EFFECTS OF MATERNAL HEALTH CARE UTILISATION ON CHILD IMMUNISATION AND MOTHER'S WELLBEING AMONG AGRICULTURAL HOUSEHOLDS IN RURAL NIGERIA

BY

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DOCTOR OF PHILOSOPHY

of the

UNIVERSITY OF IBADAN

MARCH, 2023

CERTIFICATION

I certify that this study was carried out by Mobolaji Victoria, AFOLABI with Matric number 158943 under my supervision in the Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria.

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DEDICATION

I dedicate this work to God almighty, the Most High; for his endless mercy, grace and favour that preserved me, and also to my parents Mr, and Mrs. Afolabi who have always believed in me and supported me, and to my Husband, Engr. Oluwadare John Adejoorin for the unflinching love, understanding and support he has been giving me since the inception of our relationship.

ACKNOWLEDGEMENTS

Indeed, the Lord has been good to me. My profound gratitude goes to my main supervisor, Prof. K. K. Salman. I feel lucky and thankful to have benefitted from his knowledge and wealth of experience. I also appreciate his tremendous support. May he continue to grow from strength to strength. My sincere thanks and appreciation also go to other members of my supervisory committee in person of: Prof Kemisola O. Adenegan, Dr. Ogheneruemu Obi-Egbedi and Prof. M. D. Dairo for their time, commitment, support and feedback in the course of the programme. May Almighty God reward you abundantly.

My appreciation and gratitude also go to the Head Department of Agricultural Economics Prof. T. T. Awoyemi and other members of the academic staff in the Department in persons of Professors M. A. Y. Rahji, V. O. Okoruwa, S. A. Yusuf, B. T. Omonona, O. A. Oni, Adetola. I. Adeoti as well as Doctors. Adeola. O. Olajide, Oluwakemi. A. Obayelu, Abimbola. O. Adepoju, Olubunmi. O. Alawode, F. A. Sowunmi and C. O Idiaye. I am also extending my profound gratitude to the non-academic staff members of the Department namely: Alhaja Fausat Oladejo, Mr C. A. Ogbolu, Mr K. O. Moses and Mrs. Nike. A. Olawande.

I am grateful to my parents, Mr and Mrs A. O. Afolabi and my in-laws Mr and Mrs M. A. Adejoorin. I am very grateful to Dr Adedoyin. M. Rufai, Dr Mutiat. B. Salawu, for their willingness to share their bright thoughts with me. May Almighty God grant your heart's desires. My special thanks go to my colleagues Mr. A. O. Ogunniyi, Mr. G. B. Dada, Mr. I. O. Fasakin, as well as other postgraduate students of the Department. My journey with you has impacted my life positively and I pray we meet in higher places in the nearest future.

My appreciation is not complete without my sincere gratitude to my husband Engr, Oluwadare. J. Adejoorin. He has really empowered me and I will forever be grateful to him for being a good partner to me and a loving father to our children. Words alone cannot express my gratitude to him for his unflinching love, support and commitment since the beginning of our relationship. My appreciation also goes to my children Michelle, Mike and Melvin Adejoorin. They have indeed assisted me in finishing my assignment like they

always say “and now my uncle would be very happy with me”. I thank them for sparing me part of their time to achieve this objective.

On a final note, I would like to appreciate everyone who has made this a reality and also apologise for not mentioning every name.

M. V. Afolabi

ABSTRACT

The health of a mother before, during and after pregnancy is essential for the wellbeing of the household, generally and that of the mother and child, specifically. Maternal Health Care Utilisation (MHCU) in rural Nigeria is low with high maternal mortality. It has also been established that MHCU is a veritable input that could improve child health outcomes through child immunisation. There is limited empirical evidence that link MHCU to child immunisation and mother's wellbeing therefore, effect of MHCU on child immunisation and mother's wellbeing among agricultural households investigated.

Secondary data sourced from 2018 National Demographic Health Survey (for rural Nigeria) were utilised in this study. Information used included household characteristics (age, education of household heads, region and household size), child characteristics (age, birth order, sex and birth weight), mothers' characteristics (occupation, age at first birth, education and media exposure). The level of MHCU was profiled across the six geopolitical zones of Nigeria and its variables were; delivery in health care facility, availability of skilled birth attendant and postnatal care. The MHCU was categorised into low (≤0.333), moderate (0.334-0.667) and high (0.668-1.00) levels among mothers while child immunisation status was categorised into unimmunised (not vaccinated), partially (uncompleted vaccination) and fully immunised. Wellbeing Index (WI) was categorised into low (≤0.333), moderate (0.334-0.667) and high (0.668-1.00) wellbeing levels. Data were analysed with descriptive statistics, multiple correspondence analysis, Fuzzy set analysis, Tobit regression model and extended ordered logit model at $\alpha_{0.05}$.

The age of household heads, household size and age of mothers at first birth were 44.7±9.9 years, 8.3±3.6 persons and 18.5±3.8 years, respectively. Majority of mothers were uneducated (59.65%). Children were male (51.47%), with third or above birth order (90.66%) and not weighed at birth (84.05%). The mean MHCU was 0.54±0.23 among mothers. Mothers with moderate MHCU were (39.1%). More mothers in South West (24.16%) and North Central (17.1%) had low MHCU. Mother's occupation (β = -0.0383), education (β = -0.0669), age at first birth (β = -0.0082), media exposure (β = -0.0347), sex of household head (β = -0.0394) and birth order (β = 0.0198) influenced MHCU. Children (55.85%) were unimmunised and were found in the North West and the North East zones. Mean WI of mothers was 0.424±0.167 and most mothers had moderate WI (74.77%). The MHCU (β=0.042) and husband's education (β = 0.068) improved partially immunised status in children while husband's education (β = 0.0247) and mothers fully employed into agriculture (β = 0.0107) improved child's full immunisation status. Furthermore, MHCU (β = 0.0912), household size (β = 0.0105) and mothers fully employed in agriculture (β = 0.0060) improved moderate wellbeing status in mothers while household size ((β = 0.0003) and mothers fully employed in agriculture (β = 0.0016) improved mother's high wellbeing status.

Maternal health care utilisation improved child immunisation status and mother's wellbeing among agricultural households in rural Nigeria.

Keywords: Maternal health care utilisation, Child's birth order, Agricultural household, Rural Nigeria.

Word count: 487

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MHCU	Maternal health care utilisation
BMI	Body Mass Index
EPI	Expanded Programme on Immunization
FMOH	Federal Ministry of Health
HepB	Hepatitis B
OPV	Oral polio vaccine
NPC	National Population Commission
NDHS	Nigeria Demographic and Health Survey
BCG	Bacilli Calmette Guerin vaccine against Tuberculosis
ANC	Ante-natal care
OLS	Ordinary Least Squares
SDG	Sustainable Development Goals
UN	United Nations
UNICEF	United Nations Children Emergency Fund
WHO	World Health Organizatio

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

A population with poor health would produce fewer labour and resources, which will have an impact on productivity, improving children's and mother's health in a home is both an end in and of itself. Good health is an important driver of productivity and can be regarded as a durable good (Asenso-Okyere et al 2011). In Nigeria, the agricultural industry is the one that employs the most people and generates the most income (World Bank Survey, 2020) and any household having its reference person economically active in agriculture is said to be an agricultural household (Hill, 1990). Globally, maternal health is receiving more attention, with a particular emphasis on lowering maternal mortality, simply because of the alarming maternal death rate between 1990 and 2015 that claimed the lives of an estimated value of 10.7million women globally World Health Organisation (WHO, 2018).

WHO (2023) report established that the global maternal mortality ratio (MMR) declined from 351 deaths per 100,000 live births in 2000 to 223 deaths per 100,000 live births in 2020, this represents a 34% decline in the MMR. However, there is still much work to be done, as 800 women still die every day from preventable causes related to pregnancy and childbirth. Around 99% of maternal deaths worldwide in 2015 took place in underdeveloped nations, with sub-Saharan Africa alone accounting for 66% of those deaths, followed by southern Asia (WHO 2018). According to WHO's (2023) report on maternal mortality, India and Nigeria were responsible for 24% and 12% of all maternal deaths globally in 2020, respectively. This means that these two countries accounted for nearly one third of all maternal deaths globally.

WHO (2023) claims that, Nigeria ranked fourth among countries with the worst maternal death rate, behind Sierra Leone, the Central African Republic, and Chad, and was among

the most dangerous places on earth to give birth. According to estimates from the World Bank (2023), Nigeria's mortality rate MMR, was 521 per 100,000 live births and 57,600 maternal deaths in 2023, fertility rate of 5.3%, and annual birth rate of almost 22,4%, bringing the daily rate of maternal deaths in childbirth down to about 156 per day.

Children are particularly susceptible to diseases, illnesses, and death between birth and age five. Pneumonia, diarrhea, malaria, measles, and HIV are the leading causes of death among children aged one month to five years (Beth et al 2010) .Child vaccination program, which consists of a whole series of shots given to children from the time of their birth until they are five years old, serves as a preventive strategy at the childhood stage. A fair chance in life begins with a strong, healthy start. Unfortunately, many children in Nigeria are still deprived of this (Muhammed, 2017).

According to Nigeria's recommended standard immunisation schedule, babies should receive: a dose of Bacillus Calmette-Guerin (BCG) vaccine at birth (or as soon as possible); three doses of Pentavalent {DPT, Hep B and Hib} vaccine at 6, 10 and 14 weeks of age; at least three doses of oral Polio vaccine (OPV) – at birth, and at 6, 10 and 14 weeks of age; and one dose of Measles vaccine at 9 months of age. However, since the inception in 1956, the nation's immunization programs have been characterized by sporadic successes and failures. In order to provide immunization services to children aged 23 months and under, immunization programs were once again implemented as the Expanded Programme on Immunization (EPI) in 1979. The immunization program was restarted in 1984 after repeated and uneven early successes. In 1995, the National Programme on Immunisation (NPI) initiative, formerly known as the EPI program, underwent a review.

Feeling well and performing well are two components of wellbeing (Ruggeri et al 2020). The wellbeing of a household largely depends on the wellbeing of its occupants. Health is wealth and, maternal and child health within the household aids the smooth running of the entire household at large. Death of mothers and children can be prevented when a woman receives adequate medical attention from a qualified practitioner during pregnancy, during delivery, and soon after birth.

1.2 **Statement of the Research Problem**

Despite government's efforts in ensuring improved wellbeing and reducing poverty, poverty is still prevalent in rural area in Nigeria (CSEA, 2020). Between 2000 and 2020, the maternal mortality ratio dropped globally by about 34% according to WHO, (2023) however, Nigeria still ranks high among the Sub-Sahara Africa nations with high maternal mortality rates. A good healthcare system will encourage maternal wellness and lower mother mortality as supported by Omoruyi et al (2008).

Furthermore, globally, about 23 million children under the age of one did not receive basic vaccines which are the highest since 2009, over 60% of these children lives in Nigeria and nine other countries (WHO, 2021). According to World Health Organization (WHO 2021), only 23% of children in Nigeria receive all of the recommended vaccinations which means that nearly 1 in 4 Nigerian children receive all of the recommended vaccinations, with 36% receiving them in urban areas and only 14% in rural areas, which puts them at risk of preventable diseases. UNICEF (2020) reported that there were 858,000 under-five fatalities there on average in 2019; as a result, Nigeria became the country with the highest rate of under-five deaths worldwide.

The most severe maternal morbidity problem, both during pregnancy and after birth, is facing Nigeria's health sector as it is ranked 187th among 190 United Nations member states by WHO, (2020). Millions of women nationwide lacked timely access to high-quality maternal healthcare service or couldn't afford it, this threaten access to care and negatively impact the way pregnant women seek out health care which causes deterioration in child vaccination coverage (Shuaib, 2020).

Additionally, because agricultural households receive their primary source of income from farming, their capacity to access and buy goods and services connected to food, water, land, and health directly affects their ability to maintain overall health. A child who is not immunized is predisposed to diseases and vulnerable to death. As a result, the time available to the mother to attend to other healthy children is limited and this also renders her less productive as one of the major sources of labour in an agricultural household. All these

consequently limit productivity, affect livelihood and income generation. Generally, a sick child affects the ability of mothers to actively participate in the labor force, which will improve sustainable development. Moreover, for mothers to have a balanced household and a professional life, good health is essential for all members of the households.

The current state of affairs in Nigeria is very worrying, according to Olonade et al (2019) who utilize maternal and newborn mortality as social indices to gauge a nation's level of progress. The poorest households, mostly in rural areas, account for the majority of maternal deaths that do occur according NPC and ICF (2018), only two out of ten women in the poorest households with no formal education gave birth in health facilities, compared to nine out of ten women from wealthy households with tertiary education. Thus, the following research questions were raised in this study in light of the aforementioned:

1.3 Research Questions

i. What is the level of maternal health care utilisation in agricultural households in rural Nigeria?
ii. What are the factors affecting the usage of maternal healthcare services in households?
iii. What impact does the use of maternal healthcare services has on mother's wellbeing?
iv. What is the effect of maternal health care utilisation on child immunisation status among agricultural households in rural Nigeria?

1.4 Objective of the Study

The broad goal of this study is to determine how maternal health care utilisation influences child immunisation status and mother's wellbeing among agricultural households. The specific objectives are to;

i. Assess the level of maternal health care utilisation;
ii. Examine the factors influencing maternal health care utilisation;
iii. Examine the effect of maternal health care utilisation on mother's wellbeing;
iv. Determine the effect of maternal health care utilisation on child immunisation status.

1.5 Justification for the Study

The World Bank Survey (2020) indicates that agriculture is Nigeria's major employer of labor and source of money and with National Development Plan 2021–2025 charged with the task of lifting 25 million people out of poverty and boosting job creation, taking into consideration the factors affecting the health and wellbeing level of members in agricultural households is the catalyst to achieving the dream of creating jobs and sustaining the sector. Literatures abound on poverty and women's wellbeing (Deoti and Akinwande 2013; Bashaasha, et al 2006; and Kabubo-mariara et al 2010). Albeit, there are limited literature examining the influence of maternal health care utilisation on mother's wellbeing, this study will therefore bridge the gap in literature by examining the effect of health care utilisation on child immunisation status and mother's wellbeing among agricultural households in rural Nigeria.

Various methods have been used in assessing maternal health care utilisation and child immunisation (Subhani et al 2015) a common trend is that many of the studies employed multinomial logit regression model. This is because the model allows for dependent variable that has three or more categories. However, the method did not carter for likely correlation between the independent variables. Hence, this study will employ the extended ordered probit model to determine the effect of maternal health care usage on child immunisation

Several studies have looked into child immunisation's issues in Nigeria, including uptake patterns and underlying factors (Babalola et al 2009; Jegede et al 2013). However, these studies only centers on usage of specific vaccinations, frequently at remotely comparable locations, selecting the variables that affect child's immunisation status in a representative sample of the nation will help the government with detailed information through well-articulated policies, projects, and programs as well as good standards of practice. The knowledge and understanding of the linkages, interaction and their consequences will be useful in planning developmental programmes in agriculture households, health and immunisation programme by policy makers. This study will as well provide the basis or need to invest in health capital, especially maternal and child health in order to enhance their wellbeing.

1.6 Study Hypothesis

The research was structured on the following hypothesis.

The null hypothesis (H) states that there is no correlation between the use of maternal health services, the immunisation status of the children, and the wellbeing of the mothers.

1.7 Report's Structure

Six chapters make up this study. The first chapter is the introductory part, and the second chapter examines the theoretical and literature review. The methodology, which is covered in chapter three, covers the study regions, sampling strategy, and method of data processing. The findings of the analysis are presented in chapter four along with a discussion of results of analysis. The summary of findings, conclusion, and recommendation (as chapter five) finally brings the study to a close.

CHAPTER TWO

LITERATURE REVIEW

The assessment of maternal health care usage, child immunisation, household wellbeing, methodological, empirical review, and conceptual framework are all discussed in this chapter.

2.1 Theoretical Review

2.1.1 Theory of Demand for Health

Traditional demand theory holds that people directly maximize their utility function by making market-based purchases of goods and services. In the first study of its kind, Becker (1965) showed a substantial departure from conventional demand theory by introducing the idea of the "home production function" as a tool for analysing consumer behaviour. He believed that some commodities required the consumer's own time in addition to inputs from the market, placing them in the utility function. The theory claims, for instance, that the individual utilize own time to produce health and other things while also using transportation and leisure time to make trips to medical care facilities.

Despite the fact that some economists had already made the connection between health and human capital in the early 1960s, not until Grossman's (1972) study did the "health demand" paradigm come into existence. In addition to taking into account health capital and using Becker's idea of household production, he also examined consumer behaviour. Grossman also used inter temporal utility function and took into account the entire life span. The study, which established the framework for all subsequent health economics research, was the first of its kind to describe the issue involved in healthcare decision-making.

This dissertation; benefitted from the studies of Becker (1965) and Grossman (1972) to build a theoretical framework for the use of maternal health care. Let a woman's utility function model be

$$J = J(T, K) \quad (2.1)$$

Where T refers to the woman's health and K represents other consumption commodities. assuming $J_T > 0$, $J_K > 0$; $J_{TT} < 0$, $J_{KK} < 0$, from Becker's view, the representative woman will directly enter her utility role by combining her time with the use of market items or healthcare services to produce health or other commodities. Consequently, the commodities for consumption and health can be stated as

$$T = T(M, T_{M;}\, E_M) \quad (2.2)$$

$$K = K(X, T_X;\, E_X) \quad (2.3)$$

When an individual buys a particular commodity, the individual does so because of some level of satisfaction derived from the consumption of that commodity. The satisfaction that is derived from the consumption of certain commodity is called utility Marshall (1920). Utility is commonly described in two ways namely total and marginal utility. Total utility refers to the amount of satisfaction derived by a consumer from the consumption of a commodity per unit of time. It is known that as more of a commodity is consumed the utility derived increased to a certain point. After which the consumer will not derive greater satisfaction from consumption of that commodity. The concept of utility is represented in Figure 2.1.

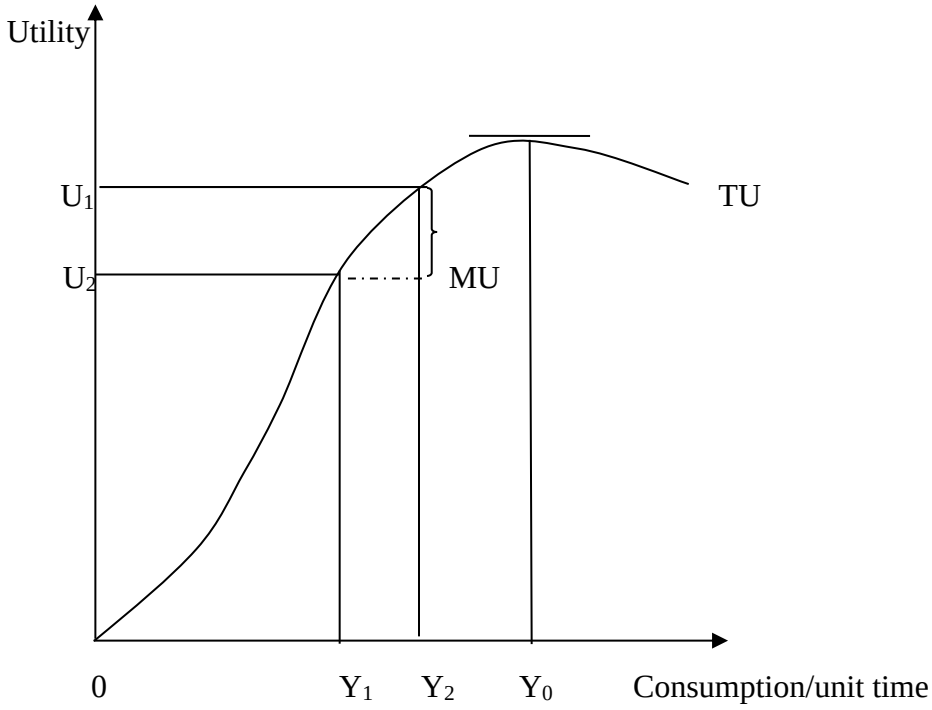

Figure 2.1: The Concept of Utility

Source: Adapted from Nicholson and Snyder (2021)

2.1.1.1 The Indifference Map

Although it is assumed that health (or excellent health) is desirable, it is also assumed that other things are regarded more highly than health. There are several reasons why one could consider good health to be desirable. Being in excellent health enables one to carry out daily tasks like work, socializing, and other such activities Daniel, (2015).

If "units of health" may be used to assess health, then "consumption" can be used to describe the "other things in life" that give one joy. As used above, "consumption" refers to a collection of consumption actions. Figure 2.2 displays consumption units along the vertical axis and health units along the horizontal axis. Any point on the graph represents a confluence of consumption and health. It was formerly considered that enjoying one's health and engaging in consumer activities gave one pleasure. As a result, a person would feel happier at point b than at point a; for example, since the individual is in better health and consumes more there. Generally, the farther someone travels from the origin 0, the higher will be the person’s wellbeing.

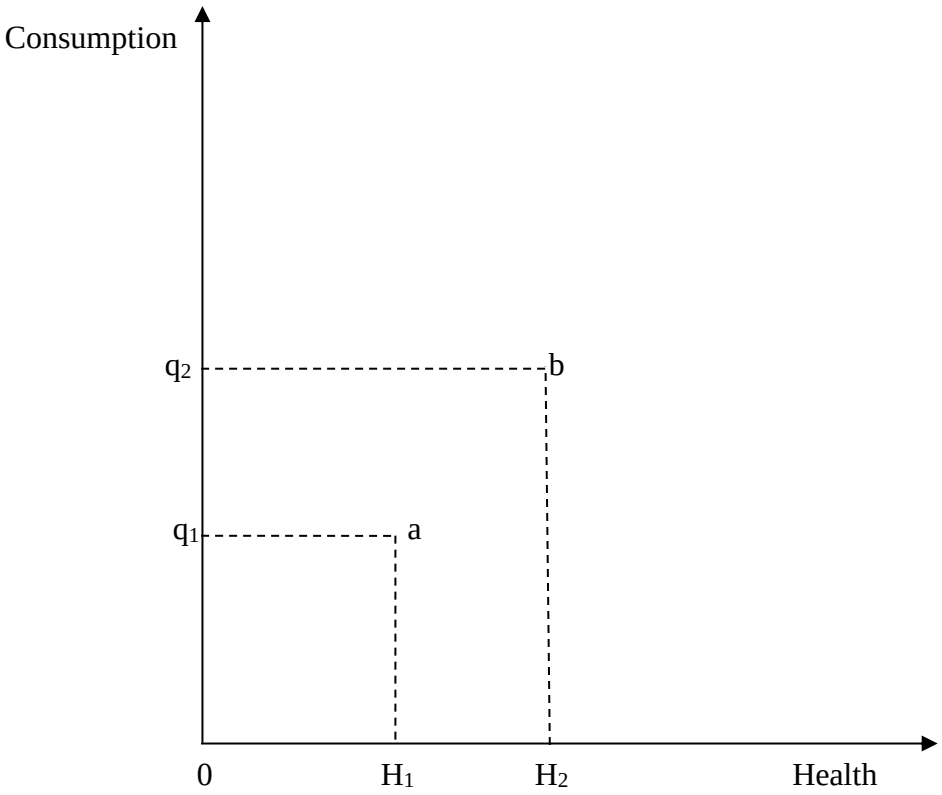

Figure 2.2: Health Consumption Curve

Source: Adapted from Nicholson and Snyder (2021)

An "indifference curve" or "welfare contour" might be used to diagrammatically represent the aforementioned supposition. Similar to how a contour on a map connects all locations with the same height, figure 2.2's welfare contour connects all sites with the same level of wellbeing. The individual is "indifferent" to any of the health and consumption combinations along the curve because they all produce the same amount of welfare, therefore the name "indifference curve." People value both health and consumption, but do not perceive having excellent health as being so vital that it takes precedence over everything else. As a result, the indifference curve slopes downward.

Because consumption must rise in order to offset a decline in health and vice versa, the welfare contour slopes downward. However, as one descends the indifference curve, it becomes more and more challenging to persuade the person to accept further declines in health. This is based on the idea that an individual will need an increasing number of consumption units to make up for losing progressively more units of health. (Alternatively, as the individual is provided progressively more health units, the person will need progressively less consumption units as recompense). The indifference curve's bent shape is a result of this supposition.

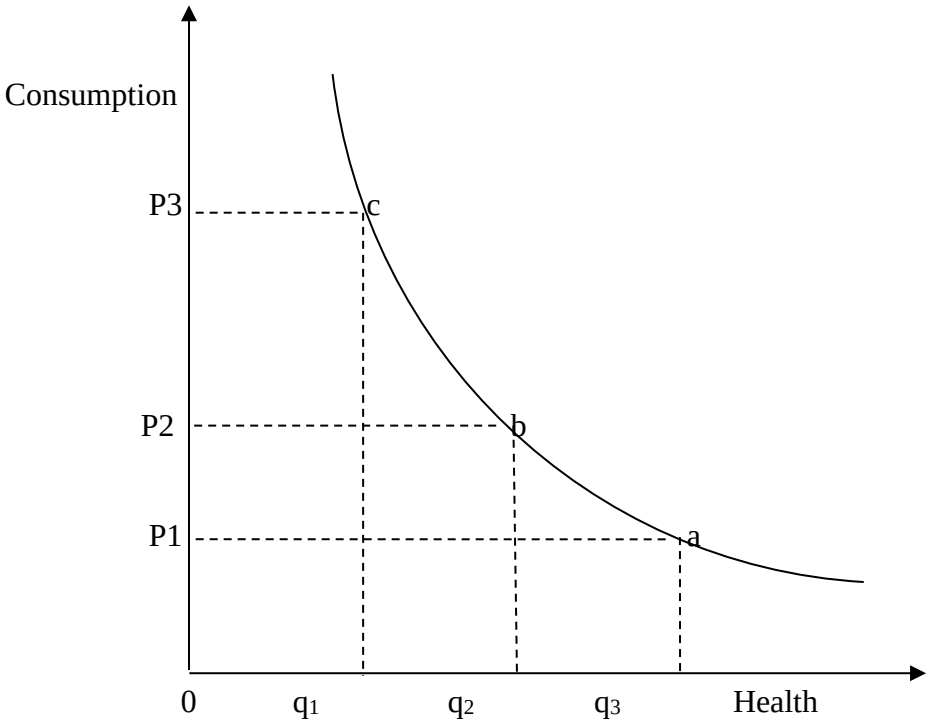

Figure 2.3: Health Consumption Indifference Curve

Source: Adapted from Nicholson and Snyder (2021)

One conceivable indifference curve is the one shown in Figure 2.3. These curves can be made in any number, all with the same shape, some nearer the origin than in Figure 2. 3 and others farther away. The person is agnostic about the points on a given curve, but is not agnostic about the curves themselves. In Figure 2.4, the individual will favour IC_3 over IC_2 and IC_2 over IC_1, as IC_3 provides the individual with more consumption for a given level of health. As a result, the person will try to get the highest indifference curve.

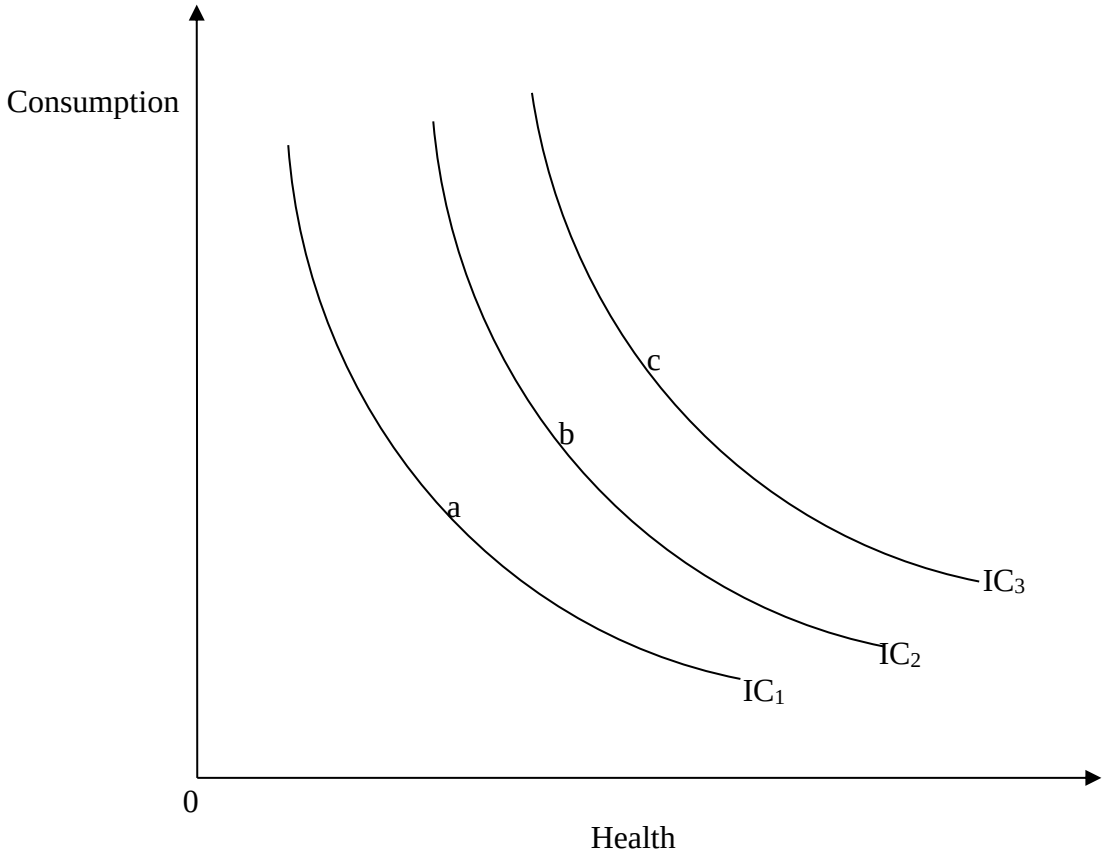

Figure 2.4: Health Consumption Indifference Curves

Source: Adapted from Nicholson and Snyder (2021)

2.1.1.2 Health Production Function

The following can be used to express the second premise upon which the current strategy is built. Due to their ability to change their environments, health-affecting consumption patterns, and use of health care, people have a relatively high level of control over their health.

The idea of the "health production function" can be used to describe this assumption considerably more precisely. These concepts are used in the "demand for health" strategy, which envisions the individual "creating" his health by mixing "health inputs". Although it was previously stressed, medical treatment is merely one example of a factor of health. It is an example of a health input. Similar to consuming activities, it is helpful to discuss health inputs as a "bundle" that includes food, warmth, medical treatment, and other inputs. These inputs are connected to the output, health, through the "health production function." Figure 2.5 provides an illustration of the health production function. More health is produced as more units of health input are utilised. Figure 2.5 also shows that increasing the amount of health inputs used results in a successively smaller increase in health. The excess number of output units that come from using one more unit of input is known as the "marginal product," and this phenomenon is known as the "law of declining marginal product" Robert, (2013).

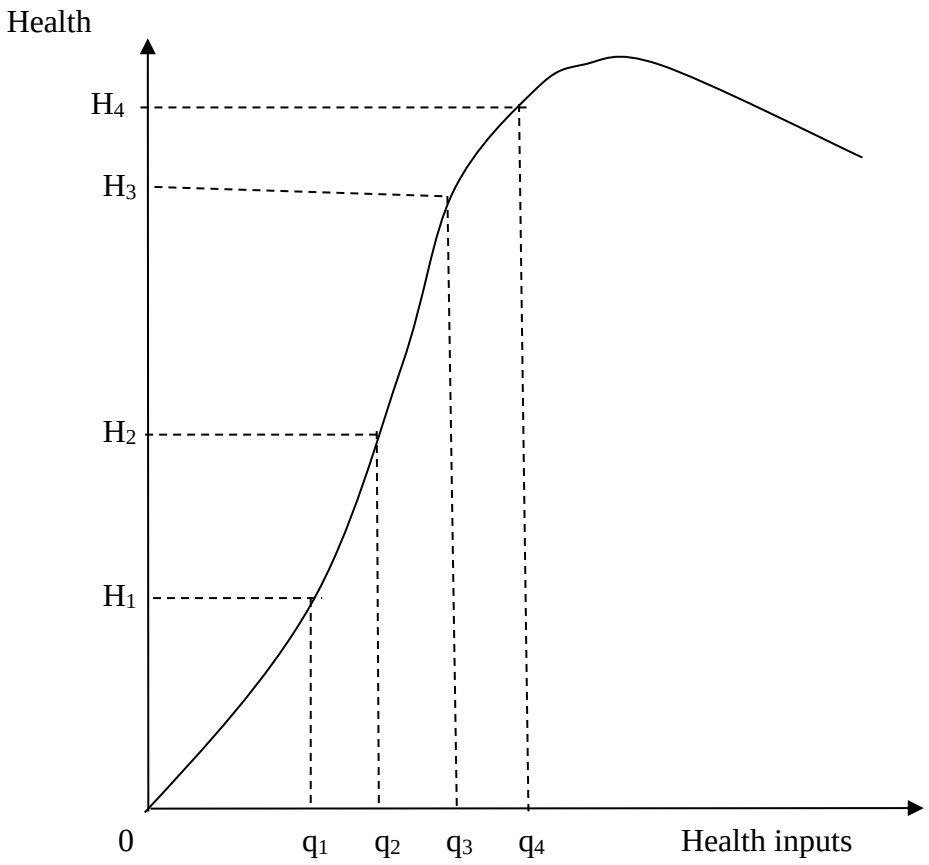

Figure 2.5: Health Production Function

Source: Adapted from Nicholson and Snyder (2021)

2.1.2 The Theory of Planned Behaviour

The Theory of Reasoned Action (TRA) was renamed the Theory of Planned Behaviour (TPB) in 1980 in order to predict a person's intention to engage in behaviour at a specific time and location. The theory was developed to describe any behaviour that a person may exercise self-control over. The most crucial component of this model is behavioural intent, which is affected by beliefs about the likelihood that actions will produce the intended results and by a subjective assessment of the related risks and benefits. The TPB has been used successfully to predict and explain a variety of health behaviours and intents, including substance use, breastfeeding, using health services, and smoking.

According to the TPB, behavioural success is a function of both ability and motivation [intention] [behavioural control]. It makes a distinction between the behavioural, normative, and control types of beliefs. Six constructs that together represent a person's actual control over the behaviour as developed by Ajzen (2002) which make up the TPB are as enumerated below.

i. Attitudes:- This term relates to how favourably or unfavourably a person perceives the relevant conduct. It necessitates considering how actions will influence outcomes.
ii. Behavioural intention:- is concerned with the motivations behind a certain conduct; the more intense the desire to carry out the behaviour, the more likely it is to be done so.
iii. Subjective norms :- This is the perception of whether most people find the behaviour to be acceptable or not. Regarding whether peers and acquaintances think the person should engage in the conduct is relevant.
iv. Social norms:- also known as customary codes of conduct, are part of a group of people or a larger cultural framework. In a group of people, social norms are regarded as normative or standard.
v. Perceived power:- is the perception of elements that may help or hinder the performance of behaviour. A person's perceived behavioural control over each of those aspects is influenced by their perception of power.

vi. Perceived Behavioural control:- This refers to an individual's assessment of how easy or difficult it is to carry out the targeted behaviour. A person's views of behavioural control change depending on the circumstance because perceived behavioural control differs between contexts and behaviours. The shift from the Theory was created by the addition of this theory construct.

According to Ajzen (2002), the TPB has a number of restrictions, including the following:

- It is based on the supposition that the person, regardless of their intentions, has access to the tools and opportunities required to successfully engage in the desired behaviour.
- It disregards other elements that influence behavioural intention and motivation, such as fear, threat, mood, or prior experience.
- Normative effects are taken into account, but economic or environmental factors that can impact a person's intention to engage in behaviour are not taken into account.
- It assumes that conduct is the result of a linear decision-making process, ignoring the possibility that behaviour could alter over time.
- Although it was a vital addition to the theory, the extra concept of perceived behavioural control reveals nothing about actual behavioural control.

The TPB has shown higher utility for public health than the Health Belief Model, although it is still limited by its inability to consider environmental and economic elements. Over the past few years, researchers have used some of the TPB's features and added other components from behavioural theory to make the TPB a more cohesive model. This was done in reaction to the TPB's inability to adequately handle public health issues.

2.2 Methodological Review

2.2.1 Correspondence Analysis

One of the many diverse methods for processing and displaying the relationships between categorical data is correspondence analysis (CA). As with exploratory data analysis, correspondence analysis can reveal unexpected features and connections. Analytical and visual representations of the correspondence analysis' findings are available. This technique, which was first created in France, can be used to examine non-negative cases-by-variable-categories matrices. Another multivariate descriptive data analysis method is correspondence analysis. In general, correspondence analysis produces a straightforward yet thorough analysis by demystifying difficult data and giving a complete description of nearly every piece of information in the data (Greenacre,1984).

The following benefits of correspondence analysis include the multivariate treatment of the data using numerous categorical variables, which is a key component of correspondence analysis. This multivariate nature offers the advantage of exposing linkages that might emerge from a series of variable pairwise comparisons. In addition to this, CA is favoured over other techniques if the variables are uniform, and the structure of the data matrix is either unknown or poorly understood. Additionally, the graphical display generates two twin displays with similar row and column geometry. This makes it easier for analysis to find relationships that other multivariate techniques to graphical data display do not.

2.2.2 Multiple Correspondence Analysis

Multiple Correspondence Analysis (MCA) helps in the investigation of the relationships' pattern of categorical dependent variables which is an extension of correspondence analysis (CA). To examine tables with three or more variables, correspondence analysis is extended in a multivariate manner. Additionally, MCA can be seen as an expansion of PCA for categorical variables that highlight patterns in large, complicated data sets.

By placing each variable or unit of analysis as a point in a small-dimensional space, multiple correspondence analysis can be used to characterize patterns of relationships in a unique way utilizing geometrical methods. MCA is helpful for mapping both factors and specific people, enabling the creation of intricate visual maps whose organization can be understood.

It also has the ability to link case-centered and variable-centered approaches (Greenacre, 1993).

2.2.3 Principal Component Model

A big set of variables can be condensed into a smaller set that still contains the most of the data in the larger set using the dimension-reduction method known as principal component analysis (PCA). A number of (potentially) linked variables are converted into a (smaller) number of uncorrelated variables known as principal component by a mathematical process. As much of the data's variability as possible is accounted for by the first principal component, and the remaining variability is as much as possible accounted for by each component after it.

Principal components analysis resembles the multivariate technique known as factor analysis. They are frequently confused, and many scientists do not know how the two approaches differ or for what kinds of analysis each is most appropriate. PCA is highly helpful for continuous data and afford the researcher a way to present or summarize a collection of facts in two-dimensional graphical shapes. The horseshoe effect, a severe flaw in PCA, prevents it from being used with most of ecological data sets. Additionally, PCA is sensitive to outliers and only depicts sample occurrences in species space.

2.2.4 Logistic Regression Model

This econometric technique is used to analyse a dataset in which one or more dependent variable affect the outcome. One of the binary choice regression models is the logit regression model, which considers a dichotomous regression variable as the dependent variable (Gujarati 2003). The dependent variable in logistic regression only contains data that is either 1 (such as TRUE, success, pregnant and registered in voucher program) or 0 (such as FALSE, failure, non-pregnant, and not registered in a voucher program). Finding the best-fitting (but biologically plausible) model to explain the link between a set of independent (predictor or explanatory) variables and a set of dichotomous features of interest (dependent variable = response or outcome variable) is the aim of logistic

regression. Gujarati (2003) asserts that the Logit model ensures that the estimated probabilities are in the 0–1 range and are not linearly related to the explanatory factors.

$$l = \frac{e^{m_i\beta}}{1 + e^{m_i\beta}} \qquad (2.4)$$

$$R = \beta_0 + \beta_i M_i + \varepsilon_i \qquad (2.5)$$

Where;

l = logistic function,

m_i =independent variable,

β = coefficient,

e = natural logarithm,

β_i =the coefficients,

M_i =independent variable,

ε_i = error term,

β_0= intercept.

According to Wooldridge (2010), One of the few straightforward models that yield results which are simple to understand and aids in resolving the issue that frequently arises when trying to estimate the linear probability model using multiple regression model analysis is the logit regression. This issue is resolved by developing a logit regression predicted probabilities so that they fall inside a range of zero to one (0 - 1). Although the explanatory variables that are estimable in the logit model are those with relative effect rather than absolute effect, the logit model cannot be applied with panel data because unobserved factors are associated across time for each decision maker Wooldridge (2010).

2.2.5 Probit regression model

Especially in binary form (0 and 1), Probit models and Logit models are largely similar. However, Probit functions very differently when there are three or more outcomes (in this

case, ranking or ordering). It makes use of a single regression equation, which limits the application of marginal effects to the "extreme" (higher and lower rankings). Probit models are typically utilized in double hurdle models, where they are taken into account for adoption models at the first hurdle (dichotomous dependent variable).

The cumulative distribution function of the standard normal distribution is used by the Probit model to create f (*). Any number can be scaled by the function to fall between 0 and 1. The probit model, according to Gujarati (2003), is one method used for creating a probability model for a binary response variable. The Probit technique, according to Amoo et al (2013), uses a modified Newton-Raphson algorithm to compute maximum likelihood estimates of the parameters and C of the Probit equation. When Y is a binary response with values of 0 and 1, the Probit equation is

$$\text{prob}\left(k = {}^{1}/_{g}\right) = \int_{-\infty}^{g'\beta} \Phi(t)dt = \Phi\left(g'\beta\right) \qquad (2.6)$$

Where,

$\text{prob}\left(k = {}^{1}/_{g}\right)$ is the probability of k being equal to 1/g,

k is a threshold value that determines whether or not a binary event occurs,

1/g is another threshold value that determines whether or not a binary event occurs,

$\int_{-\infty}^{g'\beta} \Phi(t)dt = \Phi\left(g'\beta\right)$is the integral of the logistic function $\Phi(t)$ from negative infinity to infinity $\left(g'\beta\right)$,

$\Phi(t)$ is the logistic function.

$g'\beta$ is a value that determines the threshold at which the logistic function $\Phi(t)$ returns 0.5.

The probit model has several advantages over the traditional bivariate probit approach, including its simplicity and ability to function effectively in real-world situations. Additionally, it offers a relatively straightforward and cost-effective balance between the traditional bivariate probit model and various alternative variables that partially vary depending on the situation. Also, it takes into account the dependent variable's boundaries, permits varying rates of change at the low and high ends of the beer scale, and assumes that

the independent variables have been properly specified in order to eliminate heteroskedasticity. However, Implementation in practical situations can prove to be very difficult and it does not help to control bias that may occur during sample selection Wooldridge (2010).

2.2.6 Tobit Model

A type of linear regression is the Tobit model. It is utilized primarily when regressing a CONTINUOUS dependent variable that is biased in one direction. It pertains to metrics-dependent variables. Censored regression model is another name for it. Consistent estimates are produced using the Tobit model, which makes use of all available data, including data on censoring. It is also a non-linear model that is calculated using the maximum likelihood estimation technique, just like the Probit model. The probability distribution function for non-censored observations makes up the first component of the Tobit model's likelihood function, while the cumulative distribution function makes up the second term for censored observations (Rajulton, 2011).

Tobit Model is "restricted" in that it cannot be utilized for binary or discrete outcomes and is only noticed if it is above or below a cut off level. Gujarati (2003) claims that because the Tobit model arises when there are only partially observed data, it is sometimes referred to as a censored model. However, because of the limitations placed on the values used in the regression, it is referred to among authors as a limited dependent variable regression model (Cameron 1998). Statistically, the Tobit model can be expressed as follows:

$$y_i^* = x_i^{'}\beta + \varepsilon_i \qquad (2.7)$$

$$\varepsilon_i \sim N(o, \sigma^2).$$

Where;

$x_i^{'}$ = independent variable,

β = the coefficient,

ε_i = error term.

y_i^* is a concealed variable that is visible when its value exceeds 0. The following equation defines the observed y.

$$y_i = \begin{cases} 0 & \text{if } y_i^* \leq 0 \\ y_i^* & \text{if } y_i^* > 0 \end{cases} \qquad (2.8)$$

The Tobit model is effective in the elimination of bias that may result from sample selection censored at zero.

2.2.7 Multiple Regression Model

Multiple regression, according to Higgins (2005), is a statistical technique that enables the researcher to look at how several independent factors connect to a dependent variable so that, once the link is found, action may be taken. It is used to make much more powerful and accurate predictions about why things are the way they are. This process is what is known as Multiple Regression.

The benefits of using a multiple regression model include better prediction from a variety of independent variables and avoiding reliance on a single independent variable to interpret the findings. Furthermore, it makes it possible to examine more complex research hypotheses than is achievable with simple correlations. According to Gujarati (2003), the equation is given as

$$Y_i = \beta_0 + \beta_i X_i + \varepsilon \qquad (2.9)$$

Y = the dependent variable,

β_0= the 'Y' intercept,

β_1= the change in Y for each unit increment (change) in X_i,

ε_i = the error term.

2.2.8 Multinomial Logit

Based on a number of independent variables, multinomial logistic regression is used to forecast categorical placement in or the likelihood of category membership on a dependent

variable. The independent variables may either be continuous (interval or ratio) or dichotomous (binary). There are more than two categories in which the dependent or outcome variable might be divided with the help of multinomial logistic regression, which is a straightforward extension of binary logistic regression. The probability of categorical membership is assessed using maximum likelihood estimation.

The multinomial method can be used to analysed preferences and choice. It is mostly used when a dependent variable capable of taking on more than two categorical variables such as: Y= (1, 2, 3, …..n) can be specified. The independent variables (X_i) could be discrete, categorical or continuous. Following (Greene 2003) it is specified as:

$$\Pr(Y_i = j) = \frac{e^{\beta_j' X_i}}{1 + \sum_{k=1}^{J} e^{\beta_k' X_i}} \quad \text{for } j = 1,2,3,4 \qquad (2.10)$$

Where;

$\Pr(Y_i = j)$ The probability that the value of the dependent variables of Y_i is equal to j,

j = the possible values that the dependent variable Y_i can take on,

β_1=the coefficient for the independent variable X_1,

X_1= the independent variable

2.2.9 Ordered Logit

A regression model for an ordinal response variable is the ordered logit model. The model is based on the response variable's accumulated probabilities, and more specifically, it assumes that the logit of each cumulative probability is a linear function of the covariates, with constant regression coefficients across answer categories. Ordered logit is used when there are more than two categories in the dependent variable. On the other hand, the dependent variable is ordinal. However, because the categories in the dependent variable are organized according to a specific rank or order, the ordered logit regression model differs dramatically from the model of multinomial logit regression.

In a multinomial logit model, the categories in the dependent variable are ranked or arranged in a certain order, but they are independent in this model. An ordered probit generates

predictions about the chances that a responder will select option 1, 2,..., k. It does this by dividing up the domain of an N (0, 1) distribution into k categories defined by k - 1 cut points, c_1, c_2,…, c_{k-1}. Individual respondents are assumed to have a score $s = X\beta + \epsilon$, where$\epsilon \sim N(0,1)$, and then that score is used along with the cut points to produce probabilities for each respondent producing response 1, 2, . . . , k. According to Cameron (2005), the equation is specified as;

$$\Pr(\text{response is } i/X) = \Pr(c_{i-1} < X\beta + \epsilon < c_i) \quad (2.11)$$

$$\text{logit}(p_1) \equiv \log\frac{p_1}{1-p_1} = \alpha_1 + \beta' X \quad (2.12)$$

$$\text{logit}(p_1 + p_2) \equiv \log\frac{p_1}{1-p_1-p_2} = \alpha_2 + \beta' X \quad (2.13)$$

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$$\text{logit}(p_1 + p_2 + \ldots + p_k) \equiv \log\frac{p_1}{1-p_1+p_2-\ldots-p_k} = \alpha_2 + \beta' X \quad (2.14)$$

$$p_1 + p_2 + \ldots + p_k = 1 \quad (2.15)$$

Where;

$\text{logit}(p_1)$ = the natural logarithm of the odds of category 1.

p_1= the probability of category 1,

$1 - p_1$= the probability of category,

α_1= the intercept,

β'= the vector of coefficients for the independent variables.

2.2.10 Extended Ordered Logit Model

Any arrangement of endogenous covariates, non-random treatment assignment, and endogenous sample selection can be accommodated by an extended ordered probit model, which fits an ordered probit regression model. It also accepts covariates that are endogenous and are continuous, binary, and ordinal Greene (2012).

It is specified as:

$$y_1 = vh \quad \text{iff} \quad k_{h-1} < X_i\,\beta + \varepsilon_i \leq K_h \tag{2.16}$$

The limits on the unobserved ε_i based on the observed values of y_i and S_i

$$l_{1i} = c_{i(h-1)} \qquad \text{if } y_i = v_h \tag{2.17}$$

$$u_{1i} = c_{ih} \qquad \text{if } y_i = v_h \tag{2.18}$$

the log likelihood is written as

$$1nL = \sum_{I=1}^{N} w_i \ln\phi_i(l_{1i}, v_{1i}, 1) \tag{2.19}$$

The conditional probabilities of success can be written For h = 1,……, H as;

$$\Pr(y_i = v_h / X_i) = \phi_i(c_{i(h-1)}, c_{ih}, 1) \tag{2.20}$$

Where ;

y_i =the dependent variable, which is a categorical variable with h possible values.

y_h= the h^{th} possible value of the dependent variable.

k_{h-1} = the $(h-1)^{th}$ threshold value.

K_h= the h^{th} threshold value.

X_i = he independent variable.

β = the vector of coefficients for the independent variables.

ε_i = the error term

2.2.11 Fuzzy Logit

The degree of mother's wellbeing was evaluated using the fuzzy set. Fuzzy set replaces the characteristic function of a crisp set that conventionally allots a value of either 1 or 0 to each element in the large set, with a generalized characteristic function which varies between 0 and 1. Values that are higher indicate a higher level of membership (Chiappero- Martinetti, 2000; Lelli , 2001; and Majumder, 2009).

When a dichotomous variable is questioned, the answer is either "Yes" or "no," and the states of wellbeing or deprivation are denoted by the numbers 1 or 0, respectively

Wooldridge (2010). There are numerous values that can be expressed using categorical variables. The linear equation that Lelli (2001) and Majumder (2009) used is as shown below;

$$\mu_q(a_i) = X_j(a_i) = x_{ij} \tag{2.21}$$

and thus; $x_{ij} = 0$, if $C_{ij} = C_{min}$

$$x_{ij} = \frac{c_{ij} - c_{min}}{c_{max} - c_{min}} \qquad \text{if} \quad C_{max} \leq C_{ij} \leq C_{min} \tag{2.22}$$

$x_{ij} = 1$, if $C_{ij} = C_{max}$

Where Cmin is the number that represents the lowest level of wellbeing in the j^{th} attribute, and Cmax is the maximum level of wellbeing in the j^{th} attribute, which reflects the highest level of wellbeing among the aith mothers in the household. , According to Adeyemo and Oni (2013) and Oyekale (2008), the Fuzzy wellbeing index for the population as a ratio of the ai^{th}mother's wellbeing index Cij is specified below;

$$\mu_q = \frac{\sum_{i=1}^{n} \mu_q(a_i) n_i}{\sum_{i=1}^{n} n_i} \tag{2.23}$$

μ_q is the fuzzy wellbeing index for the population of mothers studied.

$$= \frac{1}{n} \sum_{i=1}^{n} \mu_q(a_i) n_i \tag{2.24}$$

Equation 2.19 and 2.20 express the degree of attainment of the selected wellbeing attribute. This could also be conceptualized as:

$$\mu_q = \frac{\sum_{j=1}^{m} x_{ij} w_j}{\sum_{j=1}^{m} w_j} \tag{2.25}$$

Where wj is the weight given to the jth attribute

$$w_j = \log \frac{n}{\sum_{i=1}^{n} x_{ij} n_i} \tag{2.26}$$

2.2.12 Measures of Maternal Health Care Utilisation

Different indicators of maternal health care services utilisation which were found to greatly reduce maternal morbidities and mortality in literatures are discussed below;

2.2.12.1 Ante-natal Care (ANC): A lot of disagreement exists in literature about how well ANC works to lower mother morbidities and mortality. Pregnancy and childbirth complications can happen at any time and frequently occurs quickly without notice. Due to the fact that the risk factors are not the direct cause of the bad outcome, it is claimed that the typical use of ANC to pinpoint risk factors (such as age and parity) associated with poor maternal outcomes has limited advantage (Yuster, 1995).

2.2.12.2 Skilled Birth Attendance: The phrase "skilled attendance" refers to both the professionals' presence (such as midwives, doctors and nurses) during childbirth and the availability of the tools, medications, and other supplies needed to handle obstetric complications effectively and efficiently (Bell et al 2003).

2.2.12.3 Post-natal Care (PNC): The postnatal period is the time from immediately after birth up to 41 days. It is important for mothers to receive care at this time as it has been recorded that more than 60% of maternal deaths take place during the postnatal period (Gill et al 2007).

2.3 Empirical Review

2.3.1 Issues in Maternal Health Care Utilisation

Using multivariate analysis, Chakraborty et al (2003) discovered that the usage of maternal health care services is influenced by the accessibility, value, and cost of the services as well as the social structure, health beliefs, and individual user characteristics. While the study is inconclusive with regard to mother's age, the number of prior pregnancies, and availability to health facilities, it is favourably connected with the mother's education and the husband's employment. Using logistic regression analysis, Elo et al (1992) discovered that access to health care services, mother's childhood residence, household socioeconomic position, and mothers' formal education are all positively correlated with the utilisation of maternal health care.

Mallick et al (2016) used Chi square tests of independence to measure statistical relationship between indicators and socio demographic variables (maternal age at birth, parity, education, household wealth quintile, urban-rural locality and region/geopolitical zone). According to the examination of trend, several maternal health indicators have changed significantly between the 2003 and 2013 surveys, but not all of them. Mahapatro (2012) studied the utilisation of maternal and child health care services in India. The results of the regression analysis reveal that, despite having sole decision-making authority, women have not fully utilized health care services, suggesting that there are numerous other factors that restrict the utilisation of maternal and child health services in developing nations. The accessibility, availability quality and user nature are some of these.

Adamu (2011) in his work on utilisation of maternal health care services in Nigeria used logistic regression model to analyse the pattern of maternal health care utilisation and to access the differential factors affecting utilisation across the regions. The results from the regression analysis showed that women in the southern region were more likely to utilise the services compared to those in the northern region. Mirast (2014} used hazard and logistic regression models to forecast the factors affecting maternal service utilisation. The result of the analysis showed that overall women who attended maternal clinic and those who succumbed to maternal related death were young. Levels of education, voucher for health, payment for services and knowledge on maternal visits were the factors identified to influence maternal service utilisation in the study area. Cooke et al (2013) in a research work on maternal health in Nigeria identified the challenges facing maternal care to be poverty, lack of education, poor infrastructure, governance corruption and neglect.

Obiyan et al (2015) established that household wealth index and woman's educational attainment were the two socioeconomic indicators chosen. The outcome of the descriptive analysis and concentration index clearly showed that socioeconomic disparities in the utilisation of maternal health care services had grown over time in Nigeria. Using univariate and bivariate analysis as well as the Chi-square test, Kiplagat (2009) examined the factors impacting the quality of ante-natal care in the study region in public maternal and child

health institutions in Nairobi, Kenya. The outcome of the content analysis demonstrates that closeness to the residence; affordability and perceived good services were the main reasons for choice of ante-natal facility.

2.3.2 Issues in Child Immunisation

In certain selected rural and urban communities in the North Central region of Nigeria, Bello et al (2017) used descriptive statistics to compare the characteristics of the mothers and the status of their children's immunisations. Factors like parity, age at marriage, marital status, number of children, household income, and place of indexing were not influencing child immunisation status while, there was a significant correlation between respondents' age, employment status, and mothers' educational status and the child's immunisation status.

Multilogistic regression was used by Subhani et al (2015) to determine the effect of a mother's education on her child's immunisation status in Pakistan. The results showed that mothers with low levels of education immunise their children less frequently than mothers with high levels of education. It was also found that the location of settlement had a significant influence on children's immunisation rates because people who live in rural settings immunise their children less frequently than those who live in urban settings.

The impact of maternal health care on child survival was evaluated by Nazimoh et al (2014) using non-randomized data from a cross-sectional survey in rural Bangladesh. Bivariate probit models and two stage least square simultaneous equation were employed to analyse the data. It was found out that the likelihood of a child surviving increases by about 18% for women who gave birth in medical facilities; consequently, if every woman had the option of giving birth in a medical facility, the likelihood of a child surviving in Azerbaijan as a whole would have increased by about 16%. The results of the descriptive statistics used by Joseph et al (2017) to investigate childhood immunisation in Nigeria showed those socio-demographic characteristics, including occupation, cultural beliefs, and tradition, among others, as the factors influencing childhood immunisation coverage. According to Chaudhary et al (2015), a link was established between mother’s educational level and

children's full immunisation status. Also, there was a declining tendency in immunisation as the mother's age increased, and there was no gender variance in the immunisation status

In Nigeria, Winter et al (2016) looked at trends in important child health indices. The indicators addressed three major aspects of children's health namely child nutrition, sickness prevention (immunization, insecticide-treated mosquito net use, and immunization coverage), and illness care seeking. Regression analysis's findings indicated that Nigeria's health status for children urgently needs to be improved. In contrast to the other two child health indicators, where there was a reduction in performance throughout the ten-year period, child immunisation coverage showed a significant improvement (positive trend). Young age of parents, low parental education levels, and birth order were some of the characteristics that influenced immunisation compliance, according to research by Luman et al (2003) and Frimpong et al (2006).

2.3.3 Perspectives and Issues in Mother's Wellbeing

The impact of migration on household wellbeing and health risk in Mexican homes is examined by Rene et al (2018) using cross-sectional data. The findings demonstrated that there were differences in socioeconomic, demographic, and health situations between households with and without emigrants. These disparities were shown not to be related to migration and cannot be regarded as characteristics that predispose people to migrate. Aslihan et al 2015 examined the economic burden of maternal mortality on households in rural western Kenya. The study was able to establish that households who experienced a maternal death used about one-third of their annual per capita consumption expenditure on use and access of healthcare as opposed to at most 12% among households who had a healthy pregnancy and delivery. Also, the surviving members of the households had significant redistribution of labor and obligations to make up for the missing contributions of the dead women.

Examining the impact of maternal mortality and maternal health care in Nigeria on social and economic development, Olawale et al (2019) reviewed several academic papers and was able to determine that, in addition to the medically similar causes (direct and indirect)

of maternal mortality, certain socio-cultural and socioeconomic variables also had an impact in the course of pregnancy. A weak social structure that results in a bad health care system is another contributing factor. Olawale et al (2019) concluded that maternal mortality has detrimental effects on any country's socioeconomic development. Therefore, to promote sustainable growth, the government must enhance maternal health and end poverty.

Utilising the capacity approach, fuzzy set theory, and logistic regression, Oni et al (2011) examined the multidimensional wellness of rural Nigeria. The findings indicated that Zamfara State, out of the states in Nigeria, has the greatest potential for opportunities to improve welfare, while Imo State has the least. The regression analysis's findings also indicated that the various conversion factors have an impact on how well-capable rural Nigeria is. Age, the size of the household, and the household head's polygamous lifestyle all had a positive correlation with capability wellbeing. The fuzzy set result showed that the ability to achieve a desired level of wellbeing is highest in relation to asset ownership and lowest in relation to security.

2.4 **Conceptual Framework**

A state of overall physical, mental, and social wellbeing, rather than just the absence of disease or infirmity in all matters relating to women of reproductive age, is what the World Health Organization (WHO) defined as maternal health (WHO,2005). According to Okeke (2016), maternal health would also entail the capacity to "exercise reproductive rights of household planning, prenatal care, and access to basic focused ante-natal care, without the encumbrances of patriarchy, economical, or geographical inhibitions harming the mother’s overall health"

A wide range of medical services are made available to mothers before conception, throughout the pregnancy, after birth, and as postpartum care. Prenatal, labor and delivery, and postpartum care are all enclosed in maternal health care services. Therefore, using maternal health care services includes using prenatal care, attending ante-natal, skilled birth attendant, attended deliveries in a hospital setting, and postpartum care. The indicators of mothers' use of maternal health care are shown in Figure 2. 6.

Pre-natal care: It is offered in the form of prenatal checkups, which include advice on how to manage healthcare before getting pregnant as well as information on prenatal nutrition, including prenatal vitamins, and biological changes that occur during pregnancy. This safeguards against probable health problems throughout pregnancy and advances the wellbeing of both the mother and the unborn child (WHO 2005).

Ante-natal care**:** It is the routine health control of presumed healthy pregnant women without symptoms (screening), in order to diagnose disease or complicating obstetric conditions without symptoms and to provide information about lifestyle, pregnancy and delivery (Yuster 1995).

Assisted delivery: any house or institutional delivery where mothers are supported by medical professionals, such as a doctor, an auxiliary nurse midwife/nurse/mid wife/lady health visitor, or other health employees, has been classified as medical assistance at delivery. The phrase "skilled attendance" refers to both the professionals' (midwives, doctors and nurses) presence during childbirth and the availability of the tools, medications, and other supplies needed to handle obstetric difficulties effectively and efficiently (Bell et al 2003).

Post-natal care**:** The first six weeks following delivery are referred to as the post-natal phase. According to WHO (2018), post-natal care is the support provided to mothers and their new born children after the placenta is born for the first six weeks (42 days) of life.

Numerous variables, including dietary status, infant mortality, and immunisation status, can be used to assess the health of children (WHO, 2014). The immunisation status will be used in this study as a proxy for children's health. According to the study's conceptualisation, which is depicted in Figure 2.6, the use of maternal health care is influenced by a number of background characteristics. The usage of maternal health services is influenced and affected differently by a variety of socio-demographic characteristics. Age at first birth, education, occupation, autonomy, and media exposure are all factors related to the mother. While the children factors include age, birth weight, birth order, and sex. The household factors are household size, economic position (wealth index), and region of residence.

A number of factors have been widely documented in literature and are known to affect the use of maternal health services across the world there are; maternal education, woman's age, employment and incomes, socio-economic status, residence (rural/urban), parity, distance to health facilities, and exposure to the media. Regarding parity, it is generally argued that those who have more than three living children tend to believe that they are more experienced to handle their maternal and reproductive health issues; as such, they utilise maternal health services less frequently as compared to those who had less than three children (Baral et al 2012, Simkhada et al 2008).

A child is said to be unimmunized if he missed out on all vaccines scheduled for the age group. A child who is partially immunized missed a dose or more of any of the recommended vaccines while a fully immunized child is a child who has taken all the scheduled vaccine to time and to date.

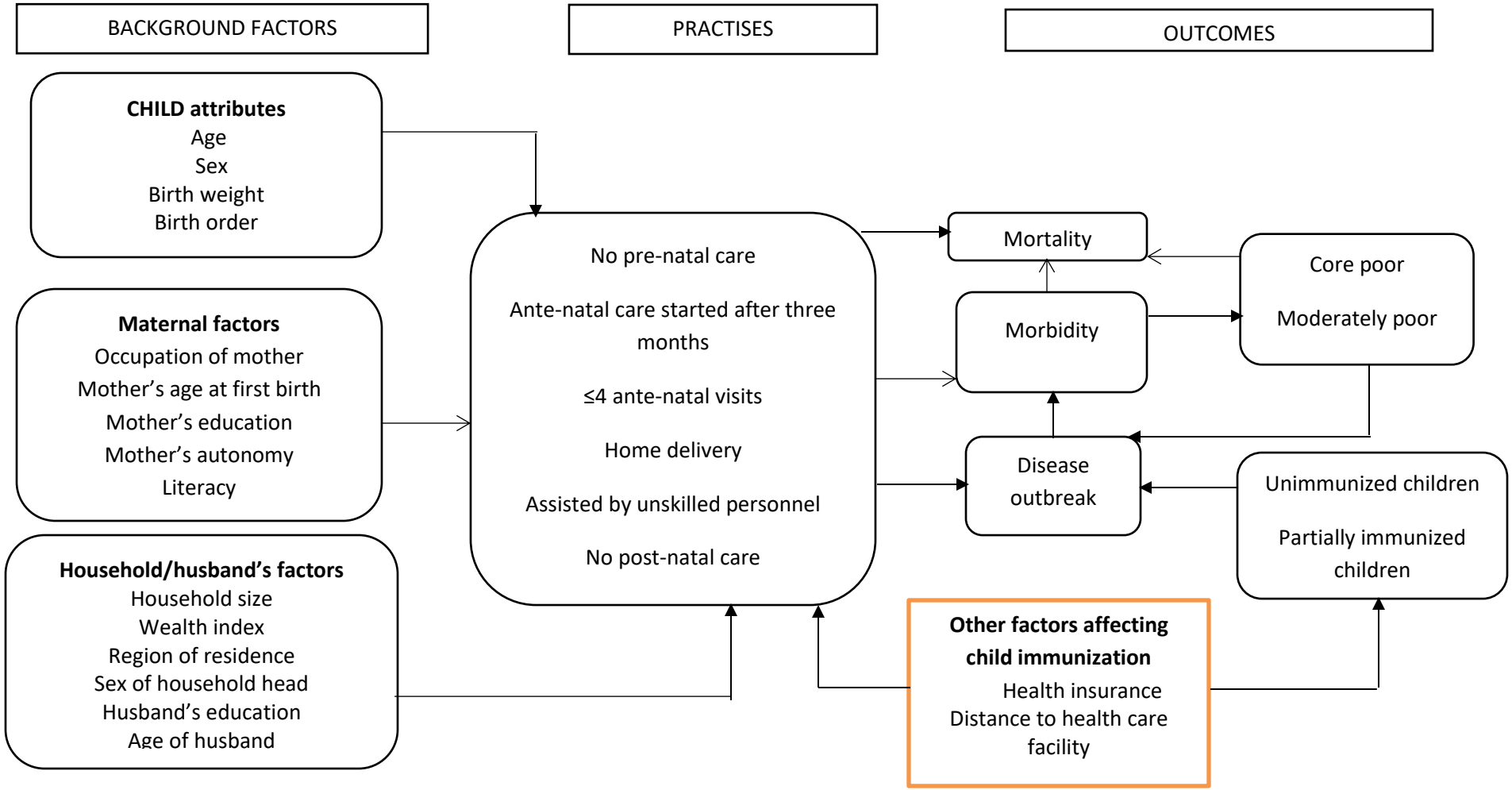

Fig 2.6: Relationship between maternal health care utilisation, child immunisation status and mother's wellbeing

Source: Author's concept (2023)

CHAPTER THREE
METHODOLOGY

This chapter outlines the study's aim, its scope, the type of data it used, and its data analysis techniques.

3.1 Scope

Agricultural households in rural Nigeria were the subject of this investigation. It concentrated on married mothers and their under-five children and profiled mothers' use of maternal health care across several differentials including socio-demographic characteristics of households, the features of the mother, and the characteristics of the child.

The mothers' characteristics and the immunisation status of the children were described and characterised across households. The study also outlined maternal health care utilisation variables in relation to households and the characteristics of the mothers, as well as the extent of maternal health care utilisation and the impact of maternal health care utilisation indicators on child immunisation status and mother's level of wellbeing.

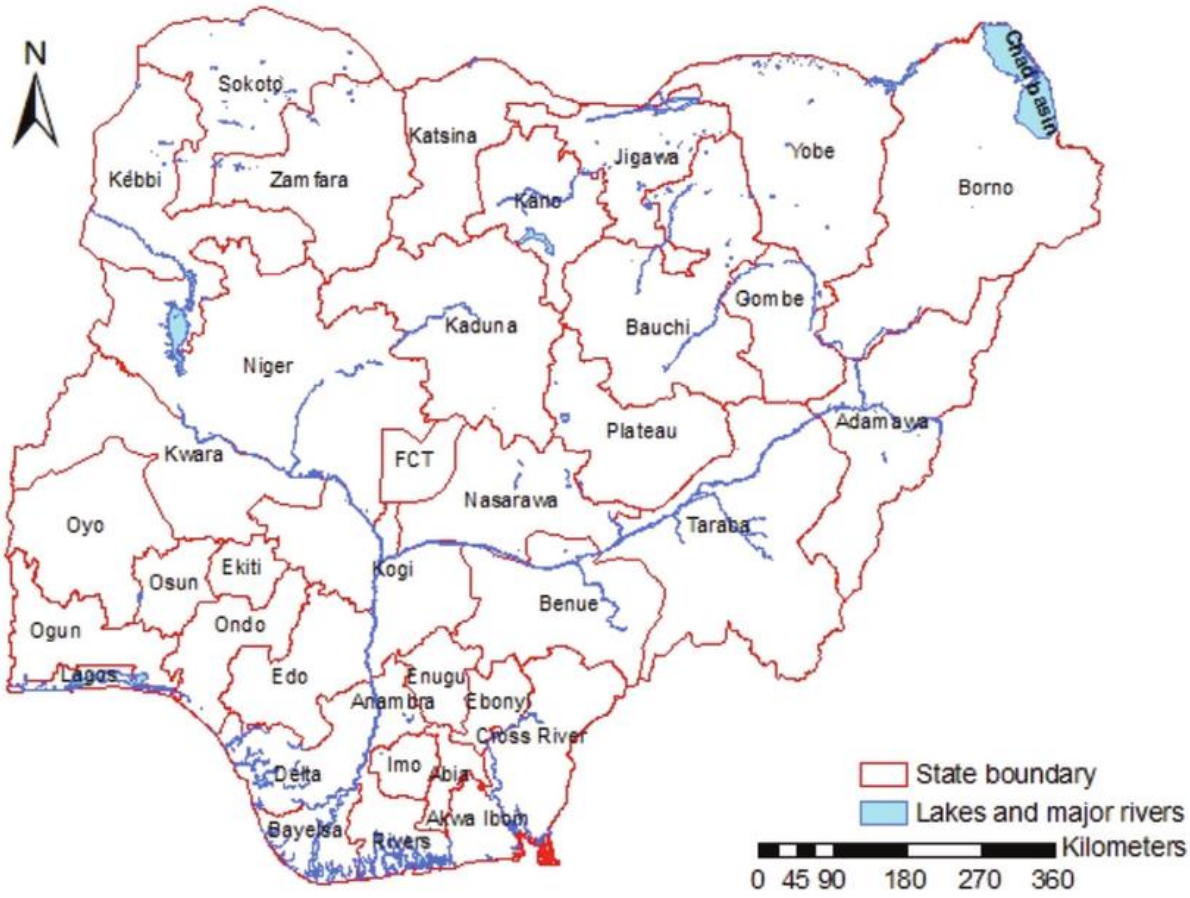

Figure 3.1: Map of Nigeria

Source: Godby 2023

3.2 Source and Type of Data

This study made use of secondary data. The National Population Commission's National Demographic and Health Survey (NDHS), which was conducted in 2018, served as the primary source of data. The sixth demographic survey to be carried out in the nation since 1990 is the NDHS of 2018. The NDHS contains data on the demography, diet, and health of the Nigerian population.

Three primary questionnaires were utilized in the survey, which were one for households, one for female respondents, and a third one for male respondents. Data on the socioeconomic and demographic traits of respondents in rural agricultural households in Nigeria, indicators of maternal health care utilisation, data on child vaccines (such as BCG, hepatitis B, POLIO, PENTA and measles for under five-year-olds), and mother's body mass index, and health-related data were used, among other things.

3.3 Sampling Technique and Sample Size

According to the NDHS 2018 report, enumerations areas (EAs) served as the sampling units for the first stage of a stratified, two-stage cluster design that was used to choose the sample for the survey. In each of the 1400 chosen EAs, a comprehensive list of all households was conducted as the second stage. The target population in Nigeria included men and women between the ages of 15 and 59 in randomly chosen households. For the survey, a sample of roughly 42,000 households were chosen as being representative. A total of 40,427 households, 41,821 women and 13,311 men were interviewed. Also, 23,403 rural homes were surveyed for this study, however, the number of rural households included was decreased to 6,514 homes after data cleaning and sorting. Since this study focused on mothers in agricultural households in rural Nigeria, the 6,514 rural households were further disaggregated into agricultural (2,751) and non-agricultural households (3,763) using the employment of the husband. Therefore, the study utilised data on 2,751 women with under five children in agricultural household in rural Nigeria.

3.4 Data Analysis

3.4.1 Multiple Correspondence Analysis

Multiple correspondence Analysis (MCA) was used to aggregate the various indicators of maternal health care utilisation to generate a maternal health care utilisation index. A lower weighted average for all the indicators indicates low utilisation while a higher weighted average indicates high utilisation. Table 3.1 below shows the five indicators of maternal health care utilisation that was adopted for this study.

Table 3.1: Maternal health indicators /variables

S/N	Indicators	Definition of Indicators	Response Options
1	Pre-natal care	women who received care prior to pregnancy (such as family planning, fertility test)	Yes = 1, 0 otherwise (No)
2	Timing of first ante-natal	pregnant women who started ante-natal in the first trimester and those who started in second or third trimester	Yes = 1, 0 otherwise (N0)
3	Numbers of ante-natal visits during pregnancy	Total number of ante-natal visits to the health facility before delivery	$\geq 4 = 1, < 4 = 0$
4	Place of delivery	Pregnant women who delivered in a health facility and those that delivered in other homes.	Yes = 1, 0 otherwise (No)
5	Assisted by skilled attendant	Pregnant women who were assisted by a skilled birth attendant during delivery and those assisted by unskilled attendants	Yes = 1, 0 otherwise (No)
6	Post-natal care	women who received care immediately after delivery till 6 weeks after from a trained professional and those who do not receive care from skilled workers	Yes = 1, 0 otherwise (No)

Source: Adapted from Manthalu et al 2016

3.4.2 Tobit Regression Model

The model was used to examine factors influencing maternal health care utilisation. It's specified as follows;

$$L_i^* = r_i^{'}\beta + \varepsilon_i \quad (3.1)$$

$$L_0 = \beta_0 + \beta_1 R_1 + \beta_2 R_2 + \beta_3 R_3 + \beta_4 R_4 + \beta_5 R_5 + \beta_6 R_6 + \beta_7 R_7 + \beta_8 R_8 + \beta_9 R_9 + \beta_{10} R_{10} + \beta_{11} R_{11} \quad (3.2)$$

Where:

L_i^* *is the dependent variable*

β_0 is the intercept

$\beta_1, \beta_2 \ldots\ldots \beta_{11}$ are the coefficients of the independent variable

$R_1, R_2 \ldots\ldots\ldots R_{11}$ are the independent variables

ε_i *is the error term*

L_0 is maternal health care utilization index

3.4.3 Descriptive Statistics

Descriptive Statistics was used to profile the immunisation status of under-five children. This includes tables of frequencies and percentages as well as mean and standard deviation. The various vaccines received by the children were used to describe immunisation status of the children as shown in Table 3.2. Children were described as partially immunized (when a dose of any of the vaccine is skipped), fully immunized (when all the doses of the vaccines were received) and unimmunized (when all the doses of the vaccines were not received/when oral polio vaccine only is received). This approach follows Kumar et al (2010).

Table 3.2: Routine immunisation in Nigeria according to (NPI)

Vaccines	Schedule	Fully Immunized	Unimmunized	Partially immunized
Bacillius Calmette Guerin (BCG)	At birth			
Hepatitis B				
OPV 0				
PENTA (DPT, Hep B and Hib) (3 doses)	6,10,14th weeks			
Oral Polio Vaccine (3 doses)	6,10,14th weeks			
Oral Polio inactive	14th week			
Measles	9 months			

Source: Adapted from Kumar et al (2010)

3.4.4 Fuzzy Set

The degree of the mother's wellbeing was evaluated using the fuzzy set. The characteristic function of a crisp set, which typically assigns a value of either 1 or 0 to each element in the universal set, is replaced with a generalized characteristic function in a fuzzy set that ranges between 0 and 1. Greater values represent higher levels of membership (Chiappero-Martinetti, 2000, Lelli, 2001 and Majumder 2009). Using a multidimensional approach, the dimensions used as shown in Table 3.3a and Table 3.3b were housing and sanitation, education, literacy, employment, health and autonomy. A mother can either have a low, moderate or high wellbeing depending on her level of wellbeing in the household.

Table 3.3a: Mother's wellbeing indicators/dimension

Indicator	Selected criteria	Deprivation
Housing and Sanitation		
Source of drinking water	Pipe borne water and treated 1 = improved,0 = otherwise	0 = non deprived,1= deprived
Toilet facility	1 = improved,0 = otherwise	0 = non deprived,1= deprived
Main floor material	1 = improved,0 = otherwise	0 = non deprived,1 = deprived
Main wall material	1= use of finished material, 0 = otherwise	0 = non deprived,1 = deprived
Main roof material	1= use of finished product, 0= otherwise	0 = non deprived,1 = deprived
Autonomy		
Final say on travel to market and outside village/community	Husbands take decisions alone=4 Women and husband take decision =3 Women take decisions with another person = 2 Women take decisions alone = 1	0 = non deprived,1 = deprived
Final say on own health	Same as above	0 = non deprived,1 = deprived
Final say on visit to friends and relatives	Same as above	0 = non deprived,1 = deprived
Final say on making large household purchases	Same as above	0 = non deprived,1 = deprived
Final say on monetary expenditure.	Same as above	0 = non deprived,1 = deprived
Final say on husband's earnings	Same as above	0 = non deprived,1 = deprived
Health and Nutrition		
Body Mass Index (BMI**)**	18.5kg/m^2 to 25.0kg/m^2 = 1 <18.5kg/m^2 and >25.0kg/m^2= 0	0 = non deprived,1 = deprived

Table 3.3b: Mother's wellbeing indicators/ dimension cont'd

Education		
level of educational attainment	mothers with no formal education =0 mothers with primary education =3 mothers with secondary education =2 mothers with tertiary education = 1	0=non deprived,1=deprived
Literacy	Mothers who can read part of a sentence or a whole sentence are regarded as literate. A value of 1was assigned, 0= otherwise	0=non deprived,1=deprived
Employment		
Employment status	Currently employed=1, 0= otherwise	0=non deprived,1=deprived

Source: Adapted from Adeoti et al (2013)

3.4.5 Extended Ordered Probit Regression Model

To examine how maternal health care use affects child's immunisation status, an extended ordered probit regression model was employed. The model is appropriate because it takes into account endogenous variables, non-random treatment assignment, endogenous sample selection, panel data, or other grouped data.

Child's Characteristics

X_1 = Age of the child (months)

X_2 = Child's sex. (1 if male and 0 if otherwise)

X_3 = Child's birth weight (kg)

X_4 = Child's age square (months)

X_5= Total children (numbers)

X_6= Birth order (number)

Mother's Characteristics

Y_0= Maternal health care utilisation index

X_7 = Mother's educational status (1 if formal, 0 if otherwise).

X_8 = Mother's age at first birth (years)

X_9 = Mother's occupation (0 = Agriculture part–time, 1 = agriculture full time.)

X_{10}= Media exposure (1 = exposed, 0 = otherwise)

Household's Characteristics

X_{11} = Household size (persons)

X_{12} = Family wealth index

X_{13} = Sex of household head. (1 if male, 0 if otherwise)

X_{14} = Husband's educational status (1= formal, 0 = no formal)

X_{15}= Husband's age (years)

Region of Residence

X_{16} = 1 if North–central, 0 if otherwise

X_{17}= 1 if North–east, 0 if otherwise

X_{18}=1 if North-west, 0 if otherwise

X_{19} =1 if South-east, 0 if otherwise

X_{20} =1 if South-south, 0 if otherwise

X_{21} =1 if South-west, 0 if otherwise

Extended Ordered Probit Regression model was also used to determine the effect of maternal health care utilisation on mother's wellbeing. An ordered probit regression model that can take into account any arrangement of endogenous covariates, non-random treatment assignment, and endogenous sample selection can be fit using an extended ordered probit model. Additionally, it takes into account endogenous continuous, binary, and ordinal factors. Mother's wellbeing status is categorised into low, moderate and high.

Y_2 = Mother's wellbeing categories (0 = low, 1 = moderate, 2 = high)

3.5 Limitation of the Study

In this study, other factors that could affect use of maternal health care facilities in Nigeria were not accessible since secondary data was solely utilized. Some of the factors were distance to health care facilities, health insurance scheme. Having a sound knowledge on the proximity to health care facilities or access to health insurance scheme will help ascertain the level of maternal health care utilization of the mothers better

Table 3.4: A-priori expectations for the factors influencing maternal health care utilisation

Variables	Expected Sign	Literature
Age of the mother	+ve/-ve	Burgard (2004), Magadi, Agwanda & Obare, (2007) Elo (1992)
Birth Order	+ve/-ve	Elo (1992), Chakraborty et al (2003)
Mother's Education	+ve	Elo (1992), Bello et al (2017), Chakraborty et al (2003)
Women's Employment	+ve/-ve	Furata & Salway (2006),MilesDoan& Brewster(1998)
Family wealth Index	+ve	Mallick et al (2016), Elo (1992),
Place of Residence	+ve	Chakraborty et al (2003), Ayele(2014), Mallick et al (2016), Adamu(2011)
Parity	-ve/ +ve	Baral et al (2012), Simkhada et al (2008)
Woman's autonomy	-ve/ +ve	Furuta and Salway (2006), Kamar (2010), Mahapatro(2012)
Husband's employment	+ve	Ayele (2014), Chakraborty et al (2003)
Household size	+ve	Ayele (2014)

Source: Compilation from Literature

Table 3.5: A-priori expectations for the factors affecting child immunisation status

Variables	Expected Sign	Literature
Age of mother at first birth	+ve/-ve	Antai (2011), Atugba 2016, Onyekachi (2019), Suleman et al (2013)
Birth Order	+ve	Antai (2011), Atugba (2016), Suleman et al (2013)
Mother's Education	+ve/-ve	Rahama & Obada (2010), Bbaale (2015), Etana & Deressa (2012), Tagbo et al (2014), Oyefara (2014), Abdu;raheem &Onajole (2011), Rahaji &Ndikom (2013)
Family wealth Index	+ve/-ve	Onyekachi et al (2019), Suleman et al (2013), Antai (2009), Bbaale (2015)
Region of Residence	-ve/ +ve	Onyekachi et al (2019), Antai (2011), Atugba (2016), Suleman et al (2013),
Woman's autonomy	-ve/ +ve	Bharat (2014), Ebot (2019), Singh et al (2013)
Household size	+ve	Ayele (2014), Bbaale (2015), Etana & Deressa (2012), Tagbo et al (2014),
Media Exposure	-ve/ +ve	Suleman et al (2013)
Religious Affiliation	+ve	Sule (2018), Kim Famong, Rivers &Krone Field 2017.
Attendance of ante-natal care	-ve/ +ve	Onyekachi et al (2019), Mbengue (2014), Lakew et al (2015), Ethana & Deressa (2012).
Post-natal care	+ve	Onyekachi et al (2019), Lakew et al (2015)
Delivery in Health facility	+ve/-ve	Mbengue et al (2017), Lakew et al (2015)

Source: Compilation from Literature

Table 3.6: Analysis of objectives

S/N	Objectives	Meaning	Data Requirement	Proposed tools of analysis
1	To assess the level of maternal health care utilisation.	To measure the inequalities in the use of maternal health care services.	Data on mother's pre-natal care, timing of ante-natal care, numbers of ante-natal visits, assisted, place of delivery, post- natal care.	Multiple correspondence analysis (MCA)
2	To examine the factors that are influencing maternal health care utilisation	Estimating determinants of maternal health care utilisation	Data on mother's occupation, age at first birth, media exposure, employment status, household size, wealth index, child's sex and age.	Tobit Regression Model
3	To investigate the effect of maternal health care utilisation on child immunisation status	What is the effect of utilisation of maternal health care services on child immunisation status?	Data on maternal health care utilisation index and indicators, total children, household size, child sex, child age mother's education and occupation	Extended Ordered Probit Regression Model
4	To determine the effect of maternal health care utilisation on mothers' wellbeing	What is the effect of maternal health care utilisation on mother's wellbeing?	Data on maternal health care utilisation index and indicators, total children, household size, husband age, employment status	Extended Ordered Probit Regression Model

Source: Author's Research, (2023)

CHAPTER FOUR

RESULTS AND DISCUSSION

The findings of the study are covered in this chapter. It details the socioeconomic traits of the households, the mothers, and the children under the age of five, as well as the children's immunisation status. The use of maternal health care utilisation and how it affects children's immunization status and mothers' welfare are also highlighted in this chapter.

4.1 Socio-economic Characteristics of Members in the Household

Results of the descriptive statistics of agricultural households in rural Nigeria are presented in this section. The socioeconomic characteristics of mothers, household heads, and children under five are described using descriptive statistics.

4.1.1 Mother's Socio-economic Characteristics

Table 4.1 summaries the socioeconomic traits of mothers. According to the findings, 65.4% of the mothers had other occupations aside agriculture, while only 34.57% of were totally employed in the sector. This suggests that, aside from agriculture, majority of the mothers in the households worked in other professions like sales and administrative job. Less than 1% of mothers were between the ages of 33 and 45 years, while 54.12% were between the ages of 12 and 18 years at the time of their first delivery. Mothers were 18.54 years old on the average when they gave birth for the first time. This suggests that the majority of mothers were young women who may not have had the necessary information about child care. The low level of education among Nigerian women, which renders them idle and susceptible, may be blamed for the age at first birth. Additionally, the early marriage of young girls in rural areas may have a significant impact on age at first birth. This finding is comparable to that of Adepoju et al (2012) and Salman et al (2020).

Furthermore, 40.35% of the mothers had a formal education, whereas 59.65 percent did not. Odidi et al (2000), Adepoju et al (2012), Ayevbuoman et al (2016), Salman et al (2020), Fasina et al (2020) have all previously reported that rural women had a low degree of formal education. The lack of formal education among women in rural Nigerian homes has been linked to custom and religious belief. Additionally, 64.16% of the mothers were Muslims earlier established by Suleman et al (2013) who asserted that majority of rural women in Nigeria were Muslims especially in the Northern part of the country.

Table 4.1: Distribution of mothers by socio-economics characteristics

Characteristics	Frequency	Percentage (%)
Occupation of mothers		
Agriculture part-time	1800	65.43
Agriculture full-time	951	34.57
Age of mothers at first birth		
12-18	1599	58.12
19-25	992	36.06
26-32	143	5.20
33-45	17	0.62
Mean	18.54	-
Standard deviation	3.791	-
Education of mothers		
No formal education	1641	59.65
Formal education	1110	40.35
Religion		
Christianity	959	34.86
Islamic	1765	64.16
Traditionalist	17	0.62
Others	10	0.36

Source: Computed from NDHS, 2018

4.1.2 Socio-economic Characteristics of Households

According to the results in Table 4.2, 44.82% of the husbands in the households had no formal education, while 55.18% had formal education. Almost half (43.44%) of household heads were between the ages of 36 and 45 years, and 12.00% were over the age of 55years. The household heads' average age was 43.66 ± 9.92 years, indicating that they were still in their prime earning years. This supports Adeoti (2014) study, which claims that the heads of rural households were at their prime age for economic activity.

Very few (5.85%) of the households had a female head of households while 94.15% were led by men. This corroborate the assertion that majority of households in rural Nigeria were headed by men according to Oni and Yusuf (2008), Makama (2013), Israel et al (2015), and Salman et al (2020). Geographically, the North West of the country consist 30.61% of the households, while the South West of the nation consist of 9.38%. Furthermore, 3.2% of the households had more than fifteen people living in them, but 51.84% of households had six to ten members, with a mean household size of 8.30 ± 3.64 Ayodele et al (2012), Salman et al (2020), and Yusuf et al (2009) studies all confirmed large household sizes in agricultural households in rural Nigeria.

Table 4.2: Distribution of households by socio-economics characteristics

Characteristics	Frequency	Percentage (%)
Education of husbands		
No formal education	1233	44.82
Formal education	1518	55.18
Age of household head		
≤25	63	2.29
26-35	514	18.68
36-45	1195	43.44
46-55	649	23.59
≥55	330	12
Mean	43.66	-
Standard deviation	9.916	-
Sex of household head		
Male	2590	94.15
Female	161	5.85
Zones		
N-C	424	15.41
N-E	798	29.01
N-W	842	30.61
S-E	156	5.67
S-S	273	9.92
S-W	258	9.38
Household size		
1-5	655	23.81
6-10	1426	51.84
11-15	582	21.16
>15	88	3.20
Mean	8.30	-
Standard deviation	3.642	-

Source: Compilation for NDHS, 2018

4.1.3 Child's Characteristics

The children's socioeconomic characteristics were presented in Table 4.3. According to the results, 32.45% of the children were between the ages of 10 and 18 months, and about 18% were between the ages of 28 and 35 months. The youngsters were 15.93 ± 9.64 months old on average. According to birth order, 90.66% of the children were third or later born, while 2.60% of them were first born. The average order of birth was 6±2.603.

Also, there were roughly 51.47% male and 48.53% female among the children. Furthermore, 2.15% of the newborns weighed 2.5 kg or less, whereas approximately 84.05% of the infants were not weighted at delivery. As children who were born weighing less than 2.5kg were considered ineligible to begin the immunization program, this suggests that a small proportion of the children may have missed out on vaccinations due to low birth weight. This is probably one of the causes of the high proportion of children living in agricultural homes who were not immunized.

Table 4.3: Distribution of children by socio-economics characteristics

Characteristics	Frequency	Percentage (%)
Child's age(months)		
0-9	779	28.72
10-18	880	32.45
19-27	546	20.13
28-35	507	18.69
Mean	15.93	-
Standard deviation	9.641	-
Birth order		
1	69	2.51
2	188	6.83
≥3	2494	90.66
Mean	6.0	-
Standard deviation	2.60	-
Child sex		
Male	1416	51.47
Female	1335	48.53
Child birth weight (Kg)		
≤2.5	59	2.15
2.6-5.00	375	13.63
>5.00	5	0.18
Not weighted	2312	84.05

Source: Compilation from NDHS, 2018

4.2 Levels of Maternal Health Care Utilisation

Results from the analysis on maternal health care utilisation among agricultural households in rural Nigeria are presented in this section. It explains the variables utilised in this study to measure maternal health care utilisation across socioeconomic characteristics of mothers and households. The section also highlights the distribution of maternal health care utilisation among household, mother, and child socioeconomic and demographic factors. Results of statistics indicating differences between variables/levels of maternal health care utilisation and socioeconomic characteristics of households, mothers, and children were also presented.

4.2.1 Maternal Health Care Utilisation Variables across the Households

The measures of maternal health care utilisation along with how they affect mothers living in agricultural households in rural Nigeria are shown in Table 4.4. According to the results, just 12.58% of mothers received prenatal care in health care facility, and 12.65% of mothers had no prenatal care at all. This suggests that higher proportion of mothers in rural agricultural households in Nigeria choose unconventional settings for their prenatal care. Furthermore, 23.26% of mothers in the households began prenatal care during the first trimester, with 76.74% beginning it afterward. This suggests that the majority of expectant mothers did not begin ante-natal care during the first trimester, as advised by the World Health Organization. This is in line with Singh et al (2021), whose study found that young rural women did not frequently get ante-natal care.

In respect of number of ante-natal visits, 76.26% of the mothers had four or more ante-natal visits during their pregnancy, almost a quarter (23.74%) did not meet the minimum acceptable number of four ante-natal appointments as advised by the World Health Organization. The average number of ante-natal visits among mothers was 4.99 ± 3.07 visits. It can thus be inferred that majority of mothers received ante-natal care. Adeniyi (2021) previously exposed the subpar ante-natal care treatment in Nigeria

However, 52.96% of the mothers received skilled labor assistance, compared to about 47.04% who received unskilled labor assistance during delivery. This suggests that a sizable

proportion of mothers in rural Nigerian farming households gave birth to their infants in the presence of unskilled workers. As a result, 69.43% of mothers gave birth at home, compared to 30.57% who did so in a hospital. This is in line with findings in Nigeria, mothers frequently give birth at home, according to Adetunji et al (2019). The results also showed that 17% of mothers received what the World Health Organization refers to as post-natal care, or care after birth, while 82.22% of did not. Prior research by Tsawe et al (2015) revealed a low rate of postnatal care among mothers in n Swaziland.

Table 4.4: Distribution of mothers by maternal health care utilisation variables

Indicators	Frequency	Percentage
Prenatal care		
None	348	12.65
Others	2057	74.77
Healthcare facility	346	12.58
Timing of Ante-natal care		
Later	2111	76.74
First Trimester	640	23.26
Number of Ante-natal care		
< 4(No)	653	23.74
≥ 4(Yes)	2098	76.26
Mean	4.99	-
Standard deviation	3.074	-
Assisted During Delivery		
Others	1294	47.04
Skilled birth attendants	1457	52.96
Place of Delivery		
Others	1910	69.43
Health Facility	841	30.57
Post-natal Care		
No	2262	82.22
Yes	849	17.78

Source: Compilation from NDHS, 2018

4.2.2 Pre-natal Care by Household Socio-economic Characteristics

Table 4.5a and 4.5b shows the distribution of prenatal care utilsation across household socioeconomic factors. The number of mothers who did not use pre-natal care was higher in the northern zone than in the southern zone, according to the distribution on pre-natal care use across region of residence. The North-west zone had the highest proportion of women who did not have prenatal care, while the south-east zone had the lowest proportion of mothers with no prenatal care. Utilisation of prenatal care differed significantly ($p<0.01$) by region of residence. Yarzever et al (2013) and Okoli et al (2020) previously reported that the North-west and North-east zones were recognized mostly for low maternal health care utilization in Nigeria.

Compared to households with female heads, more mothers in male-headed households did not use prenatal care. 92.24% of mothers in homes with male heads did not use prenatal care services, compared to 7.76% of mothers in households with female heads. The sex of household heads differed significantly ($p<0.01$) by prenatal care usage. In agricultural homes in rural Nigeria, 67.82% of women from poor households did not access prenatal care, compared to just 15.23% of mothers from wealthy households. This suggests that the majority of pregnant women in rural Nigeria who did not receive prenatal care were from poor farming households. This is consistent with the findings of Okoli et al (2020), who reported that impoverished households residing in rural areas frequently had low utilisation of maternal health care facilities. The use of prenatal care varied significantly ($p<0.5$) across household economic status.

Furthermore, 37.96% of women who did not use prenatal care had husbands without a formal education, compared to 62.64% of mothers whose husbands had a formal education and did not utilise prenatal care. This suggests that mothers in agricultural households in rural Nigeria did not use or receive prenatal care more frequently because of the husband's education level. Although according to Suleman et al (2013) the under utilisation of prenatal care, was caused by mothers' lack of understanding about it though Adetunji et al (2019) later observed that low utilisation of maternal health care facilities by mothers was aided by the husband's lack of formal education. A significant difference($p<0.01$) was found between pre-natal care utilisation and the educational levels of husbands.

Households having 6-10 members form a higher proportion (47.41%) of mothers who did not use prenatal care services. Also, 43.10 percent of mothers who did not use prenatal care had household heads who were in their prime earning years. However, there was no significant relationship between pre-natal care usage by household size and age of household head

Table 4.5a: Distribution of mothers by pre-natal care utilization by household's socio-economics characteristics

Characteristic	Pre-natal care					
	None		Others		Health care facility	
Zone	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
North-central	63	18.10	327	15.90	34	9.83
North-east	57	16.38	598	29.07	143	41.33
North-west	117	33.62	709	34.47	16	4.62
South-east	23	6.61	99	4.81	34	9.83
South-south	60	17.24	135	6.56	78	22.54
South-west	28	8.05	189	9.19	41	11.85
χ^2			248.02***			
household head Sex						
Male	321	92.24	1,948	94.70	321	92.77
Female	27	7.76	109	5.30	25	7.23
χ^2			4.62**			
Wealth index						
Poorest	126	36.21	802	38.99	111	32.08
Poorer	110	31.61	634	30.82	111	32.08
Middle	59	16.95	420	20.42	66	19.08
Richer	48	13.79	167	8.12	46	13.29

Source: Compilation from NDHS,2018

Table 4.5b: Distribution of mothers on pre-natal care utilization by household's socio-economics characteristics cont'd

Zones	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Richest	5	1.44	34	1.65	12	3.47
χ^2			27.89***			
Husband level of education						
No formal education	130	37.96	968	47.06	135	39.02
Formal education	218	62.64	1089	52.94	211	60.98
χ^2			16.71***			
Household size						
1-5	104	29.89	460	22.36	91	26.30
6-10	165	47.41	1,057	51.39	204	58.98
11-15	62	17.82	471	22.90	49	14.16
>15	17	4.89	69	3.35	2	0.58
χ^2			36.35***			
Husband's age						
≤25	7	2.01	46	2.24	10	2.89
26-35	69	19.83	389	18.91	56	16.18
36-45	150	43.10	882	42.88	163	47.11
46-55	90	25.86	491	23.87	68	19.65
>55	32	9.19	249	12.11	49	14.17
χ^2			10.18			

Source: Compilation from NDHS, 2018

4.2.3 Pre-natal Care Utilisation by Mother's Socio-economic Characteristics

According to Table 4.6, a higher proportion of mothers who were too young at first birth had no pre-natal care utilisation compared to mothers in middle ages. The age range of 12 to 18 years had the largest number of mothers (58.62%) who did not use prenatal care services, while mothers over 32 years had the lowest proportion (0.29%). Pre-natal care usage and age of mothers in agricultural households differs significantly ($p<0.1$). Findings indicate that 64.66% of mothers who had no utilisation on pre-natal care service engaged in agriculture as a part-time job, whereas 35.34% who had agriculture as full- time job had no prenatal care utilisation This suggests that, compared to mothers who were completely engaged in agriculture, more mothers who had jobs other than farming did not prenatal care services. Pre-natal care utilisation differs across occupation of mothers significantly ($p<0.01$).

Majority (50.29%) of mothers who did not embrace pre-natal care utilization had a formal education and were also mostly Muslims (53.47%). There was a significant difference ($p<0.01$) between pre-natal care utilization across religion and levels of mother's education. According to earlier research by Suleman et al (2013), Muslim women particularly in northern Nigeria, regardless of their level of education, still value their privacy. This is the most plausible explanation for the respondents' limited utilisation of some maternal health care services.

Table 4.6: Distribution of mothers on pre-natal utilization across mother's socio-economics characteristics

Characteristic	Pre-natal care					
	None		Others		Health care facility	
Mother's occupation	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Agriculture part-time	225	64.66	1367	66.46	208	60.17
Agricultural full time	123	35.34	390	33.54	138	39.88
χ^2			5.37*			
Mother's age at first birth						
12-18	204	58.62	1,228	59.70	167	48.27
19-25	132	37.93	709	34.47	151	43.64
26-32	11	3.16	109	5.30	23	6.65
>32	1	0.29	11	0.53	5	1.45
χ^2			22.878***			
Education of Mother						
No formal education	161	46.26	1,307	63.54	173	50.00
Formal education	187	53.47	750	36.46	173	50.00
χ^2			52.22***			
Mother's religion						
Christian	166	47.70	629	30.58	164	47.40
Muslim	175	50.29	1409	68.50	181	52.31
Traditionalist	0	0.00	16	0.78	1	0.29
Other	7	2.01	3	0.15	0	0.00
χ^2			100.47***			

Source: Compilation from NDHS,2018

4.2.4 Timing of Ante-natal Care across Households' Characteristics

According to Table 4.7a and 4.7b, 53.39% of mothers whose husbands had formal education started ante-natal care later than first trimester, compared to 46.41% of mothers whose husband had no formal education who started ante-natal care later than first trimester. The timing of ante-natal care differs across level of husband's education significantly ($p<0.01$). 51.11% of mothers in the household who stated ante-natal care later than first trimester had household size of 6-10 persons. With respect to timing of ante-natal care, minority (2.23%) of mothers who started ante-natal care later than first trimester had more than 15 members within the households. Timing of ante-natal care by household size varied significantly ($p<0.01$). According to WHO, (2020), it is advised that mothers should start ante-natal care in the first trimester as likely complications in the pregnancy can be detected early and necessary treatment can be administered. Having mothers starting ante-natal care in later trimester within agricultural households in rural Nigeria predisposes a higher proportion of them to likely complications in pregnancy which render them unavailable as a source of labour within the households for the specific production session.

The proportion of mothers who started ante-natal care in later trimester was lowest (2.18%) in households whose head was under the age of 25years and highest (42.07%) in those whose head was between the ages of 36 and 45. This suggests that more of mothers who did not start ante-natal care at the appropriate time as recommended by WHO had spouses who were still in their productive years. Regionally, mothers who started ante-natal care at later trimester were more prevalent in the northern zone than the southern zone. The North-west zone had the largest proportion (32.73%) of mothers who started ante-natal care in later trimester, while the South-east zone had the lowest proportion (5.78%) of mothers who started ante-natal care visit in later trimester. This is consistent with study of Ovikuomagbe (2017) and Adetunji et al (2019), which found that the North-west area of Nigeria had the highest frequency of underuse of ante-natal care. Timing of ante-natal care differs significantly ($p<0.01$) by region of residence.

When compared to homes with female heads, male-headed households had the largest proportion of mothers who started ante-natal care in later trimester. According to findings, 94.08% of mothers in households with men as the head of household started ante-natal care

visit in later trimester. Majority (39.08%) of mothers who started ante-natal care visit in later trimester were found in the poorest households. Among agricultural households in rural Nigeria, 2.04% the richest household had mothers who started ante-natal care in later trimester. This indicates that starting ante-natal care visit in later trimester is influenced by the household economic status. Okoli et al (2020) observed that poorer women residing in rural areas frequently under-utilised maternal health care resources.

Table 4.7a: Distribution of mothers by timing of ante-natal care across household's socio-economics characteristics

Characteristic	Timing of ante-natal			
	Later		First trimester	
	Frequency	Percentage	Frequency	Percentage
Husband education level				
No formal education	984	46.61	249	38.91
Formal education	1127	53.39	391	61.09
χ^2			11.79***	
Household size				
1-5	513	24.30	142	22.19
6-10	1079	51.11	347	54.22
11-15	472	22.36	110	17.19
>15	47	2.23	41	6.41
χ^2			34.87***	
Husband's age				
≤25	46	2.18	17	2.66
26-35	403	19.09	111	17.34
36-45	888	42.07	307	47.97
46-55	513	24.30	136	21.26
>55	261	12.37	69	10.78
χ^2			16.57***	

Source: Compilation from NDHS, 2018

Table 4.7b: Distribution of mothers by timing of ante-natal care across household's socio-economics characteristics cont'd

Region	Frequency	Percentage	Frequency	Percentage
North-central	333	15.77	91	14.22
N-east	597	28.28	201	31.41
N-west	691	32.73	151	23.59
South-east	122	5.78	34	5.31
South-south	183	8.67	90	14.06
South-west	185	8.76	73	11.41
χ^2		34.07***		
Sex of household head				
Male	1986	94.08	604	94.38
Female	125	5.92	36	5.63
χ^2		0.078		
Household wealth index				
Poorest	825	39.08	214	33.44
Poorer	666	31.55	189	29.53
Middle	375	17.76	170	26.56
Richer	202	9.57	59	9.22
Richest	43	2.04	8	1.25
χ^2		25.68***		

Source: Compilation from NDHS, 2018

4.2.5 Timing of Ante-natal Care across Mother's Characteristics

Table 4.8 shows that 65.99% of mothers that were engaged in agriculture partially started ante-natal in later trimester. Timing of ante-natal care visit across occupation of mothers were not different significantly. Furthermore, more mothers (52.27%) in their teen ages at first birth started ante-natal care visit in later trimester compared with older mothers. This implies that higher proportion of mothers who started ante-natal care visit in later trimester were teenage mothers at first birth. However, no significant difference was observed between timing of ante-natal care visit across ages of mothers at first birth.

Starting ante-natal care visit in later trimester was more predominant among mothers with no formal education (61.06%) compared with those having formal education (38.94%). Also, 65.56% of the mothers who started ante-natal care visit in later trimester were Muslims. Timing of ante-natal visit across religion and education of mothers differs significantly ($p<0.01$).

Table 4.8: Distribution of mothers on timing of ante-natal care visit across mother's socio-economics characteristics

Characteristic	Timing of Ante-natal care			
	Later		First trimester	
Mother's occupation	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Agricultural part-time	1393	65.99	407	63.59
Agricultural full-time	718	34.01	233	36.41
χ^2		1.244		
age at first birth				
12-18	1230	58.27	369	57.66
19-25	749	35.48	243	37.97
26-32	119	5.64	24	3.75
>32	13	0.62	4	0.63
χ^2		4.24		
level of education				
No formal education	1289	61.06	352	55.00
Formal education	822	38.94	288	45.00
χ^2		7.49***		
Mother's religion				
Christianity	700	33.16	259	40.47
Islamic	1384	65.56	381	59.53
Traditionalist	17	0.81	0	0.00
Others	10	0.47	0	0.00
χ^2		18.50***		

Source: Compilation form NDHS, 2018

4.2.6 Number of Ante-natal Care Visits across Households Characteristics

Table 4.9 shows the distribution of mothers by number of ante-natal care visits across household variables. The findings indicate that mothers from poorer households were more likely to have fewer number of ante-natal visits as 35.99% of mothers in poorer households had less than four number of ante-natal visits, compared to less than 1.00% of mothers in richer households. Number of ante-natal visits and household economic status varied significantly ($p<0.01$).

In comparison to mothers whose husbands had formal education, more mothers whose husbands had no formal education had less than four number of ante-natal visits. The largest proportion (50.23%) of women who had less than four ante-natal care visits were married to uneducated husbands. An increase in the number of husbands with formal education leads to an increase in the number of ante-natal care visits by mothers. Number of ante-natal visits and household's level of education varied significantly($p<0.01$)

Furthermore, 49.0% of mothers in homes with 6 to 10 members had less than four number of ante-natal visits. These mothers tend to be more prevalent in households with medium-sized members. Regarding the number of ante-natal care visits, a smaller proportion (1.38%) of women from homes with more than 15 people had less than four ante-natal care visits. Compared to mothers in homes headed by women, more mothers in male-headed households had less than four ante- natal care visits as 93.26% of mothers in male-headed households did not have up to four ante-natal care visits.

The North-west zone had the highest proportion (46.71%) of women not having up to four ante-natal care visits while the South-west zone had the lowest proportion (3.68%) of mothers with less than four ante-natal care visits. This suggests that the northern zone has more mothers with fewer number of ante-natal care visits than the southern zone which implies that mothers in the northern zone were worse off than their counterparts in the southern zone. Number of ante-natal care visits and region of residence varied significantly ($p<0.01$).

Table 4.9: Distribution of mothers by number of ante-natal visits across household's socio-economics characteristics

Characteristics	Number of ante-natal visits			
	< 4		≥ 4	
	Frequency	Percentage	Frequency	Percentage
Household wealth index				
Poorest	228	34.92	811	38.66
Poorer	235	35.99	620	29.55
Middle	124	18.99	421	20.07
Richer	61	9.34	200	9.53
Richest	5	0.77	46	2.19
χ^2		14.26***		
Husband level of education				
No formal education	328	50.23	905	43.13
Formal education	325	49.77	1193	56.86
χ^2		10.13***		
Household size				
1-5	157	24.04	498	23.74
6-10	320	49.00	1106	52.72
11-15	167	25.27	415	19.78
>15	9	1.38	79	3.77
χ^2		18.12***		
Sex of household head				
Male	609	93.26	1981	94.42
Female	44	6.74	117	5.58
χ^2		1.22		
Region				
North-central	139	21.29	285	13.58
North-east	110	16.85	688	32.79
North-west	305	46.71	537	25.60
South-east	50	7.66	106	5.05
South-south	25	3.83	248	11.82
South-west	24	3.68	234	11.15
χ^2		203.06***		

Source: Compilation from NDHS, 2018

4.2.7 **Number of Ante-natal Care Visits across Mother's Characteristics**

The distribution of mothers by number of ante-natal care visits across mother's characteristics is presented in Table 4.10. Majority (71.52%) of mothers who had agriculture as part-time vocation had less than four number of ante-natal care visit in rural Nigeria while 28.48 % of mothers fully engaged in agriculture had less than four number of ante-natal care visits. There was a significant difference ($p<0.01$) in number of ante-natal care visits by mother's part-time and full-time agricultural vocation.

Mothers with less than four numbers of ante-natal care visit seemed to be more amidst younger mothers at first birth since 64.78% of mothers between 12 and 18 years of age had fewer number of ante-natal care visits relative to mothers above 32 years of age at first birth accounting for those with fewer number of ante-natal care visits (1.38%). There was a significant difference ($p<0.01$) in the number of ante-natal care visit among age groups of mothers at first birth.

Higher proportion (62.94%) of mothers with less than four number of ante-natal care visits had no formal education while a few proportion (37.06%) of those with formal education had less than four number of ante-natal care visit (37.06%). This implies that increase in number of ante-natal care visit increased with increase in mother's educational status. There was a significant difference ($p<0.5$) in the number of ante-natal care visits between the educated and uneducated mothers. Also,71.06% of mothers with less than number of ante-natal care visits were Muslims and a significant association ($p<0.01$) existed between number of ante-natal care visits and mother's religion.

Table 4.10: Distribution of mothers by number of ante-natal visits across mother's socio-economics characteristics

Characteristics	Number of ante-natal visits			
	< 4		≥ 4	
	Frequency	Percentage	Frequency	Percentage
Mother's occupation				
Agricultural part-time	467	71.52	1333	63.54
Agricultural full-time	186	28.48	765	36.46
χ^2		14.01***		
Age at first birth				
12-18	423	64.78	1176	56.05
19-25	188	28.79	804	38.32
26-32	33	5.05	110	5.24
>32	9	1.38	8	0.38
χ^2		27.11***		
Level of education				
No formal education	411	62.94	1230	58.63
Formal education	242	37.06	868	41.37
χ^2			3.85**	
Religion				
Christianity	182	27.87	777	37.04
Islamic	464	71.06	1301	62.01
Traditionalist	4	0.61	13	0.62
Others	3	0.46	7	0.33
χ^2		18.56***		

Source: Compilation from NDHS, 2018

4.2.8 **Place of Delivery across Household Socio-economic Characteristics**

Table 4.11a and 4.11b revealed that the proportion of women who delivered in other homes apart from health care facilities was highest (46.39%) in the poorest households compared to the richest households (0.21%), which had the fewest of mothers who delivered in other homes asides health care facilities. According to Ladipo (2006), rural mothers were more likely to deliver at home because of the unpredictable nature of labor and the limited availability of resources.

Furthermore, compared to the southern zone, the northern zone had a higher percentage of mothers who delivered in other homes asides health care facility. The North-west zone had the largest proportion (38.06%) of mothers who delivered in other, while the South-east zone had the lowest number (1.41%). This suggests that home delivery is more prevalent among mothers in the northern zone than with mothers in the southern zones. In line with reports by Adetunji et al (2019), and Fasina et al (2019), the southern zone is better off than the northern zone when respect to it delivery in health care facility.

As husbands' levels of education rose, so did delivery in health care facilities by mothers within the household. Mothers who had other homes as place of delivery majorly (54.29%), had husbands without a formal education, whereas 45.71% of mothers who delivered at other home, had husbands with formal education. Adetunji et al (2019), and Suleman et al (2013) established that low facility delivery in rural areas facilitates mothers' choice to give birth at home. Also, lack of husband's education aids home delivery in mothers as reported by Adetunji et al (2019) and low facility delivery in rural area was reported by Suleman et al 2013. There was a significant difference ($p<0.01$) between place of delivery and the level of education of husbands.

Furthermore, 52.36% of mothers with household size of 6-10 persons had other homes as place of delivery while 3.30% of mothers who delivered in other homes were from households with more than 15 persons/members. This implies that fewer mothers from large agricultural households delivered in other homes aside heath care facility. This contradicts the report of Stephanson et al (2006) who opined that having a large number of children in a household had a negative impact on delivery in a medical facility. Also, 96.65% of mothers in male-headed households had other homes as place of delivery.

There was a significant difference ($p<0.01$) by place of delivery across sex of household head in agricultural household in rural Nigeria.

In rural Nigeria, 46.34% of mothers whose household heads were between 36 and 45 years old gave birth in other homes. Additionally, 3.25% of mothers in farming homes with husbands under the age of 25 gave birth in other homes. Also, 96.65% of women in households with male heads gave birth in other. Place of delivery and sex of household head in agricultural household in rural Nigeria varied significantly ($p<0.01$).

Table 4.11a: Distribution of mothers on place of delivery across household's socio-economics characteristics

Characteristics	Place of delivery			
	Other homes		Health care facility	
	Frequency	Percentage	Frequency	Percentage
Wealth index				
Poorest	886	46.39	153	18.19
Poorer	635	33.25	220	26.16
Middle	274	14.35	271	32.22
Richer	111	5.81	150	17.84
Richest	4	0.21	47	5.59
χ^2		406.66***		
Region				
North central	243	12.72	181	21.52
North east	663	34.71	135	16.05
North west	727	38.06	115	13.67
South east	27	1.41	129	15.34
South -south	180	9.42	93	11.06
South west	70	3.66	88	22.35
χ^2		631.61***		

Source: Researcher, (2020)

Table 4.11b: Distribution of mothers on place of delivery across household's socio-economics characteristics cont'd

Education of Husband	Frequency	Percentage	Frequency	Percentage
No formal education	1037	54.29	196	23.31
Formal education	873	45.71	645	76.69
χ^2		226.71***		
Household size				
1-5	367	19.21	288	34.24
6-10	1000	52.36	426	50.65
11-15	480	25.13	102	12.13
>15	63	3.30	25	2.97
χ^2		102.58***		
Husband's age				
≤25	62	3.25	32	3.80
26-35	294	15.39	220	26.16
36-45	885	46.34	310	36.86
46-55	450	23.56	199	23.66
>55	219	11.47	80	9.51
χ^2		53.74***		
Sex of household head				
Male	1846	96.65	744	88.47
Female	64	3.35	97	11.53
χ^2		70.96***		

Source: Compilation from NDHS,2018

4.2.9 Place of Delivery and Mother's Socio-economic Characteristics

Place of delivery across mother's socio-economic factors is presented in Table 4.12. Most (70.26%) mothers who delivered in other homes had other vocations asides agriculture while mothers engaged in agriculture fully had the lowest proportion (29.74%) of mothers who delivered in other homes. This implies that mothers who were engaged in agricultural activities partially alongside with their husband delivered at other homes compared with mothers who were engaged into agriculture fully. There was a significant difference ($p<0.01$) in place of delivery across mother's occupation.

Furthermore, 66.96% of younger mothers between 12 and 18years old at first birth delivered in other homes asides health care while majority (51.84%) of mothers who delivered in health care facility were between the age of 19-25 years. This implies that delivery in health care facility increased with increase in mother's age at first birth among agricultural household in rural Nigeria. Adetunji et al (2019) reported that young mothers aged between 15-24 years had a higher prevalence of home delivery than the national average for all women of reproductive age in Nigeria. There was a significant difference ($p<0.01$) between place of delivery across mother's age.

Additionally, 73.25% of mothers with no formal education had other homes as place of delivery while 26.75% of mothers with formal education did. Also, majority (71.22%) of mothers with formal education delivered in health care facility. This is in line with the report of Okoli et al (2020) which affirms that less educated mothers living in rural area were low users of maternal health care facilities. Place of delivery and level of education of mothers differs significantly. Additionally, majority (60.29%) of mothers who delivered in health care facility were Christians while mothers who delivered in other homes were majorly (75.55%) Muslims. There was a significant association between place of delivery and mother's religion ($p<0.01$).

Table 4.12: Distribution of mothers by place of delivery across mother's socio-economic characteristics

Characteristics	Place of delivery			
	Other homes		Health care facility	
	Frequency	Percentage	Frequency	Percentage
Women's occupation				
Agricultural part time	1342	70.26	458	54.46
Agricultural full time	568	29.74	383	45.54
χ^2		64.46***		
Mother's age at first birth				
12-18	1279	66.96	320	38.05
19-25	556	29.11	436	51.84
26-32	71	3.72	72	8.56
>32	4	0.21	13	1.55
χ^2		210.89***		
level of education				
No-formal	1399	73.25	242	28.78
Formal	511	26.75	599	71.22
χ^2		479.78***		
Mother's religion				
Christianity	452	23.66	507	60.29
Islamic	1443	75.55	322	38.29
Traditionalist	15	0.79	2	0.24
Others	0	0.00	10	1.19
χ^2		376.53***		

Source: Compilation from NDHS, 2018

4.2.10 Assisted During Delivery across Household Characteristics

Mothers in households where men presided over had higher proportion (94.2%) of mothers who were assisted by unskilled birth attendants during delivery, as shown in Table 4.13a and 4.13b. In agricultural homes, there was no discernible difference in the sex of household heads and assisted delivery service. Assistance rendered to mothers by skilled or unskilled birth attendant varies across zones. The highest proportion of mothers assisted by unskilled birth attendant during delivery were found in the North-west zone (47.53%) and North-central zone (17.93%) while the least proportion (4.10%) of mothers assisted by unskilled birth attendant were found in the South-west zone This implies that the majority of mothers who were assisted by unskilled birth attendant during delivery were found in the North-west zone. Also, mothers in the southern zones were assisted more by skilled birth attendant relative to those in the northern zone of rural Nigeria. There was a significant difference between assisted during delivery across region of residence ($p<0.01$).

Furthermore, compared to mothers whose husbands had formal education, a larger proportion (51.32%) of women whose husbands had no formal education were assisted by unskilled birth attendant during delivery. Also, mothers from households with 6-10 persons top the list of mothers assisted by unskilled birth attendant during delivery. Mothers who were assisted by unskilled birth attendant were more in homes whose status are low economically relative to households that are stable economically as 38.18% of the mothers in the poorest households were assisted by unskilled birth attendant relative to 1.31% of mothers assisted by unskilled birth attendant during delivery in the richest households. There was a significant difference ($p<0.01$) between assisted during delivery across household economic status in agricultural households.

Additionally, with respect to mothers assisted by skilled birth attendant, mothers with young husbands were better off than mothers with older husbands The result shows that 1.70% of mothers in households with husband younger than 25 years old were not assisted by skilled birth attendant during their deliveries compared to 44.67% of mothers whose household heads were between 36 and 45 years old.

Table 4.13a: Distribution of mothers by assisted during delivery across household socio-economics characteristics

Characteristics	Assisted during delivery			
	Assisted by others		Assisted by skilled birth attendant	
	Frequency	Percentage	Frequency	Percentage
Sex of household head				
Male	1,219	94.2	1,371	94.1
Female	75	5.8	86	5.9
χ^2		0.01		
Region				
North central	232	17.93	192	13.18
North east	204	15.77	594	40.77
North west	615	47.53	227	15.58
South east	70	5.41	86	5.90
South -south	120	9.27	153	10.50
South west	53	4.10	205	14.07
χ^2		460.31***		
Husband's level of education				
No formal education	664	51.32	569	39.05
Formal education	630	48.69	888	60.95
χ^2		41.66***		

Source: Compilation form NDHS, 2018

Table 4.13b: Distribution of mothers by assisted during delivery across household socio-economics characteristics cont'd

Household size	Frequency	Percentage	Frequency	Percentage
1-5	273	21.10	382	26.22
6-10	679	52.47	747	51.27
11-15	298	23.03	284	19.49
>15	44	3.40	44	3.02
χ^2		12.10***		
Household wealth index				
Poorest	494	38.18	545	37.41
Poorer	407	31.45	448	30.75
Middle	231	17.85	314	21.55
Richer	145	11.21	116	7.96
Richest	17	1.31	34	2.33
χ^2		16.40***		
Husband's age				
≤25	22	1.70	41	2,81
26-35	210	16.23	304	20.86
36-45	578	44.67	617	42.35
46-55	329	25.43	320	21.96
>55	155	11.98	175	12.01
χ^2		12.22***		

Source: Compilation from NDHS, 2018

4.2.11 **Assisted During Delivery across Mother's Socio-economic Characteristics**

Table 4.14 shows the distribution of mothers by assistance rendered during delivery across mother's characteristics. Majority (71.72%) of mothers who were assisted by unskilled birth attendant during delivery had other vocation asides agriculture while minority (28.28%) of mothers assisted by unskilled birth attendant during delivery were fully engaged in agriculture. There was a significant difference ($p<0.01$) between mothers assisted by skilled or unskilled attendant during delivery across mother's occupation

Furthermore, 65.69% of young mothers between 12 and 18 years were assisted by unskilled birth attendant during delivery. Older mothers who were 32 years and above contribute a minor proportion (0.46%) to the group of mothers who were assisted by unskilled birth attendant during delivery. Assistance rendered to mothers during delivery differs across mother's age significantly. Mothers assisted by skilled birth attendant increased as the educational status of mothers improved. 62.75% of mothers with no formal education were assisted by unskilled birth attendant during delivery while 37.25% of mothers with formal education were assisted by unskilled birth attendants. Assistance during delivery across mother's level of education differs significantly. Also, majority (70.09%) of mothers who were assisted by unskilled birth attendant Muslims and there was a significant difference between assistance rendered during delivery to mothers across mother's religion ($p<0.01$).

Table 4.14: Distribution by mothers by assisted during delivery across mother's socio-economics characteristics.

Characteristics	Assisted during delivery			
	Assisted by others		Assisted by skilled birth attendant	
	Frequency	Percentage	Frequency	Percentage
Mother's occupation				
Agricultural full-time	928	71.72	872	59.85
Agricultural part time	366	28.28	585	40.15
χ^2			42.67***	
Mother's age at first birth				
12-18	850	65.69	749	51.41
19-25	379	29.29	613	42.07
26-32	59	4.56	84	5.77
>32	6	0.46	11	0.75
χ^2			57.96***	
Mother's education level				
No formal education	812	62.75	829	56.90
Formal education	482	37.25	628	43.10
χ^2			9.756***	
Mother's religion				
Christianity	363	28.05	596	40.91
Islamic	907	70.09	858	58.89
Traditionalist	15	1.96	2	0.14
Others	9	0.70	1	0.07
χ^2			64.58***	

Source: Compilation from NDHS, 2018

4.2.12 **Post-natal Care Usage across Household's Socio-economic Characteristics**

Post-natal care across household characteristics in Table 4.15a and 4.15b shows that 94.35% of mothers in male-headed households did not receive post- natal compared to 5.57% of mothers who had no post- natal care in female headed households. There was a significant difference ($p<0.01$) between post-natal care across gender of household heads in agricultural households. Also, North zone had more mothers with no post-natal than the south zone. The largest proportion (34.00%) of mothers with no post-natal care were seen in the North-west zone while the smallest proportion (5.65%) was amidst the south-east zone. Significant differences ($p<0.01$) existed between post-natal care in mothers across region of residence.

Poorest households had the highest proportion (39.48%) of mothers with no post-natal care as shown in the result relative to 1.68% of mothers with no post-natal care from the richest households. There was a significant difference between post-natal care usage across household economic status. It was also discovered from the findings that mothers with no post-natal care were mostly (54.16%) with husbands who had formal education while minorities (45.85%) of them had husbands with no formal education. There was a significant difference ($p<0.5$) between post-natal care usage across educational level of husbands.

Additionally, 52.83% of mothers with household size of 6-10 persons had no post-natal care while just 3.36% of mothers with no post-natal care had more than 15 household members. This implies that fewer mothers from large agricultural households had no post-natal care relative to mothers from medium and small sized agricultural homes. A significant difference ($p<0.5$) existed between post-natal care usage across household size. Furthermore, 43.99% of mothers whose household heads were between 36 and 45 years had no post-natal care in rural Nigeria while minority (2.03%) of mothers whose partners were less than 25 years had no post-natal care. This implies that higher proportion of mothers with no post-natal had husband/partners who were in their productive years. There was a significant difference ($p<0.5$) between post-natal care usage across the age of husbands.

Table 4.15a: Distribution of mothers by post-natal care usage across household's socio-economic characteristics

Characteristics	Post-natal care			
	No		Yes	
	Frequency	Percentage	Frequency	Percentage
Sex				
Male	2136	94.43	454	92.84
Female	126	5.57	35	7.16
χ^2		1.838NS		
Region				
North-central	378	16.71	46	9.41
North-east	588	25.99	210	42.94
North-west	769	34.00	73	14.93
South-east	128	5.66	28	5.73
South-south	181	8.00	92	18.81
South-west	218	9.64	40	8.18
χ^2		149.78***		
wealth index				
Poorest	893	39.48	146	29.86
Poorer	687	30.37	168	34.36
Middle	436	19.27	109	22.29
Richer	208	9.20	53	10.84
Richest	38	1.68	13	2.66
χ^2		16.98***		

Source: Compliation from NDHS, 2018

Table 4.15b: Distribution of mothers by post-natal care usage across household's socio-economic characteristics cont'd

Husband level of education				
No formal education	1037	45.85	196	40.08
Formal education	1225	54.16	293	59.92
χ^2		50.40**		
Household size				
1-5	534	23.61	121	24.74
6-10	1195	52.83	231	47.24
11-15	457	20.20	125	25.56
>15	76	3.36	12	2.45
χ^2		9.13**		
Husband's age				
≤25	46	2.03	17	3.48
26-35	407	17.99	107	21.88
36-45	995	43.99	200	40.90
46-55	548	24.23	101	20.65
>55	266	11.76	64	13.09
χ^2		14.48**		

Source: Computation form NDHS, 2018

4.2.13 **Post-natal Care Usage across Mother's Socio-economic Characteristics**

Table 4.16 shows that 66.98% of mothers who were partially engaged in agriculture had no post-natal care in rural Nigeria. Those in their teen ages at first birth had no post-natal care as 58.09% of mothers between the age of 12 and 18 years at first birth had no post- natal care while those above the age of 32 years at first birth contributes 0.75% to the group of mothers who had no post-natal care. However, there was no significant difference between post-natal care usage across the ages of mothers at first birth.

Lack of post-natal care was more prevalent among mothers with no formal education. 60.70% of mothers with no formal education had no post-natal care while just 39.30% of mothers did. There was a significant difference between post-natal care usage across level of education of mothers ($p<0.5$). Also, majority (65.12%) of mothers who had no post-natal care were Muslims and there was a significant difference($p<0.01$) between post-natal care usage across mother's religion.

Table 4.16: Distribution of mothers by post-natal care across mother's socio-economics characteristics

Characteristics	Post-natal care			
	No		Yes	
	Frequency	Percentage	Frequency	Percentage
Mother's occupation				
Agricultural part-time	1515	66.98	285	58.28
Agricultural full-time	747	33.02	204	41.72
χ^2		13.44***		
Mother's age a first birth				
12-18	1314	58.09	285	58.28
19-25	809	35.76	183	37.42
26-32	122	5.39	21	4.29
>32	17	0.75	0	0.00
χ^2		4.92NS		
level of education				
No-formal	1373	60.70	268	54.81
Formal	889	39.30	221	45.19
χ^2		5.80**		
Mother's religion				
Christianity	766	33.86	193	39.47
Islamic	1473	65.12	292	59.71
Traditionalist	17	0.75	0	0.00
Others	6	0.27	4	0.82
χ^2		12.51***		

Source: Compilation from NDHS, 2018

4.2.14 Levels of Maternal Health Care Utilisation in the Households

The result reveals the levels of maternal health care utilisation as shown in Table 4.17 below. A little above a quarter (26.94%) of mothers within the households had low maternal health care utilisation while 33.99% had high level of maternal health care utilisation. Low level of maternal health care utilisation in rural area was earlier reported by Buor, (2009); Fasina et al (2020). Close to half of the mothers (39.08%) were moderate users of maternal health care facilities. The mean level of maternal health care utilisation was 0.5381±0.232. Having a high proportion of the mother as low users of maternal health care facilities in an agricultural household means the mothers are vulnerable to complications prior, during and after pregnancy and when there is any health-related issue, their productivity is affected as their will be shortage in the available labour source.

Table 4.17: Distribution of Mothers by Levels of Maternal Health Care Utilisation

Levels	Frequency	Percentage (%)
Low	741	26.94
Moderate	1075	39.08
High	935	33.99
Mean	2.071	
Standard Deviation	0.778	

Source: Compilation from NDHS, 2018

4.2.15 Levels of Maternal Health Care Utilisation across Mother's Characteristics

The levels of maternal health care utilisation in relation to mother's socio-economics characteristics as shown in Table 4.18 reveals that low level of maternal health care utilisation was prevalent among mothers who had other vocation asides agriculture (57.35%). It was inferred from the result that a higher proportion of those mothers with low maternal health care utilization were partially engaged in agriculture. Levels of maternal health care utilization differs significantly ($p<0.01$) across mother's occupation.

Furthermore, mothers within the age group of 19-25 years contributes majorly (52.23%) to the category of low users of maternal health care facilities. This implies that mothers with low level of maternal health care utilisation in agricultural households within the rural Nigeria were majorly young mothers and according to Yarzever et al (2013) less education is associated with increased chances of early marriage which is common among the rural dwellers. This is consistent with the findings of Ochako (2003) and Sharon (2013). There was a significant difference ($p<0.01$) between levels of maternal health care utilisation across the age of mother at first birth.

Additionally, low level of maternal health care utilisations was observed majorly (68.02%) in mothers with formal education while fewer proportions (31.98%) with no formal education had low level of maternal health care utilisation. This is in line with the findings of Etana and Deressa (2012); Bbaale (2015) but contradicts the findings of Stepheson (2006); Babalola et al (2009) and Igyuse et al (2020) who affirms that mother's level of education aids utilisation of maternal health care facilities. Majority of the mothers in the rural area were Muslims who wants privacy, according to Sunil et al (2006), most of them have biased opinion because of cultural and religious belief. There was a significant difference ($p<0.01$) between levels of maternal health care utilisation across level of education of mothers.

Table 4.18: Distribution of mothers by levels of maternal health care utilisation across mother's socio-economic characteristics

Characteristics	Low		Moderate		High	
	Freq.	Percent (%	Freq.	Percent (%)	Freq.	Percent (%)
Women's occupation						
Agriculture part-time	425	57.35	683	63.53	692	74.01
Agriculture full time	316	42.65	392	36.47	243	25.99
χ^2			53.50***			
Women's age at first birth						
12-18	271	36.57	656	61.02	672	71.87
19-25	387	52.23	376	34.98	229	24.49
26-32	70	9.45	39	3.63	34	3.67
33-45	13	1.75	4	0.37	0	0.00
χ^2			211.28***			
Women's education						
No formal education	237	31.98	665	61.86	739	79.04
Formal education	504	68.02	410	38.14	196	20.96
χ^2			383.85***			
Mother's religion						
Christianity	435	58.70	365	33.95	159	17.01
Islamic	294	39.68	709	65.95	762	81.50
Traditionalist	2	0.27	1	0.09	14	1.50
Others	10	1.35	0	0.00	0	0.00
χ^2			365.26***			

Source: Compilation form NDHS, 2018

4.2.16 Levels of Maternal Health Care Utilisation across Child Socio-economics Characteristics

The levels of maternal health care utilisation among mothers in agricultural households in rural Nigeria across child socio-economics characteristics is as shown in Table 4.19. The Table reveals that 32.24% of mothers with low maternal health care utilisation were with children aged between 0 and 9 months, within the households about 51.96% of the mothers with low maternal health care utilisation were nursing male children. Also, mothers with children who were third born and are above dominate those with low level of maternal health care utilisation. This suggest that more of the mothers who had low level of maternal health care utilisation were experienced mothers who believed they know all it entails to manage their health and that of their children before, during and after delivery. This finding was corroborated by the study of Fasina et al (2020) who reported that birth order affects use of maternal health care utilisation in rural area.

Also, the result indicates that mothers with low maternal health care utilisation in agricultural households in rural area of Nigeria were mothers to children who were not weighed at birth (55.87%). This established the fact that most of the children were not delivered in health care facilities; otherwise, they would have been weighted at birth which indicates dominance of poor usage of maternal health care facilities by mothers in the rural area. Levels of mother health care utilization differed significantly ($p<0.01$) across child's age, birth order, and birth weight. However, level of maternal health care utilisation had no significant difference across the sex of a child among agricultural household in the rural area.

Table 4.19: Distribution of mothers by levels of maternal health care utilisation across child socio- economic characteristics

Characteristics	Low		Moderate		High	
	Freq.	Percent (%)	Freq.	Percent (%)	Freq.	Percent (%)
Child's age in months						
0-9	237	32.24	308	29.33	234	25.24
10-18	190	25.85	347	33.05	343	37.00
19-27	190	25.85	148	14.10	208	22.44
28-35	118	16.05	247	23.52	142	15.32
χ^2			78.56***			
Sex of child						
Male	385	51.96	556	51.72	475	50.80
Female	356	48.04	519	48.28	460	49.20
χ^2			1.27			
Birth order						
1	31	4.18	17	1.58	21	2.25
2	76	10.26	69	6.42	44	4.60
≥3	634	85.56	989	92.00	871	93.16
χ^2			38.76***			
Birth weight						
< 2.5	73	9.85	7	0.65	0	0.00
2.6-5.0	270	34.44	83	7.72	22	2.35
>5	5	0.67	0	0.00	0	0.00
Not weighted	414	55.87	985	91.62	913	97.64
χ^2			1.3e+03***			

Source: Compilation from NDHS, 2018

4.2.17 Levels of Maternal health care utilisation across Household's characteristics

The levels of maternal health care utilisation among mothers in agricultural households were shown in Table 4.20a and 4.20b along with household variables. Mothers with low levels of maternal health care utilisation in rural Nigeria belong primarily (89.47%) to households headed by men. The results also showed that a higher proportion of mothers (49.53%) with low maternal health care utilization had medium-sized households with 6–10 people. Also, mothers in households with husbands between the ages of 36 and 45years were more likely (38.73%) to use maternal health care facilities poorly. Level of maternal health care utilization across sex of household's head varied significantly ($p<0.01$).

In addition, mothers with husbands who had formal education outnumbered mothers with husbands who had no formal education in the category of low users of maternal health care services. This suggests that despite the husband's formal education, wives still do not use many maternal health care facilities. According to Idris et al (2013), there was a high prevalence of inadequate use of maternal health care facilities in rural areas, and Sunil et al (2006) previously observed that spouses have prejudices about using these services due to cultural and religious reasons. Levels maternal health care utilisation varied significantly ($p<0.01$) across household size and household head's educational level.

While minorities (6.88%) of women who emerge from the richest households were low users of maternal health care facilities, majority (34.95%) of mothers with low levels of maternal health care utilisation were from homes with an average wealth index, meaning they are neither rich nor poor. This suggests that the usage of maternal health care facilities by mothers in the households is highly influenced by household wealth index. This result is consistent with the findings of Buor (2009) and Adetunji et al (2019), who opined that the household wealth index is positively related with the use of maternal health care. The level of maternal health care utilisation and the household's financial situation differed significantly ($p<0.01$).

Table 4.20a: Distribution of mother by levels of maternal health care utilisation across household's characteristics

Characteristics	Low		Moderate		High	
	Freq.	Percent (%)	Freq.	Percent (%)	Freq.	Percent (%)
Sex of household head						
Male	663	89.47	1010	93.95	917	98.07
Female	78	10.53	65	6.05	18	1.93
χ^2			55.63***			
Household size						
1-5	249	33.60	246	22.88	160	17.11
6-10	367	49.53	578	53.77	481	51.44
11-15	105	14.17	208	19.35	269	28.77
>15	20	2.70	43	4.00	25	2.69
χ^2			97.33***			
Age of household head						
≤25	26	3.51	19	1.77	18	1.93
26-35	184	24.83	171	15.91	159	17.01
36-45	287	38.73	470	43.72	438	46.84
46-55	170	22.94	277	25.77	202	21.60
>55	73	9.98	138	12.83	118	12.62
χ^2			65.02***			

Source: Compilation from NDHS, 2018

Table 4.20b: Distribution of mother by levels of maternal health care utilisation across household's characteristics cont'd

Husband's education	**Freq.**	**Percent (%)**	**Freq.**	**Percent (%)**	**Freq.**	**Percent (%)**
No formal education	160	21.59	517	48.09	556	59.47
Formal education	581	78.41	558	51.19	379	40.53
χ^2			247.39***			
Household wealth index						
Poorest	124	16.73	443	41.21	472	30.48
Poorer	169	22.81	359	33.40	327	34.97
Middle	259	34.95	166	15.44	120	12.83
Richer	138	18.62	107	9.95	16	1.71
Richest	51	6.88	0	0.00	0	0.00
χ^2			535.38***			

Source: Compilation from NDHS, 2018

4.3 Determinants of Maternal Health Care Utilisation

This section covered the elements affecting rural Nigerian agricultural households' usage of maternal health care facilities. Mother's education, mother's age at first birth, mother's occupation, media exposure, sex of household head, region, and birth order were some factors that were relevant with regard to the usage of maternal health care in the household.

4.3.1 Factors Influencing maternal health care utilisation across households

The outcome from the Tobit model indicates that the sigma (σ) is statistically significant ($P<0.01$) and has a value of 0.1975 with a t-value of 73.69. This shows that the model and the data are well-matched. Eleven (11) out of the fifteen (15) variables estimated in the model were statistically significant in the analysis at various levels between one percent ($p<0.01$) and ten percent ($p<0.1$). More than 50% of the coefficients were significant demonstrating that multicolinearity is not significant in the model.

The result in Table 4.21 indicate that, compared to mothers without formal education, the coefficient of mother's education showed a significant ($p<0.01$) negative connection with maternal health care use. This suggests that, compared to mothers without formal education, women with formal education were less likely to use maternal health care facilities. In contrast, Okoli et al (2020), Adetunji et al (2017), Ekpenyong et al (2019), and Ovikuomagbe (2017) found that educated mothers were less likely to forgo using maternal health care services. Regardless of the mother's education level, she still has no say in whether or not she uses a maternal health care facility, and since the majority of the men were primarily Muslims who valued their privacy, most of their wives were denied access to medical facilities especially in the Northern part of Nigerian as earlier documented by Suleman et al (2013) and Yerzever et al (2013). According to Adamu (2003), men, particularly in rural areas, hold the primary decision-making power. The decision to go to a medical facility in an emergency must wait until the husband or in-laws give consent. Mother's formal education will less likely improve the use of maternal health care services ($s = -0.0661$, $p<0.01$).

The outcome also demonstrates a strong negative correlation between maternal health care utilisation and the mother's age at her first birth. This suggests that the likelihood of a rise

in the usage of maternal health care will be reduced depending on the age of the mothers at their first birth. There was a negative and substantial correlation between the mother's job and the use of maternal healthcare. This suggests that women who worked only in agriculture would be less likely to make use of heath care facilities prior, during and after pregnancy than mothers who had other occupations besides agriculture. It is more likely that mothers who work full-time in agriculture will utilise maternity care facilities less ($s = -0.0378$, $p<0.01$). This is consistent with the assertion of Igyuse et al (2020), who found that a mother's work had a significant impact on her decision to use maternal health care facilities.

Mothers' media exposure and the use of maternal healthcare had a negative and substantial correlation ($s=-0.0342$, $p<0.01$). This implies that mothers who had been exposed to mass media were less likely to use facilities for maternal health care. In contrast, Adetunji et al (2013) and Desalew et al (2014) reported that young mothers in Nigeria choose to give birth at home due to a lack of media exposure. It is likely that this is the case because the media content that the mothers were exposed to at each point in time may not have directly addressed or stressed the use of maternal health care, and as a result, exposure to such contents had no effect on the use of maternal health care service. Contrary to Singh et al (2021) findings from which a significant positive relationship between exposure to the mass media and the use of maternal health care was established in India.

The utilisation of maternal health care facilities was found to have a substantial unfavorable connection with the sex of the household head being female in comparison to male ($s=-0.0388$, $p<0.05$). This suggests that having a female head of home in an agricultural household in rural Nigeria will probably result in less mothers using the facilities for maternal health care. In a rural setting, males usually have access to resources like land, loan and credit facilities than a female possibly because of cultural and religious belief, this in turn improves their production and level of income which makes it possible for them to afford health care facilities better than the females.

The utilisation of maternal health care facilities in the households was shown to be positively and negatively correlated to the geopolitical region in which the households were located ($p<0.01$). Mothers in the North Western zone were more likely to use maternal

healthcare facilities than mothers in the North Central zone. In addition, women in rural Nigeria's south east zone were less likely to use maternal health care facilities than mothers in the north central area. Mothers in rural Nigeria's South South zone were found to be more likely to use maternal health care facilities than mothers in the North Central zone, and mothers in rural Nigeria's South Western zone were found to be less likely to use maternal health care facilities than mothers in the North Central zone.

Furthermore, the childbirth order significantly influenced maternal healthcare utilization ($s=0.0195$, $p<0.1$). This implies that the position a child holds either as 1^{st}, 2^{nd}, 3^{rd} born in the household is more likely to increase the use of maternal health care facilities by mothers within the households. An experience with pregnancy or delivery in time past might necessitate the need to utilize health care facility in subsequent pregnancies due to complications or advice from health care personnel who once managed the mother. The findings of Stephenson (2005); Baral et al (2012); Adetunji et al (2017) earlier reported that women who had more than three living children were less likely to make use of maternal health services (only for family planning) because of the experience they believed they have gathered over time.

Table 4.21: Distribution of mothers by factors affecting maternal health care utilisation

Variables	Coefficient	dy/dx	Std. Error	p>t
Mother's characteristics				
Mother's education				
Formal	-0.0669***	-0.0661***	0.0104	0.000
Mother's age at first birth	-0.0082***	-0.0081***	0.0011	0.000
Mother's occupation				
Agriculture full-time	-0.0383***	-0.0378***	0.0090	0.000
Media exposure				
Exposed	-0.0347***	-0.0342***	0.0088	0.000
Household characteristics				
Household size	0.0008	0.0008	0.0012	0.487
Sex of household head				
Female	-0.0394**	-0.0388**	0.0170	0.020
Wealth index	-0.0388	-0.0382	0.0046	0.000
Husband's education				
Formal	-0.0082	-0.0081	0.0098	0.400
Region				
North east	0.0379***	0.0377***	0.0130	0.004
North west	0.0431***	0.0423***	0.0136	0.002
South east	-0.1246***	-0.1222***	0.0195	0.000
South- south	0.0545***	0.0541***	0.0160	0.001
South west	-0.0879***	-0.0866***	0.0162	0.000
Child characteristics				
Child sex				
Female	0.0118	0.0116	0.0076	0.121
Birth order	0.0198*	0.0195*	0.0101	0.051
_cons	0.7428		0.0409	0.000
Number of observations	2751			
LR chi^2(15)	937.92			
Prob> chi^2	0.0000			
Log likelihood	519.875			
Sigma (σ)	0.1975		0.0027	

Source: Compilation from NDHS, 2018

4.4 Profiling Child Immunisation Status

This section presents results from the analysis of data on child immunisation status in agricultural household in rural areas of Nigeria. It describes vaccines captured in the study and their distribution across households. The section also shows the immunisation status of children in the household and their distribution across socio-economic and demographic characteristics of household, mother and child.

4.4.1 Child Vaccines across Households

The distribution of children within the households by scheduled vaccines in Table 4.22 reveals that 69.57% of the children within the households do not receive BCG at birth while 30.43% did. The result also shows that 77.83% of the children did not receive hepatitis B vaccine and for polio vaccine administered at birth, larger proportion (78.70%) of the children in the households did not receive it. This implies that majority of the children in agricultural households in rural Nigeria did not receive the vaccines scheduled for children at birth (BCG, Hepatitis B and polio 0). Low BCG vaccine coverage among children was earlier reported by (UNICEF data 1995-2005) and Ophori et al (2014).

Furthermore, 61.43% of the children in the households did not receive polio1 vaccine at 6^{th} week. Higher proportion (72.81%) of the children missed PENTA 1 vaccine scheduled for the 6^{th} week. Polio 2 vaccine that was to be taken by the 10^{th} week in children, 67.76% of the children within the households did not receive it. This means that majority of the children in agricultural households in the rural area of Nigeria did not receive Polio 2 vaccine. This is similar to the report of Laulajainen, (2012) who reported that hundreds of thousands of children continue to be missed during oral polio vaccine in Nigeria.

A large proportion (79.17%) of the children in the households did not receive PENTA 2 vaccine as at when due. This implies that higher proportion of the children in the households missed the vaccine scheduled for the 10^{th} week. The result also shows that 16.74% of the children in the households received Polio 3 vaccine at week 14, which invariably means a higher proportion (83.06%) of them did not receive it. PENTA 3 vaccine was only received by 13.63% of the children in the households, leaving about 86.37% of the children out. At the 14^{th} week when polio inactive vaccine is to be received, it was shown from the result

that 79.83% of the children in the households did not receive it. This implies that out of the vaccines scheduled for 14th week in children, PENTA 3 vaccine was skipped mostly by children.

Measles vaccine is scheduled for 9th month in children, 78.19% of the children in agricultural households in rural Nigeria did not receive the vaccine. Corsi et al (2009) reported a low coverage of measles antigen among children. Across all the vaccines, children in agricultural households in rural Nigeria missed out on majority; however, PENTA 3 vaccine was mainly skipped, Immunisation coverage for pentavalent vaccine is still below the recommended global goal of 90% as earlier reported by UNICEF (2018) while a majority of the children received polio 1 vaccine. The implication of this is that children in the rural households are vulnerable to diseases as the vaccines to develop antibodies which helps the body fight the diseases has been skipped and so the time available to the mother to take care of other healthy children is limited. Also, the mother and the sick child/children will not add up to the labour source available to the household for that production period which will affect their productivity and income negatively.

Table 4.22: Distribution of children by scheduled vaccines

Scheduled Time	Vaccines	Freq.	Percent (%)
At birth	**BCG**		
	No	1914	69.57
	Yes	837	30.43
	Hepatitis B		
	No	2141	77.83
	Yes	610	22.17
	Polio o		
	No	2165	78.70
	Yes	586	21.30
6 weeks	**Polio 1**		
	No	1690	61.43
	Yes	1061	38.57
	Penta 1		
	No	2003	72.81
	Yes	748	27.19
10 weeks	**Polio 2**		
	No	1864	67.76
	Yes	887	32.24
	Penta 2		
	No	2178	79.17
	Yes	573	20.83
14 weeks	**Polio 3**		
	No	2285	83.06
	Yes	466	16.94
	Penta 3		
	No	2373	86.37
	Yes	375	13.63
	Inactive Polio		
	No	2176	79.83
	Yes	555	20.17
9months	**Measles**		
	No	2168	78.19
	Yes	583	21.19

Source: Compilation from NDHS, 2018

4.4.2 Immunisation Status of Children

Immunisation status of children in agricultural household in rural Nigeria as seen in Table 4.23 shows that 55.83% of children in the households were unimmunized (meaning they had not received any of the vaccines scheduled), while 5.00% of the children were fully immunized. This implies that majority of the children in agricultural household in rural Nigeria did not receive any of the vaccines as at the time due. This report is in line with the report of National primary health care developmental agency (NPCHDA, 2018), that there were over four million unimmunized children in Nigeria even though improvement in child health measured by immunisation status was earlier reported by Nghargbu et al (2017). The mean of child immunisation status in the households was 1.493±0.594. Having a good number of the children unimmunized in the household implies that more of the children will be vulnerable to diseases outbreak and attacks which might eventually leads to a state of morbidity or mortality.

Table 4.23: Distribution of children by immunisation status

Categories of child immunization	Frequency	Percentage (%)
Unimmunized	1536	55.83
Partially immunized	1073	39.00
Fully immunized	142	5.16
Mean	1.4933	-
Standard deviation	0.5944	-

Source: Compliation from NDHS, 2018

4.4.3 Child Immunisation Status across Mother's Socio-economics Characteristics

As shown in Table 4.24, majority (64.13%) of the unimmunized children were from mothers who were engaged in other vocations asides agriculture while minority (35.87) were fully engaged in agriculture This implies that mothers who had agriculture as part-time occupation were mothers to most of the unimmunized children in agricultural household in rural Nigeria. However, there was no significant difference between child immunisation status across the occupation of mothers in agricultural households. This report is similar to the findings of Sunil et al (2009) who reported earlier that mother's occupation is positively significant with child immunisation status.

The result further shows that 54.04% of the unimmunized children were from mothers whose age at first birth is between 12-18years while a few of the unimmunized children were from mothers aged between 33-35 years at first birth. This is likely because of early marriage practice common among agricultural households in the rural area. Awasthi et al (2015) earlier reported that the odd of completing immunisation is higher among mothers aged between 20-34 years compared with mothers who are less than 20 years at first birth. However, there was no significant difference between child immunisation status across the age of mothers at first birth in agricultural households in this study.

Going by educational attainment, majority of the unimmunized children were from mothers who had no formal education (59.64%), while mothers with formal education gave birth to minority (40.36%) of the unimmunized children in the study area. This affirms with the report of Subhani et al (2015) and Tsawe et al (2015) who reported that illiterate mothers in India, Pakistan and Malawi immunize their children less than the highly educated ones. This implies that level of education of mothers could positively influence child immunisation status in agricultural households in rural area. This is in line with Bello et al (2017) who opined that mother's level of education is significant with child immunization status in Kaduna state in Nigeria. Furthermore, majority of the unimmunized children were from Muslim mothers (61.91%) and this aligns with the report of Sule (2018) who reported that children from Muslim mothers in Nigeria were 8 times less likely to be fully immunized compared with children from Christian mothers.

Table 4.24: Distribution of children by immunisation status across mother's socio-economic characteristics

Characteristics	Unimmunised		Partially immunised		Fully immunized	
	Freq.	Percent (%)	Freq.	Percent (%)	Freq.	Percent (%)
Women's occupation						
Agriculture part-time	985	64.13	715	66.64	100	70.42
Agriculture full time	551	35.87	358	33.36	42	29.58
χ^2			3.40			
Women's age at first birth						
12-18	874	56.90	646	60.21	79	55.63
19-25	564	36.72	373	34.76	55	38.73
26-32	85	5.53	50	4.66	8	5.63
33-45	13	0.85	4	0.37	0	0.00
χ^2			6.51			
Women's education						
No formal education	916	59.64	635	59.18	90	63.38
Formal education	620	40.36	438	40.82	52	36.52
χ^2			0.92			
Mother's religion						
Christianity	568	36.98	344	32.06	47	33.10
Islamic	951	61.91	719	67.01	95	66.90
Traditionalist	12	0.78	5	0.47	0	0.00
Others	5	0.33	5	0.47	0	0.00
χ^2			10.07			

Source: Researcher, (2020)

4.4.4 Child Immunisation and Socio-demographic Characteristics of Children

Profiling child immunisation status across child's socio-demographic characteristics in Table 4.25 reveals that 32.66% of the unimmunized children were between age 10-18months within the households, while a few proportions (18.53%) of them were between ages 28-38months. This implies that majority of the unimmunised children in agricultural households in rural Nigeria were between 10-18 months and at that age they were supposed to have received a good number of the scheduled vaccines. (they were expected to be partially immunized at that timeframe). A similar result was obtained by Corsi et al (2009) and Abebaw (2013) that child's age is strongly related with child immunization status in Ethiopia There was no significant difference in child immunisation status across the child's age.

The result further showed that 89.97% of the unimmunised children were 3rd born and above while 2.73% (who were 1st born) were found to be unimmunised This implies that majority of the unimmunised children in agricultural households in rural Nigeria were from experienced mothers who were currently nursing children who were 3rd born and above. This is in line with the report of Sule (2018) who opined that fully immunised status in children decreases with increase in number of children. There was no significant difference in child immunisation status across the child's birth order.

Majority (52.18%) of the male children in the household were unimmunised compared to the 47.85% female children unimmunised This implies that more male children were unimmunized than female children in agricultural households in rural Nigeria. This is contrary to Corsi et al (2009) reports who earlier documented that girls were less likely to be up to date with their immunisation status at any given age compared with boys as a result of inequalities in girl's access to health care facilities. Going by child's weight at birth, 83.79% of the unimmunised children were not weighed at birth, while 2.34% whose birth weight were less than 2.5kg at birth were unimmunised. A child whose birth weight is less than 2.5 kg is said to have low birth weight clinically and so unfit to start the immunisation scheme. This implies that the immunisation status of a child in the household is influenced by birth weight and majority of the unimmunised children were not weighed at birth. There

was a significant difference ($p<0.5$) in child immunisation status across the child's birth weight.

Table 4.25: Distribution of children by immunisation status across child socio-economics characteristics

Variables	Unimmunized		Partially Immunized		Fully Immunized	
	Freq.	Percent (%)	Freq.	Percent (%)	Freq.	Percent (%)
Child's age (months)						
0-9	429	28.26	317	29.91	85	24.82
10-18	492	32.66	349	32.83	40	28.37
19-27	312	20.65	198	18.68	36	25.53
28-35	280	18.53	197	18.58	30	21.28
χ^2			6.04			
Birth order						
1	42	2.73	25	2.83	2	1.41
2	112	7.29	67	6.24	9	6.34
>3	1382	89.97	981	91.43	131	22.25
χ^2			2.39			
Sex of child						
Male	901	52.15	536	49.35	79	55.63
Female	735	47.85	537	50.05	63	44.37
χ^2			2.26			
Child's birth weight (kg						
<2.5	36	2.34	21	1.96	2	1.41
2.6-5.0	213	13.87	138	12.86	24	16.90
>5	0	0.00	5	0.47	0	0.00
Not weighted	1287	83.79	909	84.72	116	81.69
χ^2			72.03**			

Source: Compilation form NDHS, 2018

4.4.5. Child 1mmunisation Status across Household Socio-economics Characteristics

The profiling of child immunisation status across household socio-economics characteristics in Table 4.26a and 4.26b reveals that 94.47% of the unimmunized children were from households headed by male while 5.53% of them were from households with female as household head. This implies that majority of the unimmunised children in agricultural households in rural Nigeria were from households majorly headed by male.

Regionally, North east zone and North West zone of rural Nigeria accounts for majority (29.75% and 28.97%) of the unimmunized children respectively in the households while the South west zone accounts minority (9.44%) of the unimmunized children. This implies that most of the unimmunided children in agricultural household in rural Nigeria were from households situated in the North eastern and western zone of Nigeria. This report is corroborated by the findings of Atugba et al (2016) and Sule (2018) that children in North western Nigeria were likely to die more than children in other zones because of high rate of unimmunised children which dominates the zone. Also, the northern zone accounts for a higher proportion of the unimmunized children compare to the southern zone of rural Nigeria, the immunisation status of children in the rural southern region of Nigeria is better compare with those in the rural northern side of Nigeria. There was a significant difference ($p<0.01$) between child immunisation status across region of residence.

A medium household size was found to be associated with more unimmunised children in agricultural households in rural area as 49.69% of the unimmunised children were from households with household size of 6-10 people. Minority (3.13%) of the unimmunised children were from households with over 15 members. This is likely because in agricultural households, more household members mean more labour source and this invariably turn to more income which aids affordability of basic health care facilities which support the immunisation status of the children within the households. Bello et al (2017) report is in line with this result as she reported that household size is significant in child immunisation status in Nigeria. There was a significant difference ($p<0.5$) in child immunisation status across household size.

Children whose father's age were between ages 36-45 years accounts mainly (42.64%) for the unimmunised children in agricultural household in rural Nigeria. This implies that

fathers who were in their productive years of life were responsible for raising majority of the unimmunised children in the study area. There was a significant difference ($p<0.01$) in child immunisation status across the ages of household heads in agricultural households. The level of education of the household head was found to be associated with the immunisation status of children within the households. Almost half (46.35%) of the unimmunised children were from mothers whose husband had no formal education while 53.65% were from fathers who had formal education. This implies that literate fathers accounts for higher proportion of the unimmunised children in agricultural household in rural Nigeria. This is likely because of the cultural and religious misconceptions been nursed by some men which makes them refuse their children's immunisation as earlier reported by Sunil et al (2006) and Yanzever et al (2013). There was a significant difference ($p<0.01$) in child immunisation status across level of education of the household head.

Households who belong to the poorest category based on family wealth index in agricultural household in rural area raised majority (38.02%) of the unimmunised children. Few (2.02%) of the unimmunised children were from the richest households. This implies that family wealth contributes significantly to the immunisation status of children in agricultural household in rural Nigeria as majority of the unimmunised children were from poorest households. This aligns with the report from NPC AND ICF (2018) which indicates that unimmunied children were mostly from poorest households. There was no significant difference in child immunisation status across family wealth.

Table 4.26a: Distribution of children by immunisation status across household's socio economics characteristics

Charcteristics	Unimmunized		Partially immunized		Fully Immunized	
	Freq.	Percent (%)	Freq.	Percent (%)	Freq.	Percent (%)
Sex of household head						
Male	1451	94.47	1007	93.85	132	92.96
Female	85	5.53	66	6.15	10	7.04
χ^2				0.82		
Region						
North-Central	229	14.91	172	16.03	23	16.20
North-East	457	29.75	290	27.03	51	35.92
North –West	445	28.97	361	33.64	36	25.35
South East	72	4.69	68	6.34	16	11.27
South- South	188	12.24	76	7.08	9	6.34
South –West	145	9.44	106	9.88	7	4.93
χ^2				43.97***		
Households size						
1-5	383	24.93	252	23.49	20	14.08
6-10	763	49.67	582	54.24	81	57.04
11-15	342	22.27	207	19.29	33	23.24
>15	48	3.13	32	2.98	8	5.63
χ^2				15.59**		
Husband's age						
<25	42	2.73	17	1.58	4	2.82
26-35	280	18.23	211	19.66	23	16.20
36-45	655	42.64	482	44.92	58	40.85
46-55	366	23.83	242	22.55	41	28.87
>55	193	12.57	121	11.28	16	11.28
χ^2				18.23**		

Source: Compilation from NDHS, 2018

Table 4.26b: Distribution of children by immunisation status across household's socio economics characteristics cont'd

Husband's education						
No formal education	712	46.35	473	44.08	48	33.80
Formal education	824	53.65	600	55.92	94	66.20
χ^2				8.67***		
Household wealth Index						
Poorest	584	38.02	407	37.93	48	33.80
Poorer	459	29.88	352	32.81	44	30.99
Middle	307	19.99	200	18.64	38	26.76
Richer	155	10.09	94	8.76	12	8.45
Richest	31	2.02	20	1.86	0	0.00
χ^2				10.80		

Source: Compilation from NDHS, 2018

4.4.6 Child Immunisation Status and Indicators of Maternal Health Care Utilisation

Table 4.27 shows the distribution of maternal health care utilisation variables across child immunisation status among agricultural households in rural Nigeria. Majority (73.24%) of the unimmunised children were from mothers who had prenatal care in other places apart from heath care facility while 13.87% of mothers of the unimmunised children used health care facility for their pre-natal care. This implies that more of the unimmunised children were raised by mothers who had pre-natal care in other places apart from health care facilities. The findings of Ekpenyong (2019) aligns with this report.

The findings further reveal that 76.50% of the mothers with unimmunised children started ante-natal care later than the first trimester while 23.50% of them started in the first trimester as recommend by the WHO. This implies that majority of the mothers who started ante-natal care in later trimester raised the highest proportion of the unimmunised children. This is corroborated by the findings of Anchukwu (2019) that mothers in Imo state Nigeria who had ante-natal care had higher likelihood of having their children fully immunised compared to those who do not. However, Lekew et al (2015) reported that ante-natal care attendance is not related with fully immunised status in children. There was a significant difference ($p<0.01$) between timing of ante-natal care across child's immunisation status.

Majority (77.54%) of the mothers with unimmunised children had 4 or more ante-natal care visit during pregnancy while 22.46% of them did not meet up with the 4 minimal number of ante-natal care visit as recommended by WHO. There was a significant difference ($p<0.01$) between number of ante-natal care visit across child's immunisation status. Most (69.27%) of the unimmunised children had mothers who delivered in other places apart from health care facility. This implies that a higher proportion of the unimmunised children were raised by mothers who had other homes asides health care facility as place of delivery. This report aligns with the findings of Mbengue et al (2019) that mothers in Senegal who delivered in health care facilities were less likely to raise unimmunised children in.

Lack of maternal health care utilisation on assisted during delivery was predominant among mothers of the unimmunised children as 55.97% of the unimmunised children were raised by mothers who were not assisted during delivery by skilled health care personnel.

There was a significant difference($p<0.01$) between place of delivery and child's immunisation status.

The highest proportion of the unimmunised children had mothers who had no post-natal care. Majority (79.10%) of the unimmunised children had mothers who did not receive post-natal care after delivery while 20.90% of their mothers had post-natal care. This implies that unimmunised children came mostly from mothers who did not receive post-natal care. The report of Onyekachi et al (2019) supported this finding. There was a significant difference between post-natal care usage across and child's immunisation status.

Table 4.27: Distribution of children by immunisation status across maternal health care utilisation variables

Variables	Unimmunized		Partially immunized		Fully immunized	
Prenatal Care	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
None	198	12.89	144	13.32	6	4.23
Others	1,125	73.24	809	75.40	123	86.62
Health facility	213	13.87	120	11.18	13	9.16
χ^2			16.755***			
Timing of ante-natal visit						
Later	1,175	76.50	842	78.47	94	66.20
First trimester	361	23.50	231	21.53	48	33.80
χ^2			10.69***			
Number of ante-natal care						
< 4 (No)	345	22.46	287	26.75	21	14.79
≥ 4 (Yes)	1,191	77.54	786	73.25	121	85.21
χ^2			13.03***			
Place of delivery						
Others	1,064	69.27	752	70.08	94	66.20
Health Facilities	472	30.73	321	29.92	48	33.80
χ^2			0.93			
Assisted during delivery						
Others	676	44.01	582	54.24	36	25.35
Skilled birth attendance	860	55.97	491	45.76	106	74.65
χ^2			54.80***			
Post-natal care						
No	1215	79.10	933	86.95	114	80.28
Yes	321	20.90	140	13.05	28	19.72
χ^2			27.03***			

Source: Compilation from NDHS, 2018

4.5 Assessing Mother's Wellbeing Status in the Households

This section presents results from the analysis of data on mother's wellbeing status in agricultural household in rural Nigeria. It describes the various dimensions aggregated to generate the wellbeing index and the status of the mothers. The section also shows the level of mother's wellbeing and their mean value across households in rural Nigeria as a whole. The level of mother's wellbeing status was also profiled across household socio-economics characteristics.

4.5.1 Dimensions of Wellbeing across Mothers in the Households

Table 4.28 shows the distribution of mothers based on dimensions of wellbeing. The result reveals that housing and sanitation's dimensions has a mean of 0.1519±0.0898. This implies that the dimension of housing and sanitation contribute 15.19% to the wellbeing status of the mothers. The dimension of education's mean was 0.1886±0.1382 among mothers in the household. This implies that the dimension of education contributes 18.96% to the wellbeing status of the mothers in agricultural households in rural Nigeria.

The dimension of literacy shows that the mean of literacy dimension among mothers in agricultural households was 0.2510±0.2508. Literacy dimension has a higher effect on the wellbeing status of mothers in agricultural households in rural Nigeria than the dimensions of education and housing and sanitation. Employment dimension has a mean value of 0.0921±0.0670 across mothers in the households which imply that the dimension of employment influences the level of mother's wellbeing by 9.21% among agricultural households in rural Nigeria.

The result further revealed that the health dimension has a mean value of 0.0757±0.0370 among mothers in agricultural households this indicates that health dimension contributes 7.6% to the wellbeing status of mothers in agricultural household. Lastly the dimension of women's autonomy in the household has a mean value 0.8314±0.5403. Overall, the dimension of women autonomy was found to contribute mainly to the wellbeing status of mothers in agricultural household in rural Nigeria. This implies that when women are involved in decision making or have a say in the households, their wellbeing will likely be

better off. It conforms to other past studies (Singh et al 2019 and United Nations 1994) that women autonomous is a vital key in maternal health and wellbeing. Also, Adeoti et al (2013) opined that the high relative contribution of autonomy underscores the point that power relations within the household is crucial and ability to participate in decision making particularly with respect to self is important for women's wellbeing.

Table 4.28: Distribution of mothers by dimensions of wellbeing

Wellbeing dimensions	Mean	Standard Dev.
Housing and sanitation	0.1519	0.0898
Education	0.1886	0.1382
Literacy	0.2510	0.2508
Employment	0.0921	0.0673
Health	0.0757	0.0370
Autonomy	0.8314	0.5403

Source: Compilation from NDHS, 2018

4.5.2 Wellbeing Status of Mothers in the Households

The level of mother's wellbeing status as shown in Table 4.29 reveals that majority of the mothers in agricultural household in rural Nigeria had moderate level of wellbeing (74.77%) while 25.01% had low wellbeing level. Castaneda et al (2018) established that 80% of people considered poor were residents in rural area.

Also, the distribution of mothers based on their wellbeing index shows that the WI for mothers in agricultural households was from 0.041 to 0.670 with an average value of 0.4244 and standard deviation of 0.1664.

Table 4.29: Distribution of mothers by wellbeing status

Levels of wellbeing	Frequency	Percentage (%)
Low	688	25.01
Moderate	2057	74.77
High	6	0.22
Mean	0.4244	
Standard deviation	0.1665	

Source: Compilation from NDHS, 2018

4.5.3 Wellbeing Status among Mothers across Household's Characteristics

The distribution of mother's wellbeing status in agricultural household in rural Nigeria across household's socio-economics characteristics in Table 4.30 reveals that 88.85% of mothers who belongs to household that had male as household head had low wellbeing while 11.05% of households headed by female accounts for mothers who had low wellbeing. This suggests that having a male as household head in agricultural household in rural Nigeria affects the wellbeing status of mothers negatively.

Regionally, 21.66% of mothers in agricultural household in rural Nigeria households who had low wellbeing emanates from the North east region of rural Nigeria, while minority (10.32%) of mothers with low wellbeing came from North-central region. Also, the wellbeing status of mothers in Southern region of rural Nigeria was worse off than their counterparts in Northern region as more mothers in Southern region had low wellbeing (53.20%) relative to those in the Northern region of rural Nigeria (46.81%). However, South-south region produced the only numbers of mothers (100%) who had high wellbeing while majority of mothers who had low wellbeing were from North east region of rural Nigeria. There was a significant difference ($p<0.01$) in mother's wellbeing status across the region of residence.

The result further revealed that higher proportion (54.51%) of mothers who had low wellbeing were from households with 6-10 members while those with 1-5 household members accounts for minority (0.75%) of mothers who had low wellbeing. This implies that large household size in rural Nigeria among agricultural households aids low wellbeing status of mothers in the households. There was a significant difference ($p<0.01$) in the wellbeing status of mothers across household size. Mothers whose partners were between the ages of 36-45 years accounts for 47.97% of the mothers who had low wellbeing, this implies that mothers who had low wellbeing were with husbands who were in their productive years and were economically active.

A higher proportion (80.67%) of mothers who had low wellbeing were with partners who had formal education while 19.33% of mother with partners who had no formal education had low wellbeing. This implies that mothers who had low wellbeing were mostly with partners who had formal education. The reason for this might be because of the low level of infrastructural facilities in the rural area that left even the few educated ones with no other

choice that to embrace agriculture. Level of wellbeing of mothers and the level of education of the husband differs significantly ($p<0.01$)

Table 4.30: Distribution of mothers by levels of wellbeing across household's socio- economic characteristics

Characteristics	Low		Moderate		High	
	Freq.	Percent (%)	Freq.	Percent (%)	Freq.	Percent (%)
Sex of household head						
Male	612	88.95	1972	95.85	6	100.00
Female	76	11.05	85	4.13	0	0.00
χ^2				45.11***		
Region						
North-Central	71	10.32	353	17.16	0	0.00
North-East	149	21.66	649	31.55	0	0.00
North –West	102	14.83	740	35.97	0	0.00
South East	115	16.72	41	1.99	0	0.00
South- South	134	19.48	133	6.47	6	100.00
South –West	117	17.01	141	6.85	0	0.00
χ^2				504.62***		
Households size						
1-5	229	33.28	423	20.56	3	50.00
6-10	375	54.51	1048	50.95	3	50.00
11-15	79	11.48	503	24.48	0	0.00
>15	5	0.73	83	4.04	0	0.00
χ^2				98.14***		
Husband's age						
<25	25	3.63	38	1.85	0	0.00
26-35	150	21.80	364	17.70	0	0.00
36-45	330	47.97	862	41.91	3	50.00
46-55	119	17.30	527	25.62	3	50.00
>55	63	9.16	266	12.93	0	0.00
χ^2				41.00***		
Husband's education						
No formal education	133	19.33	1100	53.48	0	0.00
Formal education	555	80.67	957	46.52	6	100.00
χ^2				247.92***		

Source: Compilation from NDHS, 2018

4.5.4 Wellbeing Status of Mothers across Indicators of Maternal Health care Utilisation

Most (66.25%) of the mothers who had prenatal care in other places apart from healthcare facilities had low wellbeing while 13.95% of mothers had no pre-natal care at all as shown in Table 4.31a and 4.31b. This means that majority of the mothers who were non users of pre-natal care had low wellbeing status. There was a significant difference ($p<0.01$) between pre-natal care usage across the mother's wellbeing status.

The findings further reveal that 75.87% of the mothers who started ante-natal care later than the first trimester as recommended by WHO had low wellbeing. This implies that mothers who started ante-natal care in later trimester mainly had low wellbeing status. However, no significant difference existed timing of ante-natal care across mother's wellbeing status. Majority (78.92%) of the mothers who had low wellbeing had 4 or more numbers of ante-natal care visits while minorities (21.08%) of mothers did not meet up with the recommended number of ante-natal care visit. There was a significant variation ($p<0.01$) between mother's place of delivery across mother's wellbeing status.

The highest proportion (51.02%) of mothers who had low wellbeing delivered in health care facilities while 48.98% of mothers with low wellbeing had other homes apart from health care facility as place of delivery. Also, more of mothers who had low wellbeing delivered in health care facilities relative to the mothers who had high wellbeing as 100% of mothers who had high had other homes apart from health care facility as place of delivery. This is likely due to the practice of home delivery which is common in rural area aided by how unpredictable labour starts in mothers especially in a poor resource environment as reported by Yanzever et al (2013). There was a significant difference place of delivery across mother's wellbeing status.

Most (59.16%) of the mothers who had low wellbeing were assisted during delivery by skilled birth attendant while 40.84% of the mother were assisted by unskilled birth attendant during delivery. There was a significant difference ($p<0.01$) between assisted during delivery by skilled or unskilled attendant across the wellbeing status of mothers. Lack of access to post-natal care was predominant among mothers who had low wellbeing as about 80.09% of them had no post-natal care after delivery. However, there was no significant variation between post-natal care usage across the wellbeing status of mothers.

Table 4.31a: Distribution of mothers by wellbeing status across maternal health care utilisation variables

Indicators	Mother's wellbeing status					
	Low		Moderate		High	
	Freq.	Perc.	Freq.	Perc.	Freq.	Perc.
Pre-natal care						
None	96	13.95	249	12.11	3	50.00
Others	456	66.28	1599	77.73	2	33.33
Health care facility	136	19.77	209	10.16	11	16.67
χ^2			56.36***			
Timing of ante-natal care						
Later	522	75.87	1584	77.01	5	83.33
First trimester	166	24.13	473	22.99	1	16.67
χ^2			0.52			
Number of ante-natal visits						
< 4(No)	145	21.08	508	24.70	0	0.00
≥4 (Yes)	543	78.92	1549	75.30	6	100.00
χ^2			5.60**			

Source: Compilation from NDHS, 2018

Table 4.31b: Distribution of mothers by wellbeing status across maternal health care utilisation variables cont'd

Place of delivery						
Other homes	337	48.98	1567	76.18	6	100.00
Health care facilities	351	51.02	490	23.82	0	0.00
χ^2			182.31***			
Assisted during delivery						
Others	281	40.84	1010	49.10	3	50.00
Skilled birth attendant	407	59.16	1047	50.90	3	50.00
χ^2			14.13***			
Post-natal care						
No	551	80.09	1707	82.98	4	66.67
Yes	137	19.91	350	17.02	2	33.33
			3.96			

Source: Compilation from NDHS, 2018

4.6 Effect of Maternal Health Care Utilisation on Child Immunisation Status

In Table 4.32, the effect coefficients were calculated using the unimmunised category as the reference group. The outcome displays a maximum pseudo probability of -2075.54 and a significant Wald $chi^2$of 38.65 ($p<0.01$). With 10 degrees of freedom in the chi^2 distribution, the chi^2value shows that at least one of the predictor regression coefficients is not equal to zero. This is significantly different from zero, hence, the decision to use a facility for maternal health care is an endogenous treatment choice. Negative conclusion is drawn that unobserved factors that reduce the likelihood of using maternal health care facilities is also likely to reduce the likelihood that a child would receive vaccinations.

The result reveals that maternal health care utilisation index, husband's educational status, age at first birth, wealth index and child's age square affects child immunisation status among agricultural household in rural Nigeria. It implies that Increase in maternal health care utilisation index increased the probability of children with a higher immunised status in agricultural household ($s=1.636$, $p<0.1$). Use of maternal health care facilities in mother (delivering in health care facility and having postnatal care) invariably means the child will receive BCG at birth and also receive the vaccines scheduled for the 6^{th} week. This at least guaranteed that the child will be partially immunised and will be immune against some diseases which helps to keep them healthy and eventually add up to labour sources in agricultural household in the future.

Husband's formal education was a determinant of child immunization status ($s=0.224$, $p<0.01$). This implies that mothers with husband with formal education relative to those without formal education will increase the probability of fully immunised status in children in the household. Formal education in husbands enlightens them on the benefits the children will derive by been immunised, desiring a good level of health for their children will necessitate having them immunised against diseases. The result was corroborated with the findings of Bello et al (2017).

Furthermore, the age of mothers at first birth's was a determinant of child's immunization status ($s=0.088$, $p<0.01$). This implies that an increase in the age of mothers at first birth will lead to a higher likelihood of having an improved immunisation status of children in

the household. Higher proportion of the mother in the households were teenagers at birth who knows little about child care and management. As women aged, their level of maturity improves and better carters for their children's health, so, increase in mother's age at birth will more likely make mothers see reasons to adopt practices that will improve the health and wellbeing of their children. Awasthi et al (2015) established that odd of completing immunsation is higher among younger mothers.

The extended ordered log-odds estimate compared the household size on child immunisation status, given that the other variables were held constant. The results showed that household size was a determinant of child immunization status ($s = 0.0831$, $p<0.5$). This implies that increase in household size in agricultural households will more likely improve the immunization status of the child. Every addition of a person to an agricultural household is invariably an addition to income, increase in income inflow will increase the affordability of basic health facilities within the household. Bello et al (2017) established from her findings that household size is significant with the immunization status of a child.

Furthermore, the result reals that child age square is a determinant of child immunization status ($s = -0.0018$, $p<0.5$). An increase in child age square will more likely lead to a decrease in the probability of an improved immunised status of children in the households. The vaccines are age bound in children, so doubling their current age will likely make them overshoot the designated age for the collection of the vaccines.

Additionally, total children among mothers who had maternal health care utilisation is a determinant of child immunization status ($s = 0.008$, $p<0.01$). Also, formal education of mothers with maternal health care utilisation influences child immunization status ($s= 0.076$, $p<0.01$). The result further shows that, age of mothers at first birth among mothers who had maternal health utilisation is affecting child immunization status among mothers in rural Nigeria ($s = -0.0103$, $p<0.01$).

Also, mother's occupation among mothers using maternal health care utilisation was a determinant of child immunization status ($s = -0.065$, $p<0.01$). This implies that an increase in mothers fully engaged in agriculture relative to those partially engaged in agriculture will

less likely improve the immunsation status of the child. Additionally, Media exposure among mothers using maternal health care facilities influences child immunisation status ($s = -0.039$, $p<0.01$). Lastly, among mothers with maternal health care utilisation, household wealth index significantly influences child immunization status ($s= -0.062$, $p<0.01$). This implies that increase in household wealth will less likely improve the immunization status of children among agricultural households in rural Nigeria.

Table 4.32: Distribution of children by the effects of maternal health care utilisation on immunisation status

Variables	Coefficient	Std. Error	Z-value
Child immunization category			
Maternal health care utilisation index	1.6355***	0.3911	4.18
Husband's education			
Formal	0.2243***	0.0516	4.34
Age of mother at first birth	0.0879***	0.0368	2.39
Sex of household head			
Female	-0.1095	0.0867	-1.26
Child sex			
Female	0.0658	0.0954	0.69
Household size	-0.0080	0.0069	-1.16
Wealth index	0.0831**	0.0390	2.13
Birth weight	-0.000	9.90e-06	-1.11
age	-0.0015	0.0022	-0.67
age square	-0.0018**	0.0009	-2.11
Maternal health care utilization			
Total children	0.0076***	0.0018	4.20
Mother's education			
Formal	-0.0759***	0.0108	-7.02
Mother's age at first birth	-0.0103***	0.0012	-0.11
Mother's occupation			
Agriculture full-time	-0.0652***	0.0088	-7.39
Media exposure			
Exposed	-0.0389***	0.0068	-5.68
Household size	0.0016	0.0013	1.19
Wealth index	-0.0615***	0.0045	-13.63
Cut 1	2.023	0.5028	
Cut 2	3.430	0.478	
Corr (e. maternal health care utilization, e. child immunization category	-0.3358***	0.0885	-3.79
Number of observation	2712		
Log pseudo likelihood	-2075.54		
Wald $chi^2(10)$	38.65		
Prob>chi^2	0.0000		

Source: Compilation from NDHS, 2018

4.6.1 Marginal Effects of Maternal Health care utilisation on Child Immunisation Status

The marginal effect estimation of the effect of maternal health care utilisation on child immunisation status in agricultural households was presented in Table 4.33. The result shows that a 1% increase in maternal health care utilisation index significantly increase the partially immunised status in children (s = 0.042, p<0.01). Also 1% increase in husband's formal educational status will decrease unimmunised status in children (s= -0.093, p<0.01). increase partial immunised status in children (s= 0.068, p<0.01) and increase fully immunised status in children (s=0.025, p<0.01). This implies that increase in husband's formal education will improve the immunisation status of children in agricultural household in rural Nigeria. Furthermore, 1% increase in child's age square will increase unimmunied status in children (s = 0.0008, p<0.5) decrease partially (s = -0.0005, p<0.5) and decrease fully immunised status in children (s= -0.0002, p<0.5) respectively.

Additionally, 1% increase in the number of total children among mothers with maternal health care utilisation will lead to decrease in unimmunized (s = -0,047, p<0.01), partially immunized (s= -0.035, p<0.01) and fully immunized (s = -0.013, p<0.01) status in children respectively. Similarly, 1% increase in mothers who are fully engaged in agriculture among mothers with maternal health care utilisation will increase unimmunised status in children (s=0.041, p<0.01), decrease partially immunized status (s = -0.029, p<0.01) and increase fully immunized (s =0.011, p<0.01) status in children. This implies that having mothers fully engaged in agriculture using maternal health care facilities, will improve the immunization status of children by increasing the chances of having many more children fully immunised

Furthermore, 1% increase in formal education among mothers who utilise maternal health care facilities will lead to increase in unimmunised status in children (s = 0.047, p<0.01), decrease in partially immunized status(s = -0.035, p<0.01) and decrease in fully immunised status (s= -0.013, p<0.01). Lastly a 1% increase in level of exposure of mothers among those utilising maternal health care facilities will increase unimmunised status (s = 0.024, p<0.01), decrease partially immunized status (s = -0.018, p<0.01) and decrease fully immunised status (s = 0.007, p<0.01) in children.

Table 4.33: Distribution of children by marginal effect of maternal health care utilisation on the immunisation status of children

Variables	Unimmunized	Partially immunized	Fully immunized
Child immunization category			
Maternal health care utilisation index	-0.0576	0.0421*	-0.0156
Husband's education level			
Formal	-0.0928***	0.0681***	0.0247***
Mother's age at first birth	0.0301	0.0220	0.0081
household head Sex			
Female	-0.0274	0.0197	0.0077
Wealth index	0.0037	-0.0027	-0.0010
Household size	0.0024	-0.0017	-0.0006
Child sex			
Female	-0.0113	0.0082	0.0030
Child birth weight(kg)	4.57e-06	-3.34e-06	-1.23e-06
Child age (months)	0.0006	-0.0005	-0.0001
Child age square (month)	0.0008**	-0.0005**	-0.0002**
Maternal health care utilization			
Total children	-0.0471***	-0.0346***	-0.0125***
Mother's occupation			
Agriculture full-time	0.0405***	-0.0298***	0.0107***
Mother's educational level			
Formal	0.0471***	-0.0346***	-0.0125***
Media exposure			
Exposed	0.0242***	-0.0177***	-0.0065***

Source: Compilation from NDHS, 2018

4.7 Effects of Maternal Health Care Utilisation on Mother's Wellbeing

In Table 4.34, the effect coefficients were calculated using the low wellbeing category as the reference group. The outcome displays a maximum pseudo probability of -1880.2243 and a significant Wald chi^2 of 881.77 ($p<0.01$). With eight degrees of freedom in the chi^2distribution, chi^2value shows that at least one of the predictor regression coefficients is not equal to zero. In comparison to a null model with no predictors, this suggests that the model is significant when compared to a null model with no predicators.

The estimated correlation between the errors from the mother's wellbeing category equation and the errors from the maternal health care utilisation equation is -0.647. This is significantly different from zero, so the treatment choice of utilisation of maternal health care facility is endogenous. Because it is negative, it could be concluded that unobserved factors that decrease the chance of using maternal health care facilities tend to also decrease the chance of a higher level of wellbeing in mothers. Results reveals that maternal health care utilisation index, household size, occupation age at first birth and husband's educational status had effect on mother's wellbeing among agricultural household.

Maternal health care utilisation index is a determinant of mother's level of wellbeing among agricultural husholds ($s =3.106$, $p<0.01$). This implies that increase in the use of maternal health care facilities by mothers will more likely improve the wellbeing status of mothers in the households. Use of maternal health care facilities in mothers will reduce money spent on illness, death and a state of morbidity in mother and child. Also, a woman who utilises health care facility prior, during and after pregnancy will likely be in good health after delivery and so add up to the labour sources available in an agricultural household which leads to higher income and higher level of wellbeing both for her and for the household at large. WHO (2022) opines that use of maternal health care facilities lower the risk of complications in mothers, improves better health outcome for babies and improves mother's general wellbeing.

The extended ordered log-odds estimate compared the household sizes on the mother's level of wellbeing, given that the other variables were held constant. The result shows that household with larger household's size were more likely to have mothers who had improved level of wellbeing. This implies that household size influences mother's level of wellbeing

(s = 0.031, p<0.01). The findings of Oni & Adepoju (2011) corroborated this report, also, Ogundele (2018) established that household size was positively associated with wellbeing in rural Nigeria.

Additionally, mother's occupation is a determinant of mother's wellbeing among agricultural households in rural Nigeria (s = 0.138, p<0.01). This implies that having more mothers fully engaged in agriculture relative to mothers partially engaged in agriculture will increase the probability of improved wellbeing status in mothers. When a woman is fully available to join efforts with the husband in farming activities, the output improves, income increases and necessary facilities to improve wellbeing will be affordable.

Similarly, