HANDLING OVER DISPERSION WITH NEGATIVE BINOMIAL AND GENERALISED POISSON REGRESSION MODELS IN ANALYSIS OF ANTENATAL VISITS UTILISATION IN NIGERIA

BY

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CERTIFICATION

I certify that this work titled "Handling Over Dispersion with Negative Binomial and Generalized Poisson Regression Models: A Case Study Of Antenatal Visits Utilization In Nigeria" was carried out by Ugalahi Linda in the Department of Epidemiology and Medical Statistics, Faculty of Public Health, University of Ibadan under my supervision.

.....23/3/2015

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DEDICATION

To God for His faithfulness

To my family for their love

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LIST OF ACRONYMS

AIC	Akaike Information Criterion
ANC	Antenatal Care
BIC	Bayesian Information Criterion
FANC	Focused Antenatal Care
GPR	Generalized Poisson Regression
MDG	Millennium Development Goal
NARHS	National HIV/AIDS and Reproductive Health Survey
NBR	Negative Binomial Regression
NDHS	National Demographic and Health Survey
PR	Poisson Regression
WHO	World Health Organization

ABSTRACT

Majority of pregnancy related complications and deaths can be prevented through the utilization of antenatal care (ANC) services. Utilisation of ANC service is measured through number of visits made to health facilities. The number of visits to an ANC facility is a count data and it is often modeled by the Poisson regression. However it is sometimes erroneously used in situations where over dispersion of the response variable exist i.e. variance exceeds the mean. Negative Binomial and Generalised Poisson regression models are alternative models for estimating regression parameters in the presence of over dispersion. This study examined the pattern of ANC xiiutilization, determined the factors that affect the optimum utilisation of ANC visits and compared Poisson, Negative Binomial and Generalized Poisson regression models to determine the best statistical model which describes the utilisation of ANC visits.

A nationally representative sample of women within reproductive age 15-49 years within households in communities was obtained from the National Demographic and Health Survey (NDHS) of 2013. The number of ANC visits and optimal utilization defined as four or more ANC visits were outcome variables and other explanatory variables include age, region, employment status, wealth index, husband's/partner's employment status, husband's/partner's educational level, place of residence and place of ANC. Binary logistic regression was used to determine the factors associated with optimal utilization, while the Poisson, Negative Binomial and Generalized Poisson regression models were also used to determine the factors associated with number of ANC visits. The best model was selected based on the values of -2logL, AIC and BIC selection test/criteria. Analysis was done on SPSS version 20 and STATA version 12.

The mean age of the women was 29 years (SD=7.0), 49.2% had no formal education and 23.5% belonged to the poorest wealth quintile. About 65% had at least one visit while 52.5% achieved optimum utilisation. Several factors were found to affect optimal utilization some of which include age; (35-49 years) (OR=1.354, 95% CI: 1.093, 1.678), geopolitical zone; south west (OR= 4.396, 95% CI: 3.493, 5.533), higher educational level (OR= 1.883, 95% CI: 1.359, 2.610). Of the three regression models Generalized Poisson regression had the least; -2logL of 81230.048, AIC=81282.048 and BIC=81475.433. Age; (35-49 years) (IRR= 1.142, 95% CI: 1.053, 1.240), south west geopolitical zone; (IRR=1.682, 95% CI: 1.589, 1.781) and rural place of residence; (IRR=0.910, 95% CI: 0.874, 0.947) were amongst other factors as determinants of the number of ANC visits.

The factors associated with number of ANC visits include age, geopolitical zone, educational status, wealth index, husband's/partners educational and employment status. In the presence of over dispersion, Generalised Poisson Regression was found to be the best regression model to estimate the factors which affect the number of ANC visits.

Key words: Antenatal care, optimum utilisation, over dispersion, model selection

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Maternal morbidity and mortality occur due to complications during pregnancy and child birth. These pregnancy related issues contribute very much to the overall ill health in the world. The World Health Organization (WHO) estimates that maternal mortality is over 500 000 deaths per year and 99 percent of these occur in developing countries. Maternal mortality ratio in African countries is 830 per 100 000 live births while it is 24 per 100 000 in European countries (World Health Report, 2005). Sub-Saharan Africa has 19 countries with this high mortality ratio. Maternal mortality ratio in Nigeria is 545 per 100 000 live births, this indicates that Nigeria accounts for about 10 percent of the world's overall maternal mortality. Maternal deaths also vary within a country amongst its sub population with higher deaths found among its rural dwellers than the urban dwellers (NDHS, 2009; WHO, 2005).

Maternal mortality is an important pointer to maternal health and well-being of a country. The health and survival of a child, the welfare of a family is affected by maternal mortality and morbidity (Adamu, 2011).

Maternal mortality is defined by the World Health Organization (WHO, 2004) as "the death of a woman while pregnant or within 42 days of a termination of a pregnancy irrespective of the duration and the site of the pregnancy, from any cause related or aggravated by the pregnancy or its management but not from accidental and incidental causes."

The Millennium Development Goal 5 (MDG 5) focuses on improving maternal health and reducing maternal mortality by 75 percent by 2015 from what it was in 1990, subsequently in 2006 the introduction of a second target was included which is to achieve universal access to reproductive health facility by reproductive age women (15-49) by 2015 (Adamu, 2011).

Majority of maternal deaths occur as a result of major pregnancy related complications, these complications can be identified and managed promptly to ensure safety of women throughout the duration of pregnancy; this is achievable through professional healthcare services obtainable in an antenatal care facility (NARHS, 2013).

Utilization of antenatal facility is measured by the number of visits, timing of the visit and characteristics of users and non-users. WHO reports that there is 98 percent coverage of at

least one visit to antenatal facility in industrialized countries while in developing countries it is 68 percent, the use of these facilities has an increment of 21 percent for developed countries and 4 percent for sub Saharan Africa between the year 1990 through to 2000/2001 (WHO and UNICEF, 2003).

In 2008 the estimated number of women getting prenatal care was about 58 percent in Nigeria according to the World Bank, (2013), these are the women who attended at least one visit connected to or during pregnancy and were attended to by a skilled health worker. The women in urban dwelling areas have a higher percentage than those in rural areas (Babalola et al, 2013)

Ante natal services are important in preventing complications where possible and any complications detected are referred for proper treatment. All women should have access to basic maternity care during prenatal period and delivery. The ante natal healthcare serves as an entry point for a woman into a healthcare facility; it functions as a link between a woman and her family to a formal health facility and increases the chances of her using a skilled birth attendant during delivery. It has an important function of offering the woman advice and information about appropriate place of delivery and recognizing the early signs of complications and how to seek for help from a professional health provider (WHO, 1994; Ornella et al, 2006; Banta, 2003).

According to WHO a woman needs at least four visits (optimum utilisation) to an antenatal care facility to attain full life saving potentials provided for women and their babies (WHO, 2002). During the period of 2006 to 2013, only 56% of women attended at least four visits to ANC facility globally, however only 52% of women attended four antenatal care visits for developing countries and 38% for low income countries (WHO, 2011). Some of the benefits of attending an antenatal clinic include the following; first, identification and management of obstetric complications such as preeclampsia and tetanus toxoid immunization; second, intermittent preventive treatment for malaria during pregnancy and third, identification and management of infections including HIV, syphilis and other sexually transmitted infections (Ornella, et al, 2006; Bernstein, 2001).

The utilisation of antenatal care facilities is assumed to greatly reduce pregnancy related deaths and the general well-being of both mother and child (Banda, 2003). Other components of antenatal care include education on nutrition and health care, counseling on signs of health dangers, birth plan, health history taking, physical examination and vaccinations to support

good health during pregnancy as well as after birth (Adewoye et al). Furthermore, it provides an opportunity to offer prophylactic treatments such as vitamins and folic acid supplements (WHO, 1994)

Antenatal care is essential to safe motherhood such that the WHO includes it in its safe motherhood package for maternal health; this package includes the following: comprising family planning, quality antenatal care, clean and safe delivery and access to essential obstetric care for high risk pregnancies and complications, these are referred to as the four pillars of safe motherhood (WHO, 1994).

Different antenatal care programs have been invented by WHO, the initial program which consist of multiple visits (traditional antenatal care) and the reduced visit program (focused antenatal care) (WHO, 2002), were pregnant women are categorized into two; the first category are those referred to as low risk pregnancies and attend a minimum of four visits, visits may increase if the need arises. The second are those with a health challenge or a risk factor that need special care (Banda, 2003, 2013; Vogel et al, 2013).

1.2 PROBLEM STATEMENT

Access to and utilisation of antenatal care facilities is not adequate in Nigeria with about 60 percent coverage in 2013 which is a decrease from an estimate of 64 percent in 1991 of pregnant women who have attended at least one visit, for a visit of four or more the percentage is far lower with below 60 percent utilisation for 1990 through 2013 (NDHS, 2013).

There are several programs and policies put in place by governments to achieve the MDG 5, but with a 60 percent coverage for at least one visit and 51 percent for at least four visits (NDHS, 2013) achieved in Nigeria, when compared to 98 percent coverage in developed countries (WHO, 2003), shows a difference and allows room for improvement.

An estimated 800 women die every day from preventable pregnancy related causes (WHO, 2013). Pregnancy related complications such as infections, eclampsia, and obstructed labour and maternal deaths can be effectively reduced through services obtainable in antenatal care services. Despite the many benefits that can be attained from antenatal care, women do not utilize them optimally.

Nigeria is a diverse country, it comprises of many ethnic groups. The country is divided into six geopolitical zones; North Central, North East, North West, South East, South South and South West. The two regions in the country i.e. Northern and Southern regions have marked socioeconomic and cultural practices which may account for differences in the factors which affect the utilisation of antenatal care visits (NDHS, 2009). There is a significant variation amongst socioeconomic factors, depending on the wealth status of the family which the woman belongs.

Antenatal care visits has a higher utilisation in urban areas than in rural, there is variation in utilisation based on geopolitical regions with the Northwest and northeast having the least utilisation in terms of number of visits. Many studies have identified factors which are responsible for preventing women from seeking medical assistance; identifying and understanding these reasons can help improve the utilisation of these health facilities. These factors include getting money for treatment, distance to health facility, having to take transport, getting permission to go for treatment, looking for someone to go with, concern for who health provider may be either a male or female attendant and any other specific problem, ignorance, quality and content of service (Yohannes, 2013; Shrestha 2013).

The number of visits to antenatal healthcare facility is the outcome variable of interest in this study and it is a count variable. Count variables take non negative integer values. Poisson regression is widely used for count outcome variable data analysis however it is sometimes erroneously used: in situations where over dispersion occurs that is variance of the response variable exceeds the mean, it is inappropriate to use Poisson regression as it underestimates the standard error and exaggerates the significance of regression parameters (Ismail and Jemain, 2007; Sileshi, 2008). Due to the heterogeneous nature of the data, over dispersion usually occur in such count outcome variable. There is more variability around the model's fitted values than is consistent with a Poisson formulation that is the mean does not equal the variance; over dispersion (Sadia, 2013). To correct this problem, Negative Binomial Regression and Generalised Poisson Regression which are more special cases of Generalised Linear Model were used in this study.

1.3 JUSTIFICATION

Nigeria has the second highest maternal mortality in the world and only an estimated 60 percent of pregnant women attend antenatal care and are attended to by a health professional. Maternal health is one of the indicators of the health status of a country and it is greatly

influenced by antenatal care as this is a channel of educating women about their health issues as well as that of their children. Utilisation of antenatal facility can help prevent complications of pregnancy and thereby improve the health of women of reproductive age in the country.

