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

Gabriel Adebe, Sadiatu Sally Obi, Susan Mshelia

College of Health Profession, Walden University, Minnesota, United States of America

## Email address:

adebeaondofa@gmail.com (Gabriel Adebe)

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**Abstract:** The Boko Haram crisis displaced people from the community leaving very little health infrastructures that cause limited access to health services. Since then, 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. A cross-sectional study assessed data from the village health worker (VHW) project implemented in Mafa LGA, Borno State from December 2019 through November 2020. Sociocultural and quality of care factors were assessed to determine quality of health care services for 1,641 women aged 15-49 who participated in the VHW intervention. Logistic regression was applied to the data to determine how quality of care factors influence newborn outcome. 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.

**Keywords:** Antenatal Care, Newborn Health, Boko Haram, Village Health Workers (VHWs)

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## 1. Introduction

The high maternal, newborn, and child mortality rates are a significant public health issue, especially in Borno State, Northeastern Nigeria, among underserved populations [13]. In Borno State, 50% of health facilities are non-functional, with 39% destroyed, leaving only 18% of Borno's health centers providing integrated clinical health management services [6]. Also, inadequate health workers, socioeconomic factors, and quality maternal newborn and childcare have been steadily decreasing due to the Boko Haram crises [15].

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 [11]). The 2018 Demographic Health Survey for Nigeria 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 [11].

Most of the primary health facilities are 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 non-existent 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.

## 2. Materials and Method

### 2.1. Research Design and Rationale

The study used a cross-sectional study design to evaluate 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. Evidence from other researchers stated although they form the mainstay of epidemiological studies, observational methods are prone to bias and confounding [5] [9]. 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.

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 and PNC are associated with the newborn outcome. 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. Factors of ANC and PNC 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. The study investigated the various independent factors to determine the association with the newborn outcome among pregnant women in the targeted community.

### 2.2. Population

Borno State, the northeastern region of Nigeria, is known to be one of the most affected states during the Boko Haram crisis. With a population of over 5 million people, the situations have displaced over 1.3 million known internally displaced persons (IDPs) [13]. A study reported that 80% of displaced individuals and returnees in northeast Nigeria are women and children [6]. The study was conducted in the Mafa local government area, located in the central region of Borno State, housing many internally displaced persons (IDPs). About 1,674 women of childbearing age (WCBA), including adolescents, ages 15-49, who have experienced childbirth, pregnancy, and displaced or living in communities affected by the Boko Haram crisis are the target population for this study.

### 2.3. 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 sampled 1,674 women who were pregnant, delivered babies, and were referred for PNC services and participated in the program from December 2019 through November 2020 from the RMNCAHN. 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.

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 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. Stratified random sampling selected only pregnant women and women with childbearing experience, who are IDPs and community members of Tamsu-Ngandua ward, Mafa LGA, where the RMNCAHN project was implemented.

## 3. Methodology

The study is a quantitative cross-sectional study that used 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.

### 3.1. Data Collection

The intervention developed and operationalized instrumentation used for collecting data for the RMNCAHN program and standardized the tools. The tools were 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 did not include some demographic variables such as mother's education level and mother's occupation.

### 3.2. Data Analysis Plan

Data for this study was retrieved from the RMNCAHN

**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
ANC	Yes, No	Dichotomous/ Nominal
PNC	Yes, No	Dichotomous/Nominal
Dependent Variable		
Newborn outcome (morbidity or mortality)	Yes, No	Nominal

### 3.3. Statistical Analysis and Test

Logistic Regression analytical technique was used to determine how much dependent or outcome variable (newborn mortality) regress on independent variables (ANC & PNC) risk factor variables. Odd ratio test with various measures was used to test the association between independent variables and the dependent variable, newborn outcome.

### 3.4. Threat to the Validity

Data tools were adapted and standardized with reviews from different stakeholders 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. 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 and ensure validity.

### 3.5. Ethical Procedures

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. This research study will sought 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 from the Borno State Ministry of Health (BSMoH) to access data in the archived RMNCAHN database as secondary data analysis for this study and was granted permission (MOH/GEN/6679/1) on 17<sup>th</sup> February 2021.

database after all ethical permission was received to accessed datasets required for the study. Independent variables for the study include age, parity, 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.

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.

## 4. Result

### 4.1. Descriptive Statistics

Total participants for the study ( $N = 1,614$ ) have different age, parity, socio-cultural, and quality of care variables. Women age 15-19 constituted 1,131 respondents (70.1%), and women age 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' 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%).

**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
Newborn outcome		
No	812	50.3
Yes	802	49.7

For the outcome variables, 1,614 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).

**4.2. ANC & PNC**

Binary logistics regression statistical technique was applied to perform analysis for the study. 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.

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, study finds a relationship between ANC and PNC services with newborn outcomes, rejecting the null hypothesis, and instead not rejecting 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

**5. Discussions**

Results from the analysis showed ANC and PNC to be statistically significant predictors of newborn outcomes in the study. Hence, concluded that there is a significant relationship between ANC and PNC with newborn outcomes.

**5.1. Quality of Care**

Findings from this research study have proven to be similar with results from other research studies. 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. Different research studies have shown that ANC and PNC attendance were strongly related to newborn survival. In another report, it proved that women who attended ANC and PNC were more likely to have their newborns survive [2, 14]. Similarly, cross-sectional study evaluated different factors that promoted newborn outcomes and found that ANC and PNC attendance is strongly related to newborn survival [7].

In this study, result showed statistical significance for 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 [1, 10]. 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.

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 [8, 12].

**5.2. Limitations of the Study**

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.

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.

## 6. 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. A study that proved pregnant women in LMICs who received free transportation support are more likely to utilize ANC services and delivery at the health facility [3, 4]. 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.

## Abbreviation

*ANC*: Antenatal care

*EmONC*: emergency obstetric newborn care

*PNC*: Postnatal care

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

*VHWs*: Village Health Workers

*MoH*: Ministry of Health

*FMoH*: Federal Ministry of Health

*IDPs*: Internally Displaced Persons

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