.

The finding aligns well with the three-delays model and agrees with deciding to seek care and accessing care at the health facility, aligning with delays one and two of the model. Sociocultural and quality of care factors affected how women decided to seek health care and access health care services at primary health facilities within the communities.

Limitations of the Study

Incomplete data for emergency transportation was an issue for the transportation variable in this research study. Hence, the study could not conduct any analysis for this Variable to draw any meaningful conclusion as 98.9% of data for the Variable was

missing. Also, the insecurity nature caused by the Boko Haram crisis within Borno State environs must have contributed to incomplete data for the transportation variable. Future research could investigate more into the transportation variable related to newborn outcomes to draw a meaningful conclusion.

The lack of supplies/equipment prevented women from accessing health care at health facilities where health workers provided health services. This could have prevented women from adequately engaging with health workers at the health facilities. Besides, most women's lack of birth preparedness and complication readiness plan could make them deliver at home and were not attended to by any skilled health worker. This could be probably due to the insecurity situation caused by the Boko Haram crisis in Borno State. The insecurity in the environs due to the Boko Haram crisis must have prevented women from accessing health care services at health facilities within their communities and delivered at home. A situation that could prevent adequate engagement of health workers and pregnant women to access ANC services at health facilities within the communities.

Findings from some variables such as availability of supplies/equipment and health workers' availability with ANC and PNC utilization contradicts findings from other research. This could be due to none provision of supplies/equipment as planned by the intervention to encourage women to access health care at the health facilities and engage with health workers. This situation could have left most women to deliver at home and been attended by traditional birth attendants (TBAs) not skilled enough to provide quality care during childbirth.

Again, most of the data collected during the intervention were self-reported data, in some cases collected remotely due to the insecurity nature of Borno State caused by the Boko Haram activities. Again, some of the intervention data was collected during COVID-19 period with restrictions to curtail spread, the intervention resulted to remote data collection. This situation could have affected the quality of data collected for some variables. These could serve as possible reasons some findings from this study contradict those from other research studies. Future research study should focus on interventions that provide supplies/equipment and health workers trained on providing quality (EmONC) to further investigate this finding from correctly observed data from the start to finish of the project.

Recommendations

Although the current study, together with other previous studies, has shown a statistically significant relationship between ANC and PNC with newborn outcomes, some findings in this study contradicts findings from earlier studies for some variables, including the relationship between ANC and PNC utilization with the availability of supplies/equipment and availability of health workers. The study analyzed secondary data from the RMNCAHN database for the VHW intervention project implemented in Borno State from December 2019 to November 2020.

It is recommended that future studies focus more on interventions where supplies/equipment is provided, and health workers trained on providing quality emergency obstetric and newborn care were supplied from the start of the intervention to

the completion. Also, future research should investigate more into the transportation variable as it relates to newborn outcomes to draw a meaningful conclusion.

Implications

Findings from this study aim at promoting positive social change to improve newborn outcomes among women aged 15-49 in Borno State, Northeastern Nigeria. This study has shown that ANC and PNC services are significantly related to newborn outcomes, especially with women aged 20-49 and women with birth experience in Borno State. This finding agrees with results from other research studies as demonstrated by Johnson et al. (2015) in a cross-sectional study; they evaluated different factors that promoted newborn outcomes and found that ANC and PNC attendance are strongly related to newborn survival. This finding has strong potential for positive social change. It could guide government and development partners to design innovative and effective ANC and PNC interventions that could help address the increasing newborn outcomes issues among people of Borno State.

Again, this study's findings showed that knowledge of illness during pregnancy is significantly related to ANC attendance among pregnant women in Borno State. The result from this study has the potentials to promote positive social change as it will serve as a guide for the Borno State government and program implementing partners/stakeholders to design and implement effective and quality health promotion interventions, especially among women and adolescent women to educate pregnant them and their husbands on benefits of utilizing ANC services and demand for ANC services.

This will significantly address the growing issues of maternal and newborn outcomes and improve maternal and newborn health outcomes for people in Borno State.

More so, government and implementing partners could use findings from this study to promote positive social change among people of Borno State as a guide to design and implement adolescent-focused education interventions/programs with their husbands' to increase knowledge of benefits of ANC service utilization at primary health facilities within the communities. The substantial evidence from this research findings that adolescent women aged 15-19 are more likely to attend ANC with knowledge of illness during pregnancy.

Furthermore, this study's findings provide evidence of a significant relationship between the availability of supplies/equipment and ANC and PNC attendance. Government and implementing partners can use these findings to promote positive social change that will serve as a guide for Borno state government and program implementers in maternal, child, and adolescent health to design and implement innovative supply chain intervention interventions to ensure availability of supplies/equipment to encourage ANC and PNC attendance among women. This will significantly address the increasing issue of maternal and newborn outcomes among people in Borno State.

Also, this study's findings showed a significant relationship between the availability of health workers and women aged 20-49. Government stakeholders and program implementing partners can use study findings to promote positive social change by implementing MNCH interventions in Borno State. This could guide these stakeholders to design and implement innovative interventions to training health workers

to provide quality health care services at primary health facilities in Borno State. This will help address the growing issues of maternal and newborn outcomes among people of Borno State.

Conclusions

There is a growing body of evidence that increasing newborn outcomes abounds among underserved communities with poor access to health services. The increasing newborn outcome situation in Borno State is unique amid the Boko Haram crisis that has destroyed most primary health care infrastructures, caused limited health workers in the state, poor or irregular supplies of supplies/equipment to provide emergency obstetric and newborn care services at HFs within the communities, increased insecurity causing transportation problems for women to the health facilities within the communities. Most of these factors primarily affect women with health needs of MNCH health outcomes and education programs targeted in increasing knowledge about benefits of ANC and PNC and best practices among people in Borno State.

There is growing concern about MNCH outcomes in Borno State that have made it a significant public health issue with special attention, especially as there is evidence for increasing maternal, newborn, and child health outcomes. Evidence from this research shows a significant relationship between ANC and PNC practices and knowledge of illness during pregnancy with newborn outcomes, especially among adolescent women aged 15-19 in the community. Effective coordination between government stakeholders and program implementing partners could inform innovative program designs and implementation in MNCH to address increasing newborn outcomes in Borno State.

Effective and innovative education/health promotion intervention programs can significantly address increasing maternal, newborn, and child health outcomes among people in Borno State.

Finally, there is evidence of a significant relationship between transportation and utilization of ANC and PNC services among women at HFs within underserved communities from other studies. For instance, Chankham et al. (2017), in a study, proved that pregnant women in LMICs who received free transportation support are more likely to utilize ANC services and delivery at the health facility. Innovative interventions in providing available transportation for women to attend ANC and PNC services in insecure environs in Borno State can significantly address the issue of increasing newborn outcomes among people of Borno State.

References

Acharya, A. S., Kaur, R., Prasuna, J. G., & Rasheed, N. (2015). Complication readiness study among antenatal women attendees of a primary health centre, Delhi. *Indian Journal of Community Medicine, 40*(2), 127-134. https://doi.org/10.4103/0970-0218.153881

Ali, S. A., Dero, A. A., Ali, S. A., & Ali, G. B. (2018). Factors affecting the utilization of antenatal care among pregnant women: A literature review. *Journal of Pregnancy and Neonatal Medicine, 2*(2), 41-45. https://doi.org/10.35841/neonatal-medicine.2.2.41-45

Allen, E., Schellenberg, J., Berhanu, D., Cousens, S., & Marchant, T. (2018). Association between increased intervention coverage for mothers and newborns and the number and quality of contacts between families and health workers: an analysis of cluster level repeats cross-sectional survey data in Ethiopia. *PLoS One, 13*(8), Article e0199937. https://doi.org/10.1371/journal.pone.0199937

Amzat, J. (2015). The question of autonomy in maternal health in Africa: A rights-based consideration. *Journal of Bioethical Inquiry, 12*(2), 283-293. https://doi/org/10.1007/s11673-015-9607-y

Arunda, M., Emmelin, A., & Asamoah, B. O. (2017). Effectiveness of antenatal care services in reducing neonatal mortality in Kenya: Analysis of national survey data. *Global Health Action, 10*(1), 1328796. https://doi/org/10.1080/16549716.2017.1328796

Atuoye, K. N., Dixon, J., Rishworth, A., Galaa, S. Z., Boamah, S. A., & Luguinaah, I.

(2015). Can she make it? Transportation barriers to accessing maternal and child health care services in rural Ghana. *BMC Health Services Research, 15,* 333. https://doi.org/10.1186/s12913-015-1005-y

Atuoye, K. N., Amoyaw, J. A., Kuuire, V. Z., Kangmennaang, J., Boamah, S. A., Vercillo, S., Antabe, R., McMorris, M. & Luginaah, I. (2017). Utilisation of skilled birth attendants over time in Nigeria and Malawi. *Global Public Health, 12*(6), 728-743. https://doi.org/10.1080/17441692.2017.1315441

Banke-Thomas, O. E., Banke-Thomas, A. O. & Ameh, C. A. (2017). Factors influencing utilization of maternal health services by adolescent mothers in low and middle-income countries: A systematic review. *BMC Pregnancy Childbirth, 17*(1), 65. https://doi.org/10.1186/s12884-017-1246-3

Barnes-Josiah, D., Myntti, C., & Augustine, A. (1998). The "Three Delays" as a framework for examining maternal mortality in Haiti. *Social Science Medicine, 46*(8): 981-993.

Begashaw, B., Tesfaye, Y., Zelalem, E., Bong, U., & Kumalo, A. (2017). Assessment of birth preparedness and complication readiness among pregnant mothers attending antenatal care services in Mizan-Tepi University Teaching Hospital, south west Ethiopia. *Clinics in Mother and Child Health, 14*, 1. https://doi.org/10.4172/2090-7214.1000257

Bitew, Y., Awoke, W., & Chekol, S. (2016). Birth preparedness and complication readiness practice and associated factors among pregnant women, northwest Ethiopia. *International Scholarly Research Notices, 2016,* Article 8727365.

https://doi.org/10.1155/2016/8727365

Billah, S. M., Chowdhury, M. A. K., Khan, A. N. S., Karim, F., Hassan, A., Zaak, N., El Arifeen, S., & Manu, A. (2018). Quality of care during childbirth at public health facilities in Bangladesh: A cross-sectional study using WHO/UNICEF 'Every Mother Every Newborn (EMEN)' standards. *BMJ Open Quality, 8*(3). Article e000596. https://doi.org/10.1136/bmjoq-2018-000596

Bogale, D. & Markos, D. (2015). Knowledge of obstetric danger signs among child bearing age women in Goba district, Ethiopia: A cross-sectional study. *BMC Pregnancy and Childbirth, 15*(1), 77. https://doi.org/10.1186/s12884-015-0508-1

Caputi, M. (2013). *Feminism and power: The need for critical theory*. Lexington Books.

Chankham, T., Yamamoto, E., Reyer, J. A., Arafat, R., Khonemany, I., Panome, S., Hongkham, D., Bounfeng, P., Anonh, X., & Hamajima, N. (2017). Knowledge of free delivery policy among women who delivered at health facilities in Oudomxay Province, Lao PDR. *Nagoya Journal of Medical Sciences, 79*, 135-145. https://doi.org/10.18999/nagjms.79.2.135

Chaurasiya, S. P., Pravana, N. K., Khanal, V., & Giri, D. (2019). Two thirds of the most disadvantaged Dalit population of Nepal still do not deliver in health facilities despite impressive success in maternal health. *PLoS One, 14*(6), Article e0217337. https://doi.org/10.1371/journal.pone.0217337

Chichiabellu, T. Y., Mekonnen, B., Astawesegn, F. H., Demissie, B. W., & Anjulo, A. A. (2018). Essential newborn care practices and associated factors among home delivered mothers in Damot Pulasa Woreda, southern Ethiopia. *Reproductive*

Health, 15(1), 162. https://doi.org/10.1186/s12978-018-0609-1

Chou, V. B., Walker, N., & Kanyangarara, M. (2019). Estimating the global impact of poor quality of care on maternal and neonatal outcomes in 81 low-and middle-income countries: A modelling study. *PLoS One, 16*(12), Article e1002990. https://doi.org/10.1371/journal.pmed.1002990

Dhital, R., Silwa, R. C., Simkhada, P., van Teijlingen, E., & Jimba, M. (2019). Assessing knowledge and behavioral changes on maternal and newborn health among mothers following post-earthquake health promotion in Nepal. *PLoS One, 14*(7), Article e0220191. https://doi.org/10.1371/journal.pone.0220191

Dickson, K. S., Darteh, E. K. M., Kumi-Kyereme, A., & Ahinkorah, B. O. (2018). Determinants of choice of skilled antenatal care services providers in Ghana: analysis of demographic and health survey. *Maternal Health, Neonatalogy, and Perinatology, 4*(1), 14. https://doi.org/10.1186/s40748-018-0082-4

Douglas, S., & Michaels, M. (2004). *The new momism*. Free Press.

Egharevba, J., Pharr, J., van Wyk, B., & Ezeanolue, E. (2017). Factors influencing the choice of child delivery location among women attending antenatal care services and immunization clinic in southeastern Nigeria. *International Journal of MCH and AIDS, 6*(1), 82-92. https://doi.org/10.21106/ijma.213

Ekwochi, U., Ndu, I. K., Osuorah, C. D. I., Amadi, O. F., Okeke, I. B., Obuoha, E., Onah, K. S., Nwokoye, I., Odetunde, O. I., & Obumneme-Anyim, N. I. (2015). Knowledge of danger signs in newborns and health seeking practices of mothers and care givers in Enugu state, southeast Nigeria. *Italian Journal of Pediatrics,*

41, 18. https://doi.org/10.1186/s13052-015-0127-5

Endeshaw, D. B., Gezie, L. D., & Yelshita, Y. (2018). Birth preparedness and complication readiness among pregnant women in Tehulederie district, northeast Ethiopia: A community-based cross-sectional study. *BMC Nursing, 17*(1), 10. https://doi.org/10.1186/s12912-018-0278-y

Gebre, M., Gebremariam, A., & Abebe, T. A. (2015). Birth preparedness and complication readiness among pregnant women in Duguna Fango district, Wolayta zone, Ethiopia. *PLoS ONE 10*(9), Article e0137570. https://doi.org/10.1371/journal.pone.0137570

Gebrehiwot, T. G., Sebastian, M. S., Edin, K., & Goicolea, I. (2015). The health extension program and its association with change in utilization of selected maternal health services in Tigray region, Ethiopia: A segmented linear regression analysis. *PLoS On, 10*(7), Article e0131195. https://doi.org/10.1371/journal.pone.0131195

Greenspan, J. A., Chebet, J. J., Mpembeni, R., Mosha, I., Mpunga, M., Winch, P. J., Killewo, J., Baqui, A. H., & McMahon, S. A. (2019). Men's roles in care seeking for maternal and newborn health: a qualitative study applying the three delays model to male involvement in Morogoro Region, Tanzania. *BMC Pregnancy and Childbirth 19*(1), 293. https://doi.org/10.1186/s12884-019-2439-8

Hill, Z., Okyere, E., Wickenden, M., & Tawiah-Agyemang, C. (2015). What can we learn about postnatal care in Ghana if we ask the right questions? A qualitative study. *Global Health Action, 8*(1), 28515, https://doi.org/10.3402/gha.v8.28515

Hirose, A., Borchert, M., Cox, J., Alkozai, A. S., & Filippi, V. (2015). Determinants of delays in travelling to an emergency obstetric care facility in Herat Afghanistan: An analysis of cross-sectional survey data and spatial modelling. *BMC Pregnancy and Childbirth, 15*(1), 14. https://doi.org/10.1186/s12884-015-0435-1

Hoque, D.M.E., Chowdhury, M.A.K., Rahman, A.E., Billah, S.M., Bari, S., Tashina, T., Hasan, M.M., Islam, S., Islam, T., Mori, R. & El Arifeen, S. (2018). A community-based cluster randomized control trial (cRCT) to evaluate the impact and operational assessment of "safe motherhood and newborn health promotion package": study protocol. *BMC Public Health, 18*, 592. https://doi.org/10.1186/s12889-018-5478-6.

Hordofa, M.A., Almaw, S.S., Berhanu, M.G., & Lemiso, H.B. (2015). Postnatal care service utilization and associated factors among women in Dembecha district, northwest Ethiopia. *Science Journal of Public Health, 3*(5), 686-692. https://doi.org/10.11648/j.sjph.20150305.24

International Peace Institute. (2019). *Providing healthcare in armed conflict: the case of Nigeria*. https://www.ipinst.org/wp-content/uploads/2019/01/IPIE-RPT-Providing-HealthcareNigeria.pdf

Islam, S., Perkins, J., Siddique, M.A.B., Mazumder, T., Haider, M.R., Rahman, M.M., Capello, C., Hoque, D.M.E., Santarelli, C., El Arifeen, S., & Rahman, A.E. (2018). Birth preparedness and complication readiness among women and couples and its association with skilled birth attendance in rural Bangladesh. *PLoS One, 13*(6), e0197693. https://doi.org/10.1371/journal.pone.0197693

Jack, S. M., DiCenso, A., & Lohfeld, L. (2005). A theory of maternal engagement with public health nurses and family visitors. *Journal of Advanced Nursing, 49*(2), 182-190. https://doi:10.1111/j.1365-2648.2004.03278.x

Jimenez, V., Klein, M. C., Hivon, M., & Mason, C. (2010). A Mirage of Change: Family-Centered Maternity Care in Practice. *Birth, 37*(2), 160-167.

Johnson, F. A., Frempong-Ainguah, F., Matthews, Z., Harfoot, A. J. P., Nyarko, P., Baschieri, A., Gething, P. W., Falkingham, J., & Atkinson, P. M. (2015). Evaluating the impact of the community-based health planning and services initiative on uptake of skilled birth care in Ghana. *PLoS One, 10*(3), e0120556. https://doi:10.1371/journal.pone.0120556

Joyce, C., Grace, O., & Waithira, M. (2018). Factors affecting birth preparedness among pregnant women attending public antenatal clinics in Migori county Kenya. *Biomedical Journal of Science & Technical Research, 3*(4), 3409-3415. https://*doi: 10.26717/BJSTR.2018.03.000929*

Kabongo, E. M., Mukumbang, F., Delobelle, P. N. A., & Nicole, E. N. A. (2018). Explaining the impact of health on maternal and child health care in low-and middle-income countries: a theory-driven scoping review. Research Squar. https://doi.org/10.21203/rs.2.19606/v2.

Kadia, R. S., Kadia, B. M., Dimala, C. A., Vogue, N., & Kenfack, B. (2020). Evaluation of emergency obstetrics and neonatal care services in Kumba health district, southwest region, Cameroon (2011-2014): a before-after study. *BMC Pregnancy and Childbirth, 20*:95. https://doi.org/10.1186/s12884-020-2774-9

Kante, A. M., Chung, C. E., Larsen, A. M., Exavery, A., Tani, K., & Philips, J. F. (2015). Factors associated with compliance with the recommended frequency of postnatal care services in three rural districts of Tanzania. *BMC Pregnancy and Childbirth, 15,* 341. https://doi10.1186/s12884-015-0769-8

Kanyangarara, M. & Chou, V. B. (2017). Linking household surveys and health facility assessments to estimate intervention coverage for the lives saved tools (LiST). *BMC Pregnancy and Childbirth, 17*(Suppler 4), 780. https://doi10.1186/s12889-017-4743-4

Kanyangarara, M., Chou, V. B., Creanga, A. A., & Walker, N. (2018). Linking household and health facility surveys to assess obstetric service availability, readiness and coverage: evidence from 17 low-and middle-income countries. *Journal of Global Health, 8*(1), 010603. https://doi:10.7189/jogh.08.010603

Khan, A. N. S., Karim, F., Chowdhury, M. A. K., Zaka, N., Manu, A., El Arifeen, S., & Billah, S. M. (2019). Competence of healthcare professionals in diagnosing and managing obstetric complications and conducting neonatal care: a clinical vignette-based assessment in district and subdistrict hospitals in northern Bangladesh. *BMJ Open, 9.* e028670. https://doi:10.1136/bmjopen-2018-028670

Kumari, R. & Shipra, K. (2020). Role of ASHA to aware about antenatal care and post-natal care services are utilised by women beneficiaries registered in JSY (Janani Suraksha Yohana) in Samastipur district in Bihar. *Journal of Pharmacognosy and Phytochemistry, 9*(3), 36-38.

Kuo, D. Z., Houtrow, A. J., Arango, P., Kuhlthau, K. A., Simmons, J. M., & Neff, J. M. (2012). Family-centered care: current applications and future directions in pediatric healthcare. *Maternal and Child Health Journal, 16*(2), 297-305.

LeFevre, A., Mpembeni, R., Kilewo, C., Yang, A., An, S., Mohan, D., Mosha, I., Besana, G., Lipingu, C., Callaghan-Koru, J., Silverman, M., Winch, P. J., & George, A. S. (2018). Program assessment of efforts to improve the quality of postpartum counselling in health centers in Morogoro region, Tanzania. *BMC Pregnancy and Childbirth, 18*: 282. https://doi.org/10.1186/s12884-018-1906-y

Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V., Adair, T., Aggarwal, R., Ahn, S., Alvarado, M., Andrews, K., Anderson, H. R., Atkinson, C., Bennet, D., Berry, R. J., Balla, K., Bikbov, B., Bolliger, I., Bucello, C., ……. Murray, C. J. L. (2012). Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *The Lancet, 380*(9859), 2095-2128.

Masoi, T. J. & Kibusi, S. M. (2019). Improving pregnant women's knowledge on danger signs and birth preparedness practices using an interactive mobile messaging alert system in Dodoma region, Tanzania: a controlled quasi experimental study. *Reproductive Health, 16,*177. https://doi.org/10.1186/s12978-019-0838-y

MacDonald, T., Jackson, S., Charles Marie-Carmele, Periel, M., Jean-Baptiste, Marie-Vena, Salomon, A., & Premilus, E. (2018). The fourth delay and community-driven solutions to reduce maternal mortality in rural Haiti: a community-based action research study. *BMC Pregnancy and Childbirth, 18.*

Mercy Corps. (2018). *Borno, Northeast Nigeria Strategic Resilience Assessment.* https://www.mercycorps.org/sites/default/files/2019-11/PRG_BornoStrategicResilienceAssessmenet_R_lo_0319_WEB_v3.pdf

McClure, E. M., Saleem, S., Goudar, S. S., Moore, J. L., Garces, A., Esamai, F., Patel, A., Chomba, E., Althabe, F., Pasha, O., Kodkany, B. S., Bose, C. L., Berreuta, M., Liechty, E. A., Hambidge, K. M., Krebs, N. F., Derman, R. J., Hibberd, P. L., Buekens, P., Manasyan, A., Carlo, W. A., Wallace, D. D., Koso-Thomas, M., & Goldenerg, R. L. (2015). Stillbirth rates in low-middle income countries 2010-2013: a population-based, multi-country study from the global network. *Reproductive Health, 12* (Suppler 2), S7. http://www.reproductive-health-journal.com/content/12/S2/S7

Mbuthia, F., Reid, M., & Fichardt, A. (2019). mHealth communication to strengthen postnatal care in rural areas: a systematic review. *BMC Pregnancy Childbirth, 19*(1): 406. https://doi:10.1186/s12884-019-2531-0.

Mgawadere, F., Unkels, R., Kazembe, A., & van den Broek, N. (2017). Factors associated with maternal mortality in Malawi: application of the three delays model. *BMC Pregnancy and Childbirth 17*:219

Millogo, T., Agbre-Yace, M. L., Kourouma, R. K., Yameogo, W. M. E., Tano-Kamelan, A., Sissoko, F. B., Kone-Coulibaly, A. S., Thorson, A., & Kouanda, S. (2020). Quality of maternal and newborn care in limited-resource settings: a facility-based cross-sectional study in Burkina Faso and Cote d'Ivoire. *BMJ Open, 10.* e036121. https://doi:10.1136/bmjopen-2019-036121

Moinuddin, M., Christou, A., Hoque, D. M. E., Tahsina, T., Salam, S. S., Billah, S. M., Kuppens, L., Matin, M. Z., & El Arifeen, S. (2017). Birth preparedness and complication readiness (BPCR) among pregnant women in hard-to-reach areas in Bangladesh. *PLoS One, 12*(12), e0189365. https://doi.org/10.1371/journal.pone.0189365

Moucheraud, C., Worku, A., Molla, M., Finlay, J. E., Leaning, J., & Yamin, A. E. (2015). Consequences of maternal mortality on infant and child survival: a 25-year longitudinal analysis in Butajira Ethiopia (1987-2011). *Reproductive Health, 12*(Suppler 1), 54. http://www.reproductive-health-journal.com/content/12/S1/S4

Mubiri, P. Kajjo, D., Okuga, M., Marchant, T., Peterson, S., Waiswa, P., & Hanson, C. (2020). Bypassing or successful referral? A population-based study of reasons why women travel far for childbirth in eastern Uganda. *BMC Pregnancy and Childbirth 20*:497. https://doi.org/10.1186/s12884-020-03194-2

Mutanda, J. N., Waiswa, P., & Namutamba, S. (2016). Community-made mobile videos as a mechanism for maternal, newborn and child health education in rural Uganda: A qualitative evaluation. *Afri Health Science, 16*(4), 923-928. http://dx.doi.org/10.4314/ahs.v16i4.6

National Population Commission (NPC) and ICF. (2019). *Nigeria Demographic and Health Survey 2018 Key Indicators Report*. Abuja, Nigeria, and Rockville, Maryland, USA: NPC and ICF. https://www.dhsprogram.com/pubs/pdf/PR118/PR118.pdf

N'Gbichi, C., Ziraba, A. K., Wambui, D. W., Bakibinga, P., Kisiangani, I., Njoroge, P., Noor, R., Njoroge, N., Salah, R. A., & Mohamed, E. (2019). *BMC Pregnancy and Childbirth, 19,* 332. https://doi.org/10.1186/s12884-019-2477-2

Nigatu, S. G., Worku, A. G., & Dadi, A. F. (2015). Level of mother's knowledge about neonatal danger signs and associated factors in north west of Ethiopia: a community-based study. *BMC Research Notes, 8,*309. https://doi.10.1186/s13104-015-1278-6

Nmandu, A. G., Mohammed, S., Usman, N. O. (2020). Barriers to adolescents' access and utilisation of reproductive health services in a community in north-western Nigeria: a qualitative exploratory study in primary care. *African Journal of Primary Health Care & Family Medicine, 12*(1), a2307. https://doi.org/10.4102/phcfm.v12i1.2307

Nuamah, G. B., Agyei-Baffour, P., Mensah, K. A., Boateng, D., Quansah, D. Y., Dobin, D., & Addai-Donkor, K. (2019). Access and utilization of maternal healthcare in a rural district in the forest belt of Ghana. *BMC Pregnancy and Childbirth, 19*, 6. https://doi.org/10.1186/s12884-018-2159-5

Office for the Coordination of Humanitarian Affairs. (2019). "*Nigeria North-East: Humanitarian Situation Update,* June 2019 Edition." https://reliefweb.int/sites/reliefweb.int/files/resources/ocha_nga_humanitarian_situation_update_june_edition.pdf

Oguntunde, O., Nyenwa, J., Yusuf, F. M., Dauda, D. S., Salihu, A., & Sinai, I. (2019). Factors associated with knowledge of obstetric danger signs and perceptions of

the need for obstetric care among married men in northern Nigeria: a cross-sectional survey. *BMC Pregnancy and Childbirth, 19*,123. https://doi.org/10.1186/s12884-019-2271-1

Okonofua, F., Ogu, R., Agholor, K., Okike, O., Abdus-salam, R., Gana, M., Randawa, A., Abe, E., Durodola, A., Galadanci, H., & The WHARC WHO FMOH MNCH Implementation Research Study Team. (2017). Qualitative assessment of women's satisfaction with maternal health care in referral hospitals in Nigeria. *Reproductive Health, 14,* 44. https://doi.10.1186/s12978-017-0305-6

Olowokere, A. E., Oyedele, A. T., Komolafe, A. O., & Olajubu, A. O. (2020). Birth preparedness, utilisation of skilled birth attendants and delivery outcomes among pregnant women in Ogun state, Nigeria. *European journal of Midwifery, 4*, 22.

Onono, M. A., Whom, S., Weeks, P., Adhu, C. K., Wagume, L. W., Serem, T., Owenga, M. A., & Ong'wen, P. (2019). Effects of an expanded Uber-like transport system on access to and use of maternal and newborn health services: findings of a prospective cohort study in Homa Bay, Kenya. *BMC Global Health, 4,* e001254. https://doi.org/10.1136/bmjgh-2018-001254

Park, Y. S., Konge, L., & Artino, A. R. (2020). The positivism paradigm of research. *Academic Medicine, 95*(5): 690-694.

Phillips, C. R. (2003). *Family-centered maternity care*. Jones & Bartlett Learning.

Pervin, J., Nu, U.T., Rahman, A.M.Q., Rahman, M., Uddin, B., Razzaque, A., Johnson, S., Kuhn, R. & Rahman, A. (2018). Level and determinants of birth preparedness and complication readiness among pregnant women: a cross-sectional study in a

rural area in Bangladesh. *PLoS One, 13*(12), e0209076. https://doi.org/10.1371/journal.pone.0209076

Petersen, M. F., Cohen, J., & Parsons, V. (2004). Family-Centered Care: Do We Practice What We Preach? *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 33*(4), 421-427.

Perry, S. E., Hockenberry, M. J., Lowdermilk, D. L., & Wilson, D. (2014). *Maternal child nursing care*: Elsevier Health Sciences.

Pedercini, M., & Barney, G. O. (2010). Dynamic analysis of interventions designed to achieve millennium development goals (MDG): The case of Ghana. *Socio-Economic Planning Sciences, 44*(2), 89 99. doi:http://dx.doi.org/10.1016/j.seps.2009.08.002

Phillips, C. R. (1996). *Family Centered Maternity and Newborn Care: A Basic Text*: Mosby Inc.

Pollard, M. D. (2006). *Meaning of maternal care giving and health perceptions in Ghana, West Africa: A visual ethnography* (Publication No. 3213580) [Doctoral dissertation, Columbia University]. ProQuest Dissertations and Theses Global.

Rahman, A. E., Perkins, J., Islam, S., Siddique, A. B., Moinuddin, M., Anwar, M. R., Mazumder, T., Ansar, A., Rahman, M. M., Raihana, S., Capello, C., Santarelli, C., El Arifeen, S., & Hoque, D. M. E. (2018). Knowledge and involvement of husbands in maternal and newborn health in rural Bangladesh. *BMC Pregnancy and Childbirth, 18*:247. https://doi.org/10.1186/s12884-018-1882-2

Rapp, S. (2016) Beyond the Three Delays: A case study of Haiti's maternal health sector. Capstone Collection. 2880.https://digitalcollections.sit.edu/capstones/2880

Sacks, E., Vail, D., Austin-Evelyn, K., Green, D., Atuyambe, L. M., Macwan'gi, M., Kruk, M. E., & Grepin, K. A. (2016). Factors influencing modes of transportation and travel time for obstetric care: a mixed methods study in Zambia and Uganda. *Health Policy and Planning, 31,* 293-301.https://doi.org/10.1093/heapol/czv057

Sakeah, E., Okawa, S., Douro, A. R., Shibanuma, A., Ansah, E., Kikuchi, K., Gyapong, M., Owusu-Agyei, S., Williams, J., Debpuur, C., Yeji, F., Kukula, V. A., Enuameh, Y., Asare, G. Q., Agyekum, E. O., Addai, S., Sarpong, D., Adjei, K., Tawiah, C., Yasuoka, J., Nanishi, K., Jimba, M., Hodgson, A., & the Ghana EMBRACE Team. (2017). Determinants of attending antenatal care at least four times in rural Ghana: analysis of a cross-sectional survey. *Global Health Action, 10,*1, 1291879, DOI:10.1080/16549716.2017.1291879

Sarker, B. K., Rahman, M., Rahman, T., Hossain, J., Reichenbach, L., & Mitra, D. K. (2016). Reasons for preference of home delivery with traditional birth attendants (TBAs) in rural Bangladesh: a qualitative exploration. *PLoS One, 11*(1), e0146161. https://doi.org/10.1371/journal.pone.0146161

Seethanna, V., Jha, S. K., & Singh, S. P. (2017). Utilization of maternal health services and health facilities for deliveries in Chiraigaon block of Varanasi district. *Indian Journal of Preventive Social Medicine, 48,* 3-4.

Singh, A. (2016). *Supply-side barriers to maternal health care utilization at health sub-centres in India*. Global health and social care unit, school of health sciences and

social work, University of Portsmouth, Portsmouth, United Kingdom.

Shah, R., Sharma, B., Khanal, V., Pandey, U. K., Vishwokarma, A., & Malla, D. K. (2015). Factors associated with neonatal deaths in Chitwan district of Nepal. *BMC Research Notes, 18*, 818.DOI 10.1186/s13104-015-1807-3

Sk, M. I. K., Paswan, B., Anand, A., & Mondal, N.A. (2019). Praying until death: revisiting three delays model to contextualize the socio-cultural factors associated with maternal deaths in a region with high prevalence of eclampsia in India. *BMC Pregnancy and Childbirth, 19*:314 https://doi.org/10.1186/s12884-019-2458-5

Srivastava, A., Avan, A. A., Rajbangshi, P., & Bhattacharyya, S. (2015). Determinants of women's satisfaction with maternal health care: a review of literature from developing countries. *BMC Pregnancy and Childbirth, 15:*97. https://doi.org/10.1186/s12884-015-0525-0

Sukoco, N. E. W. & Sparmi. (2017). Utilization of maternity waiting homes in Selaru health centre Maluku Tenggara Barat 2015. *Bulletin Penelitian Kesehatan, 45*(1), 65-72.

Sumankuuro, J., Crockett, J., & Wang, S. (2017). The use of antenatal care in two rural districts of Upper West Region, Ghana. *PLoS One, 12*(9), e0185537. https://doi.org/10.1371/journal.pone.0185537

Sumankuuro, J. (2018). *Paradoxes of factors influencing maternal health outcomes in rural northern Ghana*. School of Community health, Faculty of Science. Charles Sturt University.

Sychareun, V., Somphet, V., Chaleunvong, K., Hansana, V., Phengsavanh, A., Xayavong, S., & Popenoe, R. (2016). Perceptions and understandings of pregnancy, antenatal care and postpartum care among rural Lao women and their families. *BMC pregnancy and childbirth, 16*(1). https://doi.org/10.1186/s12884-016-1031-8

Tekelab, T., Chojenta, C., Smith, R., & Loxton, D. (2019). The impact of antenatal care on neonatal mortality in sub-Saharan Africa: A systematic review and meta-analysis. *PLoSONE 14*(9): e0222566.https://doi.org/10.1371/journal. https://doi.org/10.1371/journal.pone.0222566

Thaddeus, S., & Maine, D. (1994). Too far to walk: maternal mortality in context. *Social science & medicine, 38*(8), 1091-1110.

Thakur, L. & Singhal, A. (2016). Health seeking behavior of the mothers residing in slums of cities of Rajasthan: with special reference to antenatal care services. *Work d Journal of Research and Review (WJRR), 3*(6), 55-59.

Timsa, L., Marrone, G., Ekirapa, E., & Waiswa, P. (2015). Strategies for helping families prepare for birth: experiences from eastern central Uganda. *Global Health Action, 8:*1, 23969, https://doi.org/10.3402/gha.v8.23969

Thomasa, J. O., & Rankinb, Y. (2015). Supporting greater access to pre-and-post-natal care for women living in rural developing economies. *International Journal of Business, Humanities and Technology, 5*(1), 51-61. ISSN 2162-1357 (Print), 2162-1381

United Nations High Commissioner for Refugees. (2019). *"North-east Nigeria Situation Update, External, 04-09 February 2019."* https://data2.unhcr.org/en/documents/download/67989

Vellakkal, S., Reddy, H., Gupta, A., Chandra, A., Fledderjohann, J., & Stuckler, D. (2017). A qualitative study of factors impacting accessing of institutional delivery care in the context of India's cash incentive program. *Social Science and Medicine, 178*, 55-65.

Wilunda, C., Yerinde, K., Putoto, G., Locherò, P., Dall'Oglio, G., Manenti, F., Segafredo, G., Atzori, A., Criel, B., Panza, A., & Quaglio, G. (2015). Availability, utilisation and quality of maternal and neonatal health care services in Karamoja region, Uganda: a health facility-based survey. *Reproductive Health, 12:*30. https://doi.org/10.1186/s12978-015- 0018-7.

Wilunda, C., Putoto, G., Riva, D. D., Manenti, F., Atzori, A., Calia, F., Assefa, T., Turri, B., Emmanuel, O., Straneo, M., Kisika, F., & Tarmbulini, G. (2015). Assessing coverage, equity and quality gaps in maternal and neonatal care in Sub-Saharan Africa: an integrated approach. *PLoS One 10*(5), e0127827. https://doi.org/10.1371/journal.pone.0127827.

Zwelling, E., & Phillips, C. R. (2001). Family-centered maternity care in the new millennium: is it real or is it imagined? *The Journal of perinatal & neonatal nursing, 15*(3), 1-12.