Studies have identified factors that affect the use of antenatal facility in Nigeria. Several of these studies were done based on individual local government areas and states; Adewoye et al 2013, Onasoga et al 2012, Onasoga et al 2014, Onoh et al 2012, Umeora et al 2008, Ibor et al 2011, Dairo and Owoyokun 2010, Awusi et al 2009. Other studies were based on data collected at regional level; Adekanle et al, 2008, Amosu et al, 2011, Sambo et al, 2013. A few however, have utilized nationwide data; Nwosu et al, 2012, Adamu, 2011, Ononokpono 2013.

Women educational status, household wealth (economic) status, distance of antenatal service and differences in utilisation pattern amongst the six geopolitical zones of the country were identified as factors associated with use of antenatal care (Nwosu et al, 2012; Brown et al,2008). Poor communication, poverty, cultural norms, personal cost and poor power supply were identified as factors that affect the quality of care obtainable in an antenatal care facility; these reasons invariably affect the utilisation of these facilities (Ekabua et al, 2011). Physical accessibility of health facilities was identified as a factor that affects utilisation of ANC visits (Melhado, 2007)

As the deadline for the Millennium Development Goals (MDG 5, which focuses on maternal health and access to health facilities) approaches, it is important to evaluate the impact of Nigerian government policy and intervention programs put in place towards reducing maternal mortality by 75 percent and access to health facilities. Therefore, the rationale of this study is to define how close is Nigeria to achieving MDG 5 considering the deadline for achieving MDG 5 is 2015 which is less than a year away.

This study will also apply Poisson, Negative Binomial and Generalised Poisson regression models to the National Demographic and Health Survey (NDHS 2013) dataset to determine which model best fits the nature of the outcome variable; number of visits to an antenatal facility. It also suggests the Negative Binomial and Generalised Poisson regression models as alternative models for handling over dispersion. Furthermore, these models will be compared to ascertain which model is best for describing over dispersion.

1.4 OBJECTIVES

1.4.1 Main Objective

To ~~determine~~ the best statistical model that describes the utilisation of antenatal care visits.

1.4.2 Specific Objectives

1. To examine the pattern of utilisation of antenatal care visits.
2. To determine the socio economic factors across Northern and Southern geopolitical regions that affects optimum utilisation of antenatal care visits.
3. To determine the factors that affect optimum utilisation of antenatal care visits.
4. To compare PR, NBR and GPR models in the analysis of number of ANC visits in the presence of over dispersion.

CHAPTER TWO

LITERATURE REVIEW

2.1 BRIEF HISTORICAL REVIEW OF ANTENATAL CARE

Antenatal care is an all-encompassing term used to describe medical procedures and care a woman is given during pregnancy and child birth. It ensures the safety of both mother and child (Ekabua et al, 2011).

Antenatal care has been in existence for over 100 years, a woman was educated on the importance of healthy nutrition and maintaining good weight and monitored for any signs of complications. This is similar to what is obtainable in the current care aside from the addition of screening and diagnostic tests and reduced number of visits (Phelan, 2008).

Antenatal care was introduced in the United States and Europe in the 1900s by social reformers and nurses; antenatal care was studied by William Farr in 1914, he concluded that it reduced fetal mortality by 40 percent. It was later introduced to Nigeria in the 1950s and 1960s, its usage was creditable but it however dropped in the 1990s due to the system failing and rise in the use of spiritual churches and unorthodox health services (Ekabua et al, 2011).

2.2 COMPONENTS OF ANTENATAL CARE

The traditional antenatal care which required multiple visits and classified pregnant women into low risk and high risk pregnancy is no longer sufficient in reducing mortality as some low risk pregnancies go on to develop complication and in some cases death. These multiple visits where characterized with irregular attendance and long waiting time (Amosu, 2011). This led to a randomized multicenter trial by WHO in 53 antenatal clinics in 5 different countries; Argentina, Cuba, Saudi Arabia and Thailand to compare the traditional antenatal care (ANC) of multiple visits to that of focused antenatal care (FANC). The findings from the study led to the initiation of the new model; Focused Antenatal Care (FANC) in which a woman requires only four visits unless any risk factors are identified. The activities in FANC include: a first visit, a classifying form which is used to classify women into the basic component group or the specialized care depending on the presence of any risk factor detected in applying classifying form. There is a referral provision whereby a woman can be referred between the two groups (WHO, 2002).

WHO guidelines on FANC include general examination of the women and test procedures that are of benefit and serve an immediate purpose; monitoring fetal development, measurement of blood pressure in order to check for signs of hypertension disorder, urine test for presence of protein and bacteria, blood test for sexually transmitted diseases and HIV/AIDS, immunization against tetanus and giving vitamin supplements. Health education on nutrition, hygiene, breastfeeding, family planning, infection prevention and early signs of complications, weight and height measurement are all important components of antenatal care (Phelan, 2008; Adamu, 2011; Sharma et al, 2013).

2.3 COVERAGE AND TREND

Coverage is expressed as the fraction of women who have had at least one visit. Globally ANC has achieved a high coverage of 71 percent of women attending any ANC; over 95 percent of women in developed countries have access to antenatal care while in Sub-Saharan it is 69 percent. Trend in Sub-Saharan Africa indicate slow growth with an increase of 4 percent in the last 10 years. Factors that are responsible for low coverage include inequity, quality of antenatal service and cultural norms (Ornella et al, 2006).

In Nigeria, National HIV/AIDS and Reproductive Health Survey (NARHS 2005) reported 59 percent of pregnant women within 5 years preceding the survey used antenatal care, with 85 percent and 47 percent utilisation in urban and rural residence respectively. In terms of geo-political zones, South West had the highest with 91 percent and the lowest was North West with 36 percent. These results are slightly different from the survey of 2012 (NARHS 2012), ANC use was 65 percent with urban residence having 82 percent compared to rural residence having 57 percent. South East had a higher usage of 86 percent and North West 49 percent (NARHS, 2013).

2.4 BENEFITS OF ANTENATAL CARE

Antenatal care is an important component of healthcare every pregnant woman needs to have access to and this helps to improve the health of a population. WHO outline some benefits to include: provision of health education on basic health issues, provision of evidence based interventions and care which prevents complications, encourages use of skilled birth attendant at delivery, it serves as an entry point for women into the healthcare system, it offers an opportunity to develop a birth and emergency plan, it provides a venue of promoting lasting health to women beyond pregnancy period (Ornella et al, 2006). Lack of antenatal

care has been related with maternal and infant death, low birth weight, anemia, premature delivery (Ononokpono et al, 2013; Onoh et al 2012). Non utilisation of antenatal care services leads to missed opportunities for counseling to prevent mother to child transfer of HIV and education on malaria treatment as well as prevention using mosquito treated nets (WHO and UNICEF, 2003).

2.5 FACTORS AFFECTING THE UTILISATION OF ANTENATAL HEALTH CARE SERVICES

As mentioned earlier the utilisation of antenatal care services is still not optimal in Nigeria despite the benefits it offers and several national programs aimed at improving maternal health. To implement these programs effectively, understanding the factors that affect the utilisation of antenatal care services at community level is important. The utilisation of antenatal care facility is measured by the following;

Availability: this addresses the type and number of existing resources available to antenatal facility to provide services for the number of patients and to meet the type of need required. The facility should have adequate medical supplies, staff, emergency products and service should be available and adequate. Poor staffing, few and far apart facilities affect utilisation, in Nigeria the doctor patient ratio is 28 to 100 000 patients (1: 3600) (Aigbe, 2012); in southern Ethiopia, a study identified the quality of service provided as an influence on utilisation, satisfaction encourages further use (Yohannes, 2013). In the absence of antenatal services provided by skilled health staffs, women use traditional birth assistants which often is not the best option hence the provision of programs aimed at training traditional birth attendants by WHO in its safe motherhood package program to help combat this problem (WHO, 1994).

Accessibility: the location of a health facility and distance of client's residence from the health facility is a factor that affects utilisation, an unreliable transportation system and bad roads contribute to long travel time and waiting time in health facilities; these are barriers to utilisation. Urbanization which comes with better road network and transport system improves use of antenatal services (Aigbe and Zannu, 2012). In Zambia it was found that there was a strong influence of distance to antenatal facility and quality of service provided on utilisation (Kyei et al, 2012).

Affordability: this involves the ability of patients to pay their health bills; the cost may include direct medical cost or other indirect cost like loss of possible income, transportation. Some studies have shown that women are aware of antenatal care services but due to lack of resources they do not utilize them (Adewoye, 2013). In Ilorin, North Central state of Nigeria urbanized areas use antenatal service 74 percent, which shows better utilisation compared to 36 percent in rural areas; poor urban dwellers suffer more than non-poor rural dwellers (Babalola et al, 2013). A study among pregnant women in Ife, Osun State in Nigeria have identified affordability to be a major factor in utilisation, also the time of ANC clinics which usually takes place at morning hours coincide with working hours (Onasoga et al, 2012).

Acceptability: this informs the extent to which the health facility takes into consideration the local, cultural and social values of the community. It also considers the interpersonal skills of the health provider and the practice obtainable in the health facility. Non utilisation and late attendance were attributed to ignorance and misconception of the purpose and the right time of attending antenatal care, health education and mass enlightenment campaigns will improve acceptability (Ebeigbe et al, 2010; Onoh et al, 2012; Sambo et al, 2013).

Socio-economic status of family: studies have shown that there is a positive relationship between utilisation of health facility and a high socio economic status of a family. Antenatal care services, delivery with a skilled health attendant, postnatal care all increase with increase in household wealth, educational level, occupation of husband, household income (Sharma et al 2013; Umeora et al, 2008; Trujillo et al, 2014).

2.6 ANDERSEN AND NEWMAN CONCEPTUAL FRAMEWORK FOR ANALYSIS OF HEALTHCARE SERVICE UTILISATION

This frame work identifies conditions that either enable or inhibit utilisation. The theoretical framework emphasizes the importance of; (1) the characteristics of the health service delivery system, (2) changes in medical technology and social standards concerning the definition and treatment of disease and (3), the individual factors of utilisation (Andersen and Newman, 2005).

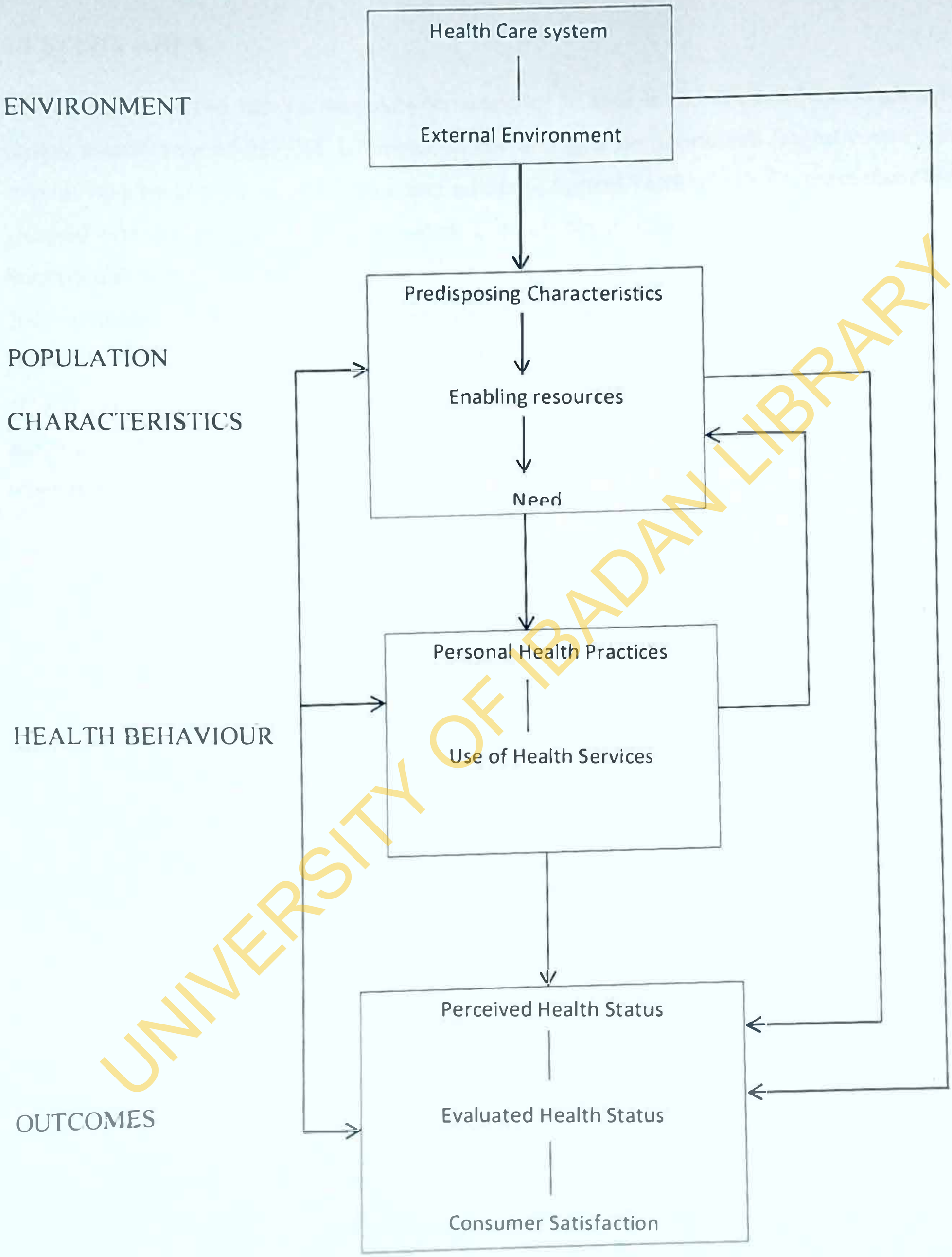
Utilisation of healthcare services can be viewed to be influenced by the individual behavior. An individual's access to and use of health services is considered to be a function of three determinants:

Predisposing factors: this includes socio cultural characteristics of an individual that exist before their illness such as; Social factors amongst which are education, occupation, ethnicity, social networks, religion and culture. Secondly, health beliefs which includes attitudes, values and knowledge of people towards healthcare system. Thirdly, demographics which include age and gender which affects an individual's utilisation of health services.

Enabling factors: this provides the means of obtaining care of which the factors include personal/family characteristics such as income/wealth index, regular source of care and quality of social relationship. Community; spatial distribution of available health personnel and facilities for use by an individual, travel time and waiting time in health facility affect utilisation. Other determinants include genetic factors and psychological characteristics.

Need factors: immediate cause of health service use including functional and health problem that generates the need for health care services. The way people perceive their health that is self-health assessment and symptoms experienced during a period of time affect their utilisation of health services (Shrestha, 2013; Andersen and Newman, 2005).

Figure 2.1: Conceptual framework for Healthcare Service Utilisation



Source: Andersen and Newman Framework (2005)

CHAPTER THREE

METHODOLOGY

3.1 STUDY AREA

Nigeria is one of the sub-Saharan African countries located in the West African region. It covers a total area of 923,768 kilometer square and it is the fourteenth largest country in Africa. Nigeria comprises of 36 states and a Federal Capital Territory (FCT), these states are grouped into six geopolitical zones; North Central, North East, North West, South East, South-South and South West. There are 774 local government areas in the country. Based on 2006 national census figure, the population of the country was 140,431,790 with an annual growth rate of 3.2 percent. Nigeria is the most populous country in Africa; it has an estimate of 374 ethnic groups. The major ethnic groups are Hausa/Fulani, Yoruba and Igbo which account for 68 percent. Edo, Ijaw, Ibibio, Kanuri, Ebira, Nupe and Tiv make up 27 percent, other minority ethnic groups make up 5 percent.

3.2 STUDY DESIGN

Data for this study was obtained from the National Demographic and Health Survey (NDHS 2013) and secondary data analysis was conducted to answer the study objectives. The survey made use of a cross-sectional population based study design. This study explores the factors affecting antenatal care visits.

3.3 STUDY POPULATION

The population for the 2013 National Demographic and Health Survey was drawn from females aged 15-49 years and males aged 15-59 years in Nigeria. Samples were derived from the target population by random selection of households in the country, the selected individuals were interviewed. For the purpose of this study, women within the reproductive age 15-49 in Nigeria are the target population. The study population was gotten as sub-samples from the samples of women interviewed in the survey of the year 2013.

3.4 SAMPLING FRAME AND TECHNIQUE

NDHS 2013 is a nationally representative sample. Administratively, Nigeria is divided into 36 states and FCT, these were divided into local government areas (LGA) and each LGA was further divided into smaller localities. The 36 states were regrouped by geopolitical location

into six zones and using the 2006 Population census implementation each locality was subdivided into Enumeration Areas (EAs). A complete list of the EAs served as the sample frame of the survey.

The sampling technique for the 2013 NDHS was a stratified sample, selected at random in three stages from the sampling frame. The first stage; each state was stratified into urban and rural areas; this resulted in a list of localities. Second stage; one enumeration area was randomly selected from a selected locality with equal probability selection, the resulting list of households served as sampling frame for the selection of households in the third stage. The third stage; fixed number of 45 households were selected in every urban and rural cluster through equal probability systematic sampling using the household listing.

3.5 SAMPLE SIZE

A representative sample of 40 320 households were selected for the NDHS 2013 survey. Of the households occupied 38 522 were successfully interviewed of which 39 902 women aged 15-49 and 18 229 males aged 15-49 were eligible for interview however 38 948 females and 17 359 males were successfully interviewed. For this study, a sample size of 31 482 women within the reproductive age of 15-49 who gave birth five years prior to the survey and provided information about antenatal visits was utilized.

3.6 DATA COLLECTION

Three types of questionnaires were used; these are the household, woman's and man's questionnaires. A face to face interview was conducted and all women within reproductive age 15-49 were selected and interviewed. Information was collected about antenatal visits from women who gave birth five years prior to the survey.

3.7 STUDY VARIABLES

The following are the variables used in this study;

3.7.1 Outcome Variable

Number of visits to antenatal care facility; Each woman who had given birth in the last five years preceding the survey were asked about the number of visits they had to an antenatal health care facility.

3.7.2 Explanatory Variables

The following factors will be included as explanatory variables in the study:

1 Age (mother's age)

2 Region (where the woman resides based on the six geopolitical zones)

3 Residence (the location of the woman's residence based on rural or urban)

4 Educational level (educational attainment of the mother)

5 Religion (percentage distribution of women based on religious affiliation)

6 Wealth index (standard of living of the woman)

7 Occupation (the proportion of women who are currently working)

8 Place of antenatal (the type of facility where the woman attained antenatal care)

9 Husband's/partner's educational level (educational attainment the woman's of the husband/partner)

10 Husband's/partner's occupation (proportion of women's husband/partner currently working)

3.8 DATA MANAGEMENT AND ANALYSIS

Extraction of relevant data from the NDHS dataset was performed, simple summary statistics (percentage for categorical variables or mean for continuous variables) for all independent variables was also performed. Sample mean and sample variance of the dependent variable (number of antenatal care visits) was calculated to check for the presence of over dispersion or under dispersion. Socio economic factors that affect utilisation of ANC visits were identified across the two regions of the country i.e. northern and southern regions. Pearson chi-square and Deviance was utilized to evaluate the presence of over dispersion. These ascertained whether the data followed a standard Poisson, Negative Binomial or the Generalised Poisson regression model. The Poisson, Negative Binomial and Generalised Poisson regression parameters were estimated after fitting the independent variables to these regression models, 95% confidence interval and incidence rate ratio (IRR) were reported.

SPSS version 20 and STATA version 12 were used for analysis.

3.8.1 Over dispersion and Under dispersion: For count data, normal distribution assumptions are not satisfied in most cases. Poisson regression models makes available a standard procedure for analysis of count data and one of the assumptions of the Poisson distribution is that the variance is equal to its mean. This is often violated when the variance is lower or higher than the mean, leading to under dispersion and over dispersion respectively. Over dispersion means the occurrence of a higher variability (statistical dispersion) in a dataset than would be expected based on a given simple statistical model. This means the observed variance is higher than the variance of a theoretical model. Over dispersion occurs frequently in practice because most populations are heterogeneous that is non-uniform. It can be determined when the variance is greater than the mean. On the other hand, under dispersion means there is less variation in the data than predicted and can be determined when the variance is less than the mean (Alexander et al, 2005).

3.8.2 Assessing Model Fit: Dispersion parameter maybe estimated by deviance or Pearson statistics divided by its degree of freedom; if the ratio is greater than one (unity), over dispersion is present however if less than one, under dispersion is present.

3.8.3 Operational Definition of Optimum utilisation of Antenatal Care Visit: Optimum utilisation is measured by the number of visits made to ANC facility which ideally is a minimum of 4 visits, timing of visits and characteristics of users and non-users (WHO, 2002; Ornella et al, 2011), this definition of optimum utilisation of antenatal healthcare facility by WHO is the same for this study.

3.9 STATISTICAL MODELS

The statistical models used in this study include the following.

3.9.1 Binary Logistic Regression

A binary logistic regression is a statistical method used for analyzing dataset with one or more independent variable determining an outcome. The outcome variable is dichotomous or binary [0; absent and 1; present] that is only two possible outcomes (Tranmer and Elliot, 2005). In this study, a binary logistic regression model was fitted; the outcome variable antenatal healthcare utilisation was categorized into two; visits of less than four visits denoted as 0 (no utilisation) and visits of four or more visits denoted as 1 (optimum utilisation) and explanatory variables such as age, region, residence etc. as mentioned earlier. This categorization of utilisation is based on the optimum utilisation recommended by the WHO.

The logistic regression function which is the logit transformation of the probability of optimum utilisation is;

$$logit(p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} \; ; (1)$$

The logit transformation is defined as log odds and it is represented as;

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} \; ; (1.2)$$

Taking the exponential of equation (1.2), the exponential of the β coefficient that is e^{β_i} , is the odds ratio for the independent variable X_i. The odds ratio gives the relative amount by which the odds of the outcome increases or decreases.

Logistic regression generates the coefficients and its corresponding standard error and significance level. The β coefficients are estimated by the method of maximum likelihood. The Hosmer-Lemeshow goodness of fit test was used to test the goodness of fit of the logistic regression model.

Statistical models designed for analysis of count data used in this study are discussed below

3.9.2 Poisson Regression

Poisson regression is used in a situation where the dependent variable is a count variable; the counts are positive integers and has a mean greater than zero. A Poisson distribution is derived as a limiting form of binomial distribution when the number of trials becomes large and the probability of success is small. Poisson regression model expresses the logarithm outcome rate as a linear function of a set of predictors. It makes an important assumption that: for a sample of observations, the mean and the variance of the distribution are equal.

A random variable Z is said to have a Poisson distribution with parameter θ if it takes integer values: 0, 1, 2 ...∞.

The probability distribution is represented as

$$Pr\{Z = z\} = \frac{e^{-\theta}\theta^z}{z!} \quad ; (2)$$

$$z = 0,1,2 \ldots \infty$$

With mean and variance represented as;

$E(Z) = \theta$ and $var(Z) = \theta$ respectively.

Writing the parameter θ as a log linear model:

$$log\theta_i = x\beta_i$$

The Poisson regression which was fitted to the number of visits made to antenatal care facility, θ was expressed for the ten independent variables as shown below, where the explanatory variables are: (X_1= Age, X_2 = Region, X_3 = Residence, X_4 = Educational Level, X_5 = Religion, X_6 = wealth index, X_7 = occupation, X_8= place of antenatal, X_9= husband's/partner's educational level, X_{10}= husband's/partner's occupation).

$$\text{Log}(\theta) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} \; ; (2.1)$$

The parameter β which represents the expected change in the logarithm of the mean per unit change in the predictor X_i can be estimated by the maximum likelihood method.

3.9.3 Negative Binomial Regression

Under the Poisson regression the mean θ_i is assumed to be homogenous within the classes, however by defining a specific distribution for θ_i the classes become heterogeneous. Negative binomial regression model is a more generalised model than the Poisson regression. Making the assumption that the mean θ_i follows a gamma distribution with mean $E(\theta_i) = \mu_i$ and variance $\text{Var}(\theta_i) = \mu_i v_i^{-1}$ and Consider the Poisson distribution $Z_i \mid \theta_i$ with a conditional mean $E(Z_i \mid \theta_i) = \theta_i$; the marginal distribution can be shown to follow a Negative Binomial distribution (Sadia F. 2013).

The probability density function of a negative binomial distribution is represented as;

$$Pr[Z_i = z_i] = \sum Pr(Z_i = z_i|\theta_i) f(\theta_i) d\theta_i = \frac{\Gamma(z_i+v_i)}{\Gamma(z_i+1)\Gamma(v_i)} \left(\frac{v_i}{v_i+\mu_i}\right)^{v_i} \left(\frac{\mu_i}{v_i+\mu_i}\right)^{z_i} \; ; (3)$$

Where;

Mean is $E(Z_i) = \mu_i$ and variance is $var(Z_i) = \mu_i + \mu_i^2 v_i^{-1}$, v is the dispersion parameter.

The maximum log likelihood function of the distribution is expressed as;

$$log(\beta, \alpha) = \sum_i \left\{\sum_{r=1}^{z_i-1} log(1+\alpha r)\right] - z_i log(\alpha) - log(z_i!) + z_i log(\alpha\mu_i) - (z_i + \alpha^{-1}) log(1+\alpha\mu_i) \; ; (3.1)$$

The parameters (β, α), can be estimated by partial differentiation of the maximum log likelihood function with respect to β and α.

The negative binomial regression does not make the assumption of equality of the mean and variance in a distribution and it corrects for over dispersion in a dataset, over dispersion arises when the variance is greater than the conditional mean.

3.9.4 Generalised Poisson Regression

Generalised Poisson regression model adjusts for both under dispersion and over dispersion properties in a dataset. For the dependent variable number of visits to antenatal care, represented by Z_i, the probability distribution function of a generalised Poisson distribution is given as

$$f(z_i, \theta_i \alpha) = \left(\frac{\theta_i}{1+\alpha\theta_i}\right)^{z_i} \frac{(1+\alpha z_i)^{z_i-1}}{z_i!} \exp\left(-\frac{\theta_i(1+\alpha z_i)}{1+\alpha\theta_i}\right) \quad ; (4)$$

Where; z = 0, 1, 2 ...∞

The standard Poisson regression model is a special form of the generalised Poisson regression model, when α is zero, the probability function of the generalised Poisson random variable reduces to the Poisson probability function. The positive value of α in the equation above indicates over dispersion while a negative value of α indicates under dispersion property of the distribution.

The mean of the dependent variable is related to the independent variables through the link function; $\theta_i = (x_i \beta)$. which is a simple linear model. This model has the disadvantage of θ_i assuming any real value but a Poisson mean assume only count non negative values. To correct this problem the logarithm of the linear model is used; this gives a link log function;

$Log(\theta_i) = (x_i \beta)$. Taking the exponential of the model we have; $\theta_i = exp(x_i \beta)$.

In the link function. x_i is (k-1) dimensional vector of explanatory variables and β is a k dimensional vector of regression parameters and α is a dispersion parameter. The mean and variance of Z_i are given by; $E(Z_i \mid X_i) = \theta_i$ and $V(Z_i \mid X_i) = \theta_i(1 + \alpha\theta_i)^2$ respectively (Sadia F. 2013; Ismail, N. and Jemain, A.A., 2007).

In the generalised Poisson regression model, the parameters (β, α) can be estimated by taking the derivatives of the log likelihood function of the model; this means partial differentiation with respect to β and α of the logarithm function of equation (3.1) below;

$$logL(\alpha, \beta; z_i) = \sum_{i=1} \left\{ z_i \, log\left(\frac{\theta_i}{1+\alpha\theta_i}\right) + (z_i - 1)\log(1 + \alpha z_i) - \frac{\theta_i(1+\alpha z_i)}{1+\alpha\theta_i} - log(z_i!) \right\} \quad ; (4.1)$$

3.10 MODEL SELECTION

Models are used to approximate reality. Model selection is used to determine the best statistical model which best approximates reality given the set of data recorded and also minimize loss of information. The following goodness of fit tests were utilized in this study for model selection.

3.10.1 Chi-square -2log likelihood statistic: the maximized likelihood, L, for a given model is the value of the likelihood function when the parameters are substituted with their maximum likelihood estimates and the statistic -2logL this is used to compare models. It is useful for comparing models fitted to the same set of data as the value of both L depends on the number of observations in the data and -2logL is a measure of agreement between the model and the data. The larger the maximum likelihood the better the agreement between the model and observed data however, smaller the value of -2logL, the better the model.

3.10.2 Akaike Information Criterion: this method of model selection is based on a relationship between maximum likelihood estimation and Kullback-Leibler Information. This information criterion was developed by Akaike. It is derived under the assumption that the operating models belong to the approximating family.

$$AIC = -2logL(\theta) + 2K$$

Where $L(\theta)$ is the maximized likelihood function and K is the number of estimated parameters included in the model (number of variables plus the intercept). The log likelihood of the model of the data is the overall fit of the model. The smaller value of the log likelihood indicates a worse fit model. However after comparing different models the model with the minimum AIC value is the best model.

In AIC the compromise occurs between maximized log likelihood -2 logL(θ); which is the lack of fit component and k, the number of free parameters estimated within the model which is a measure of the compensation for the bias in the lack of fit when maximum likelihood estimators are used. The term 2k is the penalty term, the reason for using the penalty term is to prevent over fitting (Bozdogan, 2000).

AIC uses the log likelihood which is the probability of obtaining the chosen data under the given model: hence it makes sense to choose a model that makes the probability as large as

possible. The logarithm does not affect the value but the negative sign does, it means minimizing the value of the statistics.

3.10.3 Algorithm for AIC Cross Validation

1 Assess AIC for all models.

2 Identify the model with the smallest AIC value denoted by AIC_{min}. This is the best model.

3 To further compare the models the AIC difference will be calculated for each model; $D_i = AIC_i - AIC_{min}$

4 Compute the relative likelihood, $\exp(-\frac{1}{2}D_i)$ for each model

5 Compute Akaike weights w_i for each model, these are normalized relative likelihoods

$$w_i = \frac{exp[-\frac{1}{2}D_i]}{\sum_{i=1}^{m} exp[-\frac{1}{2}D_i]}$$

These weights can be interpreted as probabilities; the probability that the given model is the best model.

3.10.4 Bayesian Information Criterion: BIC is similar to AIC the difference is in the second term which depends on the sample size n.

$$BIC = -2log(L) + p\ log(n)$$

Where L denotes the log likelihood, p the number of parameters and n the number of rating classes or number of observation utilized in the model, the smaller the BIC, the better the model. The derivation of BIC assumes equal priors on each model and uninformative priors on the parameters, given each model (Zuccini, 2000).

The goal of BIC is to find the best model for prediction using highest posterior probability while the goal of AIC is to identify the model that most plausibly generated the data. Both AIC and BIC can be used whether the models are nested or not.

Information criterion supply information on the strength of evidence for each model, it does not make use of a significance level rather it is based on maximum likelihood. It has a high potential of selecting the best model as it is independent of the order in which the models are

computed. In this study all selection models were utilized, this was to ensure agreement between the three model selection methods in order to select the best model.

CHAPTER FOUR

RESULTS

The study involved analysis of the 2013 NDHS dataset for women within reproductive age. The total number was 31 482 however sample weights were applied and the sample size was 31 828.

4.1 SOCIO DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

The mean age of the women was 29.4 years (SD=7.0). Median number of visits to antenatal care. was 4 visits (Range =30). The mean number of ANC visits was 5 (SD=6.0), the variance was 36.861, and this informs over dispersion in the variable.

Women in the age group 20-34 years constitute the highest proportion (69.4%). The North West geo political zone has the highest proportion of respondents (37.0%). Majority of the women lived in rural areas (65.0%). Similarly, most of the women do not have any formal education (49.2%) and majority of these women practiced Islam religion (62.2%).

The distribution of these women in terms of wealth index revealed that most of them belong to the lowest wealth quintile i.e. poorest (23.5%) while the richest quintile has a proportion of 16.7%. A high proportion of the respondents were employed (70.6%), similarly 70.6% received antenatal care in a government health facility. A high proportion of the husband's/partners of these women had secondary education (29.1%) and were employed (99.2%). Table 1 shows the socio demographic characteristics of respondents.

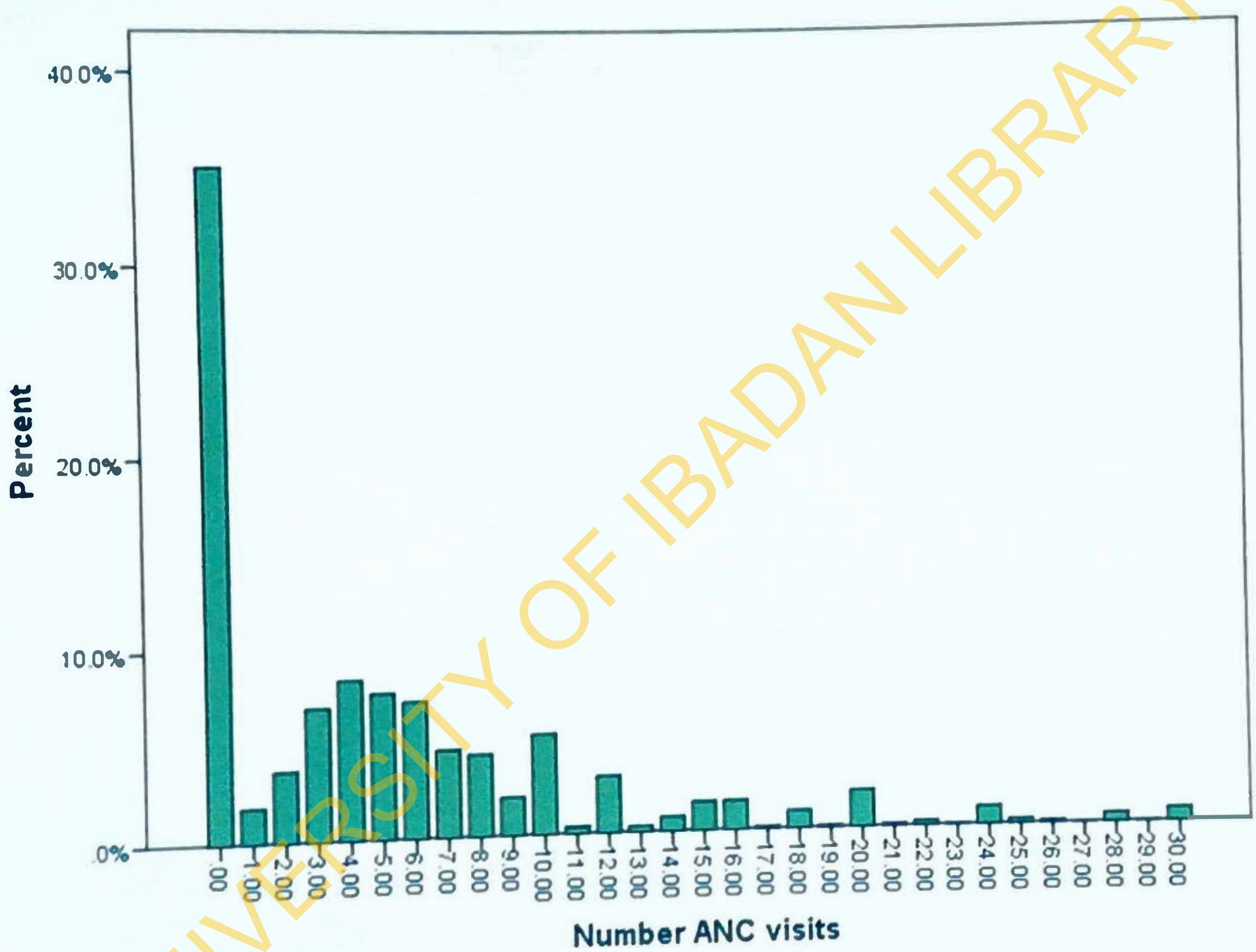
Table 1: Respondent's characteristics

Respondents Variables	N (%)
Age (in years)	
Less than 20	1597 (5.0)
20-34	22104 (69.4)
35-49	8128 (25.5)
Region	
North Central	4340 (13.6)
North East	5578 (17.5)
North West	11775 (37.0)
South East	2840 (8.9)
South South	2935 (9.2)
South West	4360 (13.7)
Residence	
Urban	11126 (35.0)
Rural	20702 (65.0)
Educational Level	
No Education	15657 (49.2)
Primary	6127 (19.3)
Secondary	8211 (25.8)
Higher	1834 (5.8)
Religion	
Christianity	11647 (36.8)
Islam	19689 (62.2)
Traditional	300 (0.9)
Wealth Index	
Poorest	7496 (23.5)
Poorer	7355 (23.1)
Middle	6001 (18.9)
Richer	5656 (17.8)
Richest	5320 (16.7)
Employment Status	
Unemployed	9324 (29.4)
Employed	22392 (70.6)
Place of ANC	
At a Home	388 (29.4)
Government health facility	9867 (70.6)
Private health facility	2967 (22.4)
Husband's/Partner's educational level	
No Education	12334 (39.8)
Primary	5884 (19.0)
Secondary	9035 (29.1)
Higher	3767 (12.1)
Husband's/Partner's employment status	
unemployed	237 (0.8)
employed	30903 (99.2)

4.1.1 Number of Antenatal Visit

The Chart below (Fig. 4.1) illustrates number of ANC visits. The minimum number of visits was zero (no visits) and the highest was 30. Women who had no visits to an ANC facility constituted 35.1% while the proportion of respondents with at least one visit was 64.9%.

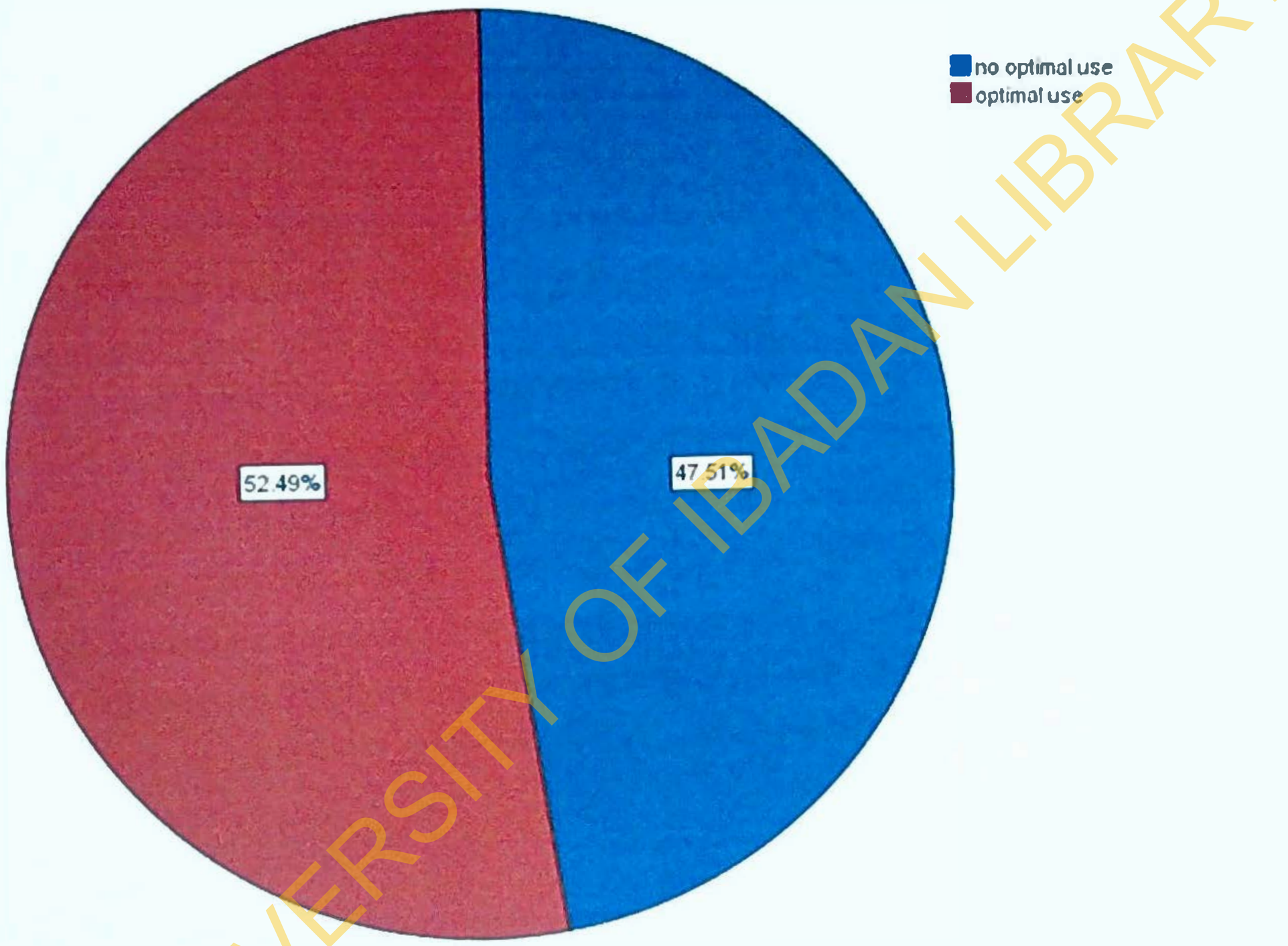
Figure 4.1: Bar Chart of number of ANC visits



4.1.2 Optimum utilisation of Antenatal Visit

Chart 2 below (Fig. 4.2) shows optimum utilisation of ANC visits, respondents with optimum utilisation (respondents with four or more visits) represented 52.5% while no utilisation (respondents with less than four visits) was 47.5%.

Figure 4.2: Pie chart of optimum utilisation of ANC visits



4.2 PATTERN OF OPTIMUM UTILISATION OF ANTENATAL CARE VISIT

Table 2 shows the pattern of utilisation of antenatal care visits, optimal antenatal visit was compared to no utilisation. ANC visits optimum utilisation were similar among respondents in the age groups 20-34 years and 35-49 years (54.1% vs. 53.4%) and these groups had higher utilisation compared to those in the age group less than 20 years (36.8%), ($p<0.001$). Respondents in the South West geo political zone had the highest optimum utilisation (89.8%) while respondents in North West zone had the least (30.7%), ($p< 0.001$). Urban dwellers had a higher utilisation rate compared to rural dwellers (77.6% vs. 38.9%), ($p<0.001$). Utilisation increased with increase in respondent's educational level, no educational level had the least proportion (27.9%) while higher educational level was highest (93.4%), ($p< 0.001$). Highest rate of utilisation was recorded among Christians (74.9%) compared to Islam (39.3%) and Traditional religions (35.0%), ($p<0.001$). There was increase in utilisation with increase in wealth quintile. The fifth wealth quintile i.e. the richest had the highest rates of utilisation (90.2%) while the poorest had the lowest rate (18.2%), ($p<0.001$). Respondents who were employed had a higher rate of utilisation compared with those unemployed (57.4% vs. 41.1%), ($p<0.001$). Respondents who had their ANC in private health facilities had the highest utilisation (90.3%), ($p< 0.001$), compared to those who went to government health facility (78.0%) and those who attended ANC at their homes or any other home (87.1%). Rate of utilisation of ANC visits increased with increase in husbands/partners educational level with those in higher educational level having the highest rates (82.6%), ($p<0.001$). Respondents with husband/partners who were unemployed had a higher rate of ANC visits compared to those who were employed, (71.4% vs. 51.9%), ($p< 0.001$).

Table 2: Pattern of ANC visit utilisation

Variables	Optimum utilisation N (%)	No utilisation N (%)	p-value
Age (years)			
Less than 20	479 (36.8)	821 (63.2)	<0.001
20-34	7091 (53.4)	6196 (46.6)	
35-49	2887 (54.1)	2448 (45.9)	
Region			
North Central	1603 (56.7)	1225 (43.3)	<0.001
North East	1334 (39.7)	2025 (60.3)	
North West	2260 (30.7)	5109 (69.3)	
South East	1425 (86.4)	225 (13.6)	
South South	1246 (68.0)	587 (32.0)	
South West	2588 (89.8)	294 (10.2)	
Residence			
Urban	5420 (77.6)	1567 (22.4)	<0.001
Rural	5037 (38.9)	7897 (61.1)	
Educational level			
No education	2699 (27.9)	6963 (72.1)	<0.001
Primary	2381 (62.7)	1414 (37.3)	
Secondary	4235 (80.8)	1006 (19.2)	
Higher	1142 (93.4)	81 (6.6)	
Religion			
Christianity	5519 (74.9)	1849 (25.1)	<0.001
Islam	4815 (39.3)	7425(60.7)	
Traditional	71 (35.0)	132 (65.0)	
Wealth index			
Poorest	844 (18.2)	3802 (81.8)	<0.001
Poorer	1601 (35.5)	2909 (64.5)	
Middle	2248 (58.9)	1569 (41.1)	
Richer	2680 (76.0)	848 (24.0)	
Richest	3084 (90.2)	335 (9.8)	
Employment status			
Unemployed	2435 (41.1)	3488 (58.9)	<0.001
Employed	7992 (57.4)	5939 (42.6)	
Place of ANC			
At a home	310 (87.1)	46 (12.9)	<0.001
Government health facility	7456 (78.0)	2105 (22.0)	
Private health facility	2557 (90.3)	274 (9.7)	
Husband's/partners educationallevel			
No education	1831 (23.8)	5856 (76.2)	<0.001
Primary	2112 (59.4)	1444 (40.6)	
Secondary	4106 (73.2)	1503 (26.8)	
Higher	2021 (82.6)	427 (17.4)	
Husband's/partners employment status			
unemployed	110 (71.4)	44 (28.6)	<0.001
employed	9977 (51.9)	9235 (48.1)	

4.3 SOCIO-ECONOMIC FACTORS AFFECTING ANC VISITS ACROSS NORTHERN AND SOUTHERN REGIONS

Socio economic factors which affect optimum utilisation of ANC visits are presented in table 3; respondents in the southern region within the age group 35-49 had the highest proportion of optimum utilisation (83.3%, p<0.001), while respondents in the northern region aged less than 20 had the least proportion of optimum utilisation (29.6%, p<0.001). Optimum utilisation increased with increase in educational level; respondents with higher educational level had the highest proportion of optimum utilisation in the two regions, 89.3% and 95.4% for northern and southern regions respectively (p<0.001). The same pattern was observed in the wealth index of respondents. The richest had the highest proportion in the regions, 83.7% for north and 92.9% for south. In the northern region, respondents in the poorest quintile had 17.2% of ANC utilisation while in the southern region had 45.2% of ANC utilisation, (p <0.001). Respondents who were employed and belong to the southern region had highest proportion of optimum utilisation of ANC (83.6%) while in the northern region, 41.7% had ANC utilisation, (p<0.001). Unemployed respondents had proportions of 78.6% for the southern region and 32.3% for northern region (p<0.001) optimum utilisation. Optimum utilisation increased with increase in the respondents husband's/partners educational level, the pattern is similar for the two regions (north 75.0% vs. south 93.1%, p<0.001), no utilisation had higher proportion in the north compared to the south (78.2% vs. 42.5, p<0.001) for respondents husbands/partners who had no education. Employment status of respondents husband/partner showed that in the northern region, respondents with employed spouses had 38.1% optimum utilisation while respondents with unemployed spouses had 60.6% optimum utilisation (p<0.001). In the southern region the proportions were; unemployed 81.0% vs. employed 83.2% but these were not statistically significant (p=0.579).

Table 3: Socio economic factors across northern and southern regions

Variables	Northern Region			Southern Region		
	Optimum utilisation	No utilisation	p-value	Optimum utilisation	No utilisation	p-value
	N (%)	N (%)		N (%)	N (%)	
Age (years)						
Less than 20	315 (29.6)	748 (70.4)	<0.001	164 (69.5)	72 (30.5)	<0.001
20-34	3521 (39.2)	5469(60.8)		3570 (83.1)	727(16.9)	
35-49	1361 (38.9)	2142(61.1)		1525 (83.3)	306(16.7)	
Educational level						
No education	2411 (26.3)	6744(73.7)	<0.001	288 (56.8)	219(43.2)	<0.001
Primary	1063 (51.2)	1013(48.8)		1318 (76.7)	400(23.3)	
Secondary	1365 (70.9)	559 (29.1)		2870 (86.5)	44 (13.5)	
Higher	359 (89.3)	43 (10.7)		784 (95.4)	38 (4.6)	
Wealth Index						
Poorest	768 (17.2)	3710(82.8)	<0.001	76 (45.2)	92 (54.8)	<0.001
Poorer	1182(30.7)	2669(69.3)		419 (63.6)	240(36.4)	
Middle	1275 (50.3)	1258(49.7)		973 (75.7)	312(24.3)	
Richer	1127 (66.9)	557 (33.1)		1553 (84.2)	291(15.8)	
Richest	845 (83.7)	165 (16.3)		2239 (92.9)	170 (7.1)	
Employment status						
Unemployed	1545 (32.3)	3245(67.7)	<0.001	890 (78.6)	243(21.4)	<0.001
Employed	3632 (41.7)	5082(58.3)		4360(83.6)	857(16.4)	
Husband's/partners educational level						
No education	1581 (21.8)	5671(78.2)	<0.001	249 (57.5)	184(42.5)	<0.001
Primary	890 (44.2)	1123(55.8)		1223 (79.2)	321(20.8)	
Secondary	1557 (59.1)	1076(40.9)		2549 (85.7)	426(14.3)	
Higher	1066 (75.0)	356 (25.0)		955 (93.1)	71 (6.9)	
Husband's/partners employment status						
Unemployed	43 (60.6)	28 (39.4)	<0.001	68 (81.0)	16 (19.0)	0.579
Employed	5072 (38.1)	8247(61.9)		4905(83.2)	988(16.8)	

4.4 LOGISTIC REGRESSION ANALYSIS OF FACTORS AFFECTING OPTIMUM UTILISATION OF ANTENATAL CARE VISITS

Binary logistic regression was performed to investigate the factors that affect the optimum utilisation of antenatal care facility. The chi square value for the Hosmer Lemeshow goodness of fit test was statistically not significant {$x^2(8, N = 12116) = 9.863$, p=0.275}, this indicates that the model is a good model and fits the data. The full model containing all predictors was statistically significant, $x^2(24, N = 12116) = 1460.939$, $p < .001$, indicating the model was able to distinguish between respondents who reported and did not report optimum utilisation. The model as a whole explained between 11.4% (Cox and Snell R square) and 18.3% (Nagelkerke R squared) of the variance in optimum utilisation and correctly classified 81.0% of cases.

As shown in Table 4, respondents aged 35-49 were more likely to utilize ANC facility optimally compared to those aged less than 20 years (OR=1.354, 95% CI: 1.093, 1.678). Optimum utilisation of ANC visits differ with respect to geo political zones. Respondents in South East, South south and South west respondents were 3, 2 and 4 times (OR=2.665, 95% CI: 2 2.096, 3.328; OR= 1.665, 95% CI: 1.328, 2.078; OR= 4.396, 95% CI: 3.493, 5.533) more likely to have optimum utilisation of ANC visits than North central zone respectively. Respondents with primary education were 3.4% less likely than those with no education to utilize ANC optimally, this was however not statistically significant (OR=0.966 p=0.628). However, respondents with secondary and higher educational levels were 1 and 2 times (OR=1.232, 95% CI: 1.044, 1.454; OR= 1.883, 95% CI: 1.359, 2.610) more likely than those with no education to utilise ANC visits optimally respectively. Respondents who belong to the richest wealth quintile were about 2.6 times more likely to utilize ANC visits optimally (OR=2.644, 95% CI: 2.057, 3.399) compared to respondents in the poorest quintile. Employed respondents were about 1 time more likely than unemployed respondents to utilise ANC visits optimally (OR= 1.090, 95% CI: 0.975, 1.218), however this was not statistically significant, (p=0.129). Respondents whose place of ANC was a government or private health facility were 1 time (OR= 1.178, 95% CI: 0.837, 1.656) and 1time (OR=1.180, 95% CI: 0.822, 1.693) respectively more likely to utilize ANC visits optimally compared to respondents whose place of ANC was at a home, this was not statistically significant. (p=0.348 and p=0.369) respectively. Respondents whose husband's/partner's belong to higher educational level were 2 times more likely to utilize ANC visits optimally compared to

respondents whose husbands had no education (OR= 1.704, 95% CI: 1.398, 2.077). Respondents whose husband/partner were employed were 61.2% less likely to utilise ANC visits optimally compared to those whose husband's/partners were unemployed (OR=0.388, 95%CI: 0.168, 0.895).

Table 4: Logistic regression analysis of factors that affect optimum utilisation of ANC

Variables	OR	S.E.	P-value	95% CI	
				Lower	Upper
Age					
Less than 20*					
20-34	1.151	0.101	0.164	0.944	1.403
35-49	1.354	0.109	0.006	1.093	1.678
Region					
North Central*					
North East	0.866	0.084	0.087	0.735	1.021
North West	0.871	0.077	0.074	0.748	1.013
South East	2.665	0.123	0.000	2.096	3.389
South South	1.661	0.114	0.000	1.328	2.078
South West	4.396	0.117	0.000	3.493	5.533
Residence					
Urban*					
Rural	1.036	0.067	0.598	0.909	1.181
Educational level					
No education*					
Primary	0.966	0.071	0.628	0.841	1.110
Secondary	1.232	0.084	0.013	1.044	1.454
Higher	1.883	0.166	0.000	1.359	2.610
Religion					
Christianity*					
Islam	1.005	0.076	0.943	0.866	1.167
Traditional	0.878	0.275	0.637	0.512	1.507
Wealth index					
Poorest*					
Poorer	1.172	0.077	0.040	1.007	1.363
Middle	1.494	0.086	0.000	1.263	1.768
Richer	1.732	0.100	0.000	1.423	2.106
Richest	2.644	0.128	0.000	2.057	3.399
Employment status					
Unemployed*					
Employed	1.090	0.057	0.129	0.975	1.218
Place of ANC					
At home*					
Government facility	1.178	0.174	0.348	0.837	1.656
Private facility	1.180	0.184	0.369	0.822	1.693
Husband's/partners educational level					
No education*					
Primary	1.308	0.074	0.000	1.133	1.511
Secondary	1.496	0.076	0.000	1.289	1.735
Higher	1.704	0.101	0.000	1.398	2.077
Husband's/partners employment status					
Unemployed*					
Employed	0.388	0.427	0.026	0.168	0.895

*Reference category

4.5 POISSON, NEGATIVE BINOMIAL AND GENERALISED POISSON REGRESSION ANALYSIS OF FACTORS AFFECTING ANC VISITS

4.5.1 Poisson Regression

Table 6 shows the regression parameters for Poisson regression, the deviance for the model was about 11.547 times larger than the degree of freedom which indicated the possible existence of over dispersion.

The number of ANC visits was higher by approximately 9.5% among respondents aged 20-34 years compared to respondents aged less than 20 years (IRR= 1.095, 95% CI: 1.062, 1.130). The number of ANC visits was higher by 18.2% among respondents aged 35-49 years compared to respondents aged less than 20 years (IRR= 1.182, 95% CI: 1.145, 1.221). Number of ANC visits among respondents from the south east, south south and south west zones were higher by 29.9% (IRR=1.299, 95% CI: 1.272, 1.327), 60.5% (IRR=1.605 , 95% CI:1.573, 1.637) and 61.5% (IRR=1.615, 95% CI:1.587, 1.644) respectively compared to number of ANC visits by respondents in the north central zone. However respondents from the north east and north west had lower number of ANC visits by approximately 10.6% (IRR=0.894, 95% CI: 0.875, 0.913) and 32.7% (IRR=0.673, 95% CI: 0.658, 0.688) respectively compared to respondents from north central. Respondents in rural residence had a 10.5% decrease (IRR=0.895, 95% CI: 0.884, 0.907) in number of ANC visits compared to respondents in urban residence. The number of ANC visits increased by 5.2% among women with secondary education compared to women with no education (IRR=1.052, 95% CI: 1.031, 1.074). Women who practiced Islam and Traditional religions had a 1.8% and 16% decrease respectively in number of ANC visits compared to women who practice Christianity (IRR=0.982, 95% CI:0.967, 0.996; IRR=0.840, 95% CI: 0.786, 0.898). Respondents in the richest wealth quintile had a 32.5% increase in number of ANC visits compared to respondents in the poorest wealth quintile (IRR=1.325, 95% CI: 1.286, 1.366). Employed respondents had a 3.4% decrease in number of ANC visits compared to unemployed respondents (IRR= 0.966, 95% CI: 0.953, 0.979). Respondents who had ANC visits in government facility had a 14.4% decrease in the number of antenatal visits compared to those who had visits at a home (IRR=0.856, 95% CI: 0.831, 0.880). Similarly respondents who had ANC visits in a private health facility had a 7.3% decrease in the number of ANC visits compared to respondents who had ANC visits at a home (IRR=0.927, 95% CI: 0.900, 0.955). Respondents whose Husband/partner had higher education had a 6.0% increase in the number

of ANC visits compared to respondents whose husbands/partners had no education (IRR=1.060, 95% CI: 1.035, 1.085). Women whose husband/partner was employed had a 20.5% decrease in number of ANC visits compared to women whose husband/partner was unemployed (IRR=0.795, 95% CI: 0.764, 0.828).

Table 6: Parameter estimates for Poisson regression

Parameters	β	IRR	Standard error	p-value	95% CI for IRR	
					Lower bound	Upper bound
Constant	2.417	11.212	0.372	<0.001	10.506	11.965
Age						
less than 20*						
20-34	0.091	1.095	0.017	<0.00	1.062	1.130
35-49	0.168	1.182	0.019	<0.00	1.145	1.221
Region						
North central*						
North east	-0.112	0.894	0.010	<0.001	0.875	0.913
North west	-0.396	0.673	0.008	<0.001	0.658	0.688
South east	0.262	1.299	0.014	<0.001	1.272	1.327
South south	0.473	1.605	0.016	<0.001	1.573	1.637
South west	0.479	1.615	0.015	<0.001	1.587	1.644
Residence						
Urban*						
Rural	-0.111	0.895	0.006	<0.001	0.884	0.907
Educational level						
No education*						
Primary	0.009	1.009	0.010	0.361	0.990	1.029
Secondary	0.051	1.052	0.011	<0.001	1.031	1.074
Higher	-0.008	0.992	0.013	0.559	0.966	1.019
Religion						
Christianity*						
Islam	-0.0185	0.982	0.007	0.014	0.967	0.996
Traditional	-0.174	0.840	0.029	<0.001	0.786	0.898
Wealth Quintile						
Poorest*						
Poorer	0.068	1.070	0.014	<0.001	1.042	1.099
Middle	0.074	1.076	0.015	<0.001	1.048	1.106
Richer	0.180	1.197	0.017	<0.001	1.164	1.231
Richest	0.282	1.325	0.020	<0.001	1.286	1.366
Employment Status						
Unemployed*						
Employed	-0.035	0.966	0.007	<0.001	0.953	0.979
Place of ANC						
At a home*						
Government facility	-0.156	0.856	0.012	<0.001	0.831	0.880
Private facility	-0.075	0.927	0.014	<0.001	0.900	0.955

Husband's/partners educational level						
No education*						
Primary	0.001	1.001	0.011	0.939	0.980	1.022
Secondary	-0.004	0.996	0.010	0.715	0.976	1.017
Higher	0.058	1.060	0.016	<0.001	1.035	1.085
Husband's/partners employment status						
Unemployed*						
Employed	-0.229	0.795	0.016	<0.001	0.764	0.828
Df	12530					
Pearson x^2	320104.174					
Deviance	144685.914					
LogL	-96233.475					
-2logL	192466.95					
AIC	192516.95					
BIC	192702.9					

*reference category

4.5.3 Negative Binomial Regression

Table 7 shows the regression parameters for Negative Binomial regression, the ratio of deviance to degree of freedom for the model is about 0.70 (approximately 1), this indicates an adjustment for over dispersion. Alpha of the model had a value significantly greater than zero (alpha=0.653, 95% CI= 0.637, 0.671), this showed that the data was better modeled by negative binomial regression due to the presence of over dispersion. The estimates of the standard error were slightly larger than those of the Poisson regression.

The number of ANC visits was higher by approximately 8.2% among respondents aged 20-34 years compared to respondents aged less than 20 years (IRR= 1.082, 95% CI: 1.000, 1.170), similarly the number of ANC visits was higher by approximately 15% among respondents aged 35-49 compared to respondents aged less than 20 years (IRR= 1.154, 95% CI: 1.063, 1.253). The number of ANC visits for respondents in the different geopolitical zones increased by 32% for south east (IRR=1.324, 95% CI: 1.244, 1.410), 61.5% for south south (IRR=1.615, 95% CI: 1.521, 1.715) and 65.9% for south west (IRR=1.659, 95% CI: 1.574, 1.748) compared to respondents in the north central zone. However respondents from the north east and north west zones had a decrease of 10.8% (IRR=0.892, 95% CI: 0.845, 0.943) and 31.7% (IRR=0.683, 95% CI: 0.646, 0.723) respectively number of ANC visits compared to respondents form north central. Respondents in rural residence had a 10.5% decrease (IRR=0.895, 95% CI: 0.884, 0.907) of number of ANC visits compared to respondents in urban residence. Women who practiced Traditional religions had approximately 23.5% decrease in the number of ANC visits compared to women who practice Christianity (IRR=0.765, 95% CI: 0.639, 0.917). Respondents in the richest wealth quintile had a 27% increase in the number of ANC visits compared to respondents in the poorest wealth quintile (IRR=1.276, 95% CI: 1.178, 1.381). The number of ANC visits was lower by about 14.3% among respondents who had ANC visits in a government facility compared to those who had ANC visits at a home (IRR=0.857, 95% CI: 0.780, 0.943). Respondents whose Husbands/partners had higher education had a 7.3% increase in the number of ANC visits compared to respondents whose husband/partner had no education (IRR=1.073, 95% CI: 1.007, 1.144). Women whose husband/partner was employed had a 18.7% decrease in the number of ANC visits compared to women whose husband/partner was unemployed (IRR=0.813, 95% CI: 0.707, 0.935).

Table 7: Parameter estimates for Negative Binomial Regression

Parameters	β	IRR	Standard error	p-value	95% CI For IRR	
					Lower bound	Upper bound
Constant	2.400	11.005	1.130	<0.001	8.999	13.458
Age						
Less than 20*						
20-34	0.078	1.082	0.043	0.048	1.000	1.170
35-49	0.141	1.154	0.048	<0.001	1.063	1.253
Region						
North central*						
North east	-0.114	0.892	0.025	<0.001	0.845	0.943
North west	-0.380	0.683	0.020	<0.001	0.646	0.723
South east	0.282	1.324	0.423	<0.001	1.244	1.410
South south	0.480	1.615	0.050	<0.001	1.521	1.715
South west	0.507	1.659	0.044	<0.001	1.574	1.748
Residence						
Urban*						
Rural	-0.098	0.906	0.018	<0.001	0.872	0.941
Educational level						
No education*						
Primary	0.011	1.011	0.026	0.679	0.961	1.063
Secondary	0.045	1.047	0.029	0.106	0.990	1.106
Higher	0.007	1.001	0.040	0.866	0.932	1.087
Religion						
Christianity*						
Islam	-0.003	0.996	0.022	0.869	0.954	1.041
Traditional	-0.272	0.765	0.071	0.004	0.639	0.917
Wealth Quintile						
Poorest*						
Poorer	0.064	1.067	0.034	0.043	1.002	1.135
Middle	0.050	1.053	0.035	0.119	0.987	1.124
richer	0.133	1.145	0.041	<0.001	1.067	1.229
Richest	0.241	1.276	0.052	<0.001	1.178	1.381
Employment Status						
Unemployed*						
Employed	-0.037	0.964	0.019	0.054	0.928	1.001
Place of ANC						
At a home*						
Government health facility	-0.154	0.857	0.042	<0.001	0.780	0.943
Private health facility	-0.069	0.934	0.047	0.173	0.846	1.031
Husband's/partners educational level						
No education*						
Primary	0.005	1.005	0.028	0.867	0.952	1.061
Secondary	0.027	1.026	0.028	0.339	0.973	1.083
Higher	0.072	1.073	0.035	0.029	1.007	1.144
Husband's/partners employment status						
Unemployed*						

Employed	-0.206	0.813	0.058	0.004	0.707	0.935
Df	12530					
Pearson x^2	29796.910					
Deviance	8821.099					
logL	-41896.924					
-2logL	83793.848					
AIC	83845.849					
BIC	84039.233					

*reference category

Employed	-0.206	0.813	0.058	0.004	0.707	0.935
Df	12530					
Pearson x^2	29796.910					
Deviance	8821.099					
logL	-41896.924					
-2logL	83793.848					
AIC	83845.849					
BIC	84039.233					

*reference category

4.5.4 Generalised Poisson Regression

Table 8 shows the regression parameters for Generalised Poisson regression. The positive value of phi (0.182 95% CI: 0178, 0.186) from the model indicated an adjustment for Poisson over dispersion. The estimates of the standard error were similar to those of the Negative Binomial regression, although slightly higher.

The number of ANC visits was higher by approximately 14% among respondents aged 35-49 years compared to respondents aged less than 20 years (IRR= 1.142, 95% CI: 1.053, 1.240). The number of ANC visits among respondents from the different zones increased by 33.6% for south east (IRR=1.336, 95% CI: 1.251, 1.428), 61.8% for south south (IRR=1.618, 95% CI: 1.516, 1.727) and 68.2% for south west (IRR=1.682, 95% CI: 1.589, 1.781) compared to respondents in the north central zone. Furthermore, respondents from the north east and north west had a 10.9% decrease (IRR=0.891, 95% CI: 0.844, 0.941) and31.4% decrease (IRR=0.686, 95% CI: 0.649, 0.725) respectively in the number of ANC visits compared to respondents form north central. Respondents in rural residence had about 9% decrease (IRR=0.910, 95% CI: 0.874, 0.947) in the number of ANC visits compared to respondents in urban residence. Women who practiced Traditional religion had approximately 26.2% decrease in the number of ANC visits compared to women who practiced Christianity (IRR=0.738, 95% CI: 0.619, 0.882). Respondents in the richest wealth quintile had a 25% increase in the number of ANC visits compared to respondents in the poorest wealth quintile (IRR=1.254, 95% CI: 1.155, 1.361). Women who had ANC visits in government health facilities had a 14.3% decrease in the number of ANC visits compared to those who had ANC visits at a home (IRR=0.857, 95% CI: 0.769, 0.954). Respondents whose husband/partner had higher education had a 7.9% increase in the number of ANC visits compared to respondents whose husbands/partners had no education (IRR=1.079, 95% CI: 1.012, 1.151). Women whose husband/partner was employed had a 17.6% decrease in the number of ANC visits compared to women whose husband/partner was unemployed respondents (IRR=0.824, 95% CI: 0.702, 0.967).

Table 8: Parameter estimates for Generalised Poisson regression

Parameters	β	IRR	Standard error	p-value	95% CI for IRR	
					Lower bound	Upper bound
Constant	2.385	10.861	1.231	<0.001	8.698	13.562
Age (years)						
Less than 20*						
20-34	0.075	1.078	0.043	0.057	0.998	1.165
35-49	0.133	1.142	0.477	<0.001	1.053	1.240
Region						
North central*						
North east	-0.115	0.891	0.025	<0.001	0.844	0.941
North west	-0.378	0.686	0.019	<0.001	0.649	0.725
South east	0.290	1.336	0.045	<0.001	1.251	1.428
South south	0.481	1.618	0.054	<0.001	1.516	1.727
South west	0.520	1.682	0.049	<0.001	1.589	1.781
Residence						
Urban*						
Rural	-0.095	0.910	0.019	<0.001	0.874	0.947
Educational level						
No education*						
Primary	0.011	1.011	0.026	0.663	0.961	1.064
Secondary	0.043	1.044	0.030	0.135	0.987	1.104
Higher	0.014	1.013	0.042	0.742	0.934	1.100
Religion						
Christianity*						
Islam	0.003	1.003	0.024	0.896	0.958	1.050
Traditional	-0.303	0.738	0.067	<0.001	0.619	0.882
Wealth Quintile						
Poorest*						
Poorer	0.065	1.067	0.033	0.035	1.005	1.133
Middle	0.044	1.045	0.034	0.172	0.981	1.114
richer	0.117	1.124	0.041	<0.001	1.047	1.206
Richest	0.226	1.254	0.052	<0.001	1.155	1.361
Employment status						
Unemployed*						
Employed	-0.038	0.963	0.019	0.059	0.926	1.001
Place of ANC						
At a home*						
Government health facility	-0.0155	0.857	0.047	0.005	0.769	0.954
Private health facility	-0.0654	0.937	0.054	0.254	0.837	1.048
Husband's/partners educational level						
No education*						
Primary	0.004	1.004	0.028	0.877	0.951	1.060
Secondary	0.040	1.041	0.028	0.144	0.987	1.098
Higher	0.076	1.079	0.035	0.021	1.012	1.151
Husband's/partners employment status						
Unemployed*						

Employed	-0.194	0.824	0.067	0.018	0.702	0.967
Df	-					
Pearson x^2	-					
Deviance	-					
Wald x^2	2683.40 (p-value <0.001)					
logL	-40615.024					
-2logL	81230.048					
AIC	81282.048					
BIC	81475.433					

*reference category

4.6 AIC CROSS VALIDATION

Table 9 shows the comparison of the three models PR, NBR and GPR utilising the difference D_i between the models and the model with the least value, hence the relative likelihood were computed, this led to Akaike weights computation. Using this cross validation of AIC, GPR model would be ranked best model 100% of the time when comparing these three models i.e. PR, NBR and GPR.

Table 9: Model comparison using AIC cross validation algorithm

Model	LogL	K	AIC	D_i	Relative likelihoods	Akaike weights W_i
PR	-96233.475	35	192516.95	111286.902	0.000	0.000
NBR	-41896.924	36	83845.849	2615.801	0.000	0.000
GPR	-40615.024	26	81230.048	0.000	1.000	1.000
					Sum=1	

CHAPTER FIVE

DISCUSSION

This study examined factors affecting antenatal care visits among women within the reproductive age (15-49 years) in Nigeria from the National Demographic and Health Survey, 2013. It focused on socio demographic factors of the respondents which affect utilisation of antenatal care visits, also on factors which affect optimum utilisation and on model selection to obtain the best regression model for the count data number of antenatal visits when there is an indication of the presence of over dispersion.

5.1 PATTERN OF UTILISATION OF ANC VISITS

The prevalence of having at least one antenatal visit was 64.9%, this prevalence is similar to the prevalence of 60% recorded in the NDHS, (2013) report and also corroborates with the prevalence of about 60% by WHO, (2003) , but slightly higher than the 47% obtained in the NARHS, 2012 report. Prevalence of optimum utilisation i.e. four or more visits was 52.5%, this lower prevalence maybe due to poor knowledge and awareness of the focused group antenatal care (Amosu et al, 2011; Umeora et al, 2007). Pattern of optimum utilisation of antenatal care visits varies based on socio demographic factors. There is a marked difference in optimum utilisation between the different age groups with older respondents 35-49 years attending ANC visits more than younger respondents. This finding agrees with the Adekanle, (2008) study. This may be due to more knowledge about the advantages of ANC by the older women. Optimum utilisation differs amongst the six geopolitical zones. Higher proportion of women in the south east, south south and south west utilized ANC visits optimally, north central had a slightly higher proportion of women having optimum utilisation compared to lower proportion observed in the north east and the north west zone had the lowest proportion. This is similar to results obtained from Adamu, (2011) and may be explained by the seeming higher socio demographic features of women residing in the south compared to those in the northern region. The type of residence the woman lives affects optimum utilisation this corresponds with NARHS, (2013) report with urban dwellers having a higher rate of utilisation. Results showed that with increase in educational level. there is an increase in optimum utilisation. Respondents with higher educational level had the highest number of visits. This is compatible with findings from a study by Nwosu et al. (2011). This may be due to the fact that with higher education, female autonomy is enhanced; which leads to better decision about self-health. The type of religion a woman practices has an effect on optimum utilisation of ANC visits Kulkarni and Nimbalkar,

(2008). With increase in wealth quintile, there is an increase in the proportion of women who utilized ANC visits optimally. The richest quintile had the highest proportion while the poorest had the least proportion. Several studies (Nisar et al, 2003; Shrestha, 2013; Kulkarni and Nimbalkar, 2008) have linked wealth quintile of women to utilisation; this may be because higher quintiles are associated with higher education, employed women and these women may also have husbands/partners with higher educational status and are also employed, and these factors influence optimum utilisation of ANC. The place of antenatal care significantly affects the optimum utilisation of ANC visits. Women who attended ANC in private health facilities had higher proportion compared to government facility and those who had visits at a home. This could be explained by under staffed government hospitals which leads to a long waiting time and affects the quality of service (Aigbe, 2012).

5.2 SOCIO ECONOMIC FACTORS AFFECTING OPTIMUM UTILISATION OF ANC VISITS ACROSS NORTHERN AND SOUTHERN REGIONS

The six geopolitical zones in the country were combined into two regions; Northern and Southern regions due to broad similarities observed in optimum utilisation of ANC visits in the three northern zones and also in the three southern zones. Results showed that socio economic factors such as wealth index, educational level were associated with ANC visit utilisation, this finding is similar with Owoo and Lambon-Quayefio, (2013). Social structure was found to be a factor that affects ANC utilization, through communication at social gathering, women talk to their peers and discuss about different features of life including health related issues. Optimum utilisation of ANC visits is significantly higher in the southern region compared to northern region. This agrees with findings from Nwosu et al, (2012); Adamu, (2011); NHDS, (2013) and NARHS, (2012) reports. This marked difference in optimum utilisation among the two regions may be explained by higher socio economic indices which consistently affects optimum utilisation of ANC visits. Respondents from southern region had higher proportion of educated women, more respondents belong to the richest wealth quintile compared to the northern region and these are factors which strongly influence utilisation of ANC visits. Hospital bills are mostly made through out-of-pocket payments in Nigeria as health insurance scheme does not cover for most of her citizens. Educated women are empowered to make decisions about self-health, stop traditional and cultural practices and hence use up-to-date healthcare services to improve health. Other important socio economic factors such as employment status, husband's/partners educational level affect optimum utilisation of ANC visits, this could be due to increase in family income

to aid in hospital bills payment, transportation fares amongst other related expenses and better knowledge of the importance of utilisation of modern healthcare facilities. Husband's/partners employment status was found to be a major factor that affects optimum utilisation of ANC visits in northern region but not for southern region. This may be due to a high dependence of women in the northern region on their husbands, both for income and decision making about health, whereas in the southern region more women are educated and this gives autonomy for decision making about healthcare seeking behaviour and a certain level of independence. Age was observed to be a factor affecting optimum utilisation with older respondents age 34-49 having highest proportions. This could be explained by increase in knowledge of importance of ANC visits and it is expected that with increase in age there should be increase in education.

5.3 DETERMINANTS OF OPTIMUM UTILISATION OF ANC VISITS

Age, geopolitical zone, educational level of respondent, wealth index, husband's/partners educational level and husband's/partners employment status were found to strongly predict optimal ANC visit utilisation. Yohannes (2013), Onasoga et al (2012), found age, educational status as determinants of utilisation of ANC; older respondents are expected to be more knowledgeable and have access to information about the importance of ANC visits. Educated women are more likely to have four or more visits, with higher education comes enhanced female autonomy which leads to decision making about self-health and to do away with cultural practices and utilize modern health care services. Simkhada et al (2007), found wealth index, husband's/partners educational level to significantly affect utilisation. This may be as a result of an association between wealth index, employment status and educational level; all these mentioned factors lead to increase in family income which influences use of healthcare services as hospital bills and other related expenses can be paid for, this is due to the non-all-encompassing Health Insurance Scheme in Nigeria. The woman's place of residence, religion, employment status and place of ANC were not statistically significant in this study; this may be due to spread of health facilities to both urban and rural areas, due to increase in education and access to information leading to less beliefs in traditional and cultural practices as well as spiritual beliefs. This however disagrees with Titaley et al (2010) and Adamu (2011) which found urban women attend ANC visits more than rural residents. Similarly, the employment status of the woman was found not to be a determinant of optimum utilisation of ANC, this may be due to the fact that some healthcare facilities provide ANC care at subsidized rates aiding unemployed women to afford bills payment, also

government policies and awareness programs about importance of ANC visits gives employed respondents the required excuse and time off work to attend ANC visits. The place of ANC was not a significant determinant, this may explained by the training of more skilled birth attendants who pay regular ANC visits to respondents in their homes or a designated home, the spread of private hospitals providing easy access to ANC services enable women to have ANC visits at a convenient time and place.

5.4 MODEL SELECTION; POISSON, NEGATIVE BINOMIAL AND GENERALISED POISSON REGRESSION MODELS

This study demonstrated that GPR model is the best model to determine the factors that predict the number of antenatal care visits to a health care facility, when there is an indication of the presence of over dispersion. The values of standard error of Poisson regression are smaller than those of Negative Binomial regression, the relatively larger values of NBR standard error led to some insignificant regression parameters β. Similarly larger values of standard error of the parameters in the GPR model led to more insignificant regression parameters. The large value of standard error in NBR and GPR shows that in the presence of over dispersion, the Poisson regression overstates the significance of the regression parameter and the significance of the evaluation factors. This is compatible with findings from other studies (Piza, 2012; Ismail and Jemain, 2007; Sadia F. 2013; Islam et al, 2013). Generalised Poisson regression was the best model selected among the three models; this was inferred from the values of the model selection test/criteria utilized in this study these are -2logL, AIC and BIC. All these test/criteria established GPR as the best model because it had the smallest value of all three selection test/criteria. The cross validation of AIC agrees with the selection of GPR as the best model for count data in the presence of over dispersion.

5.5 LIMITATIONS

The NDHS is a cross sectional survey, the information provided on the number of visits to ANC was subjective; the exact number of visits reported may not be precise. Secondly, inadequacy of some variables of interest such as place of antenatal care had a lot of missing data.

5.6 CONCLUSION

This study measured the pattern and factors that affect optimum utilisation of ANC visits. The factors include age, geopolitical zone, educational status, wealth index, husband's/partners educational and employment status.

It also selected the best regression model which best models a count data (number of visits to ANC) in the presence of over dispersion. It found GPR to be the best model for describing factors which affect utilisation of ANC visits.

5.7 RECOMMENDATIONS

Measures to improve utilisation of ANC visits for women should address the following issues; improve education of females, greater awareness of the benefits antenatal services especially in the Northern region of the country and rural development.

It is recommended that objective criteria such as AIC, BIC amongst others should be used to selected appropriate statistical models for analyzing data with over dispersion properties. In performing analysis on number of visits to ANC, Generalised Poisson regression should be utilized in the presence of over dispersion in the data.

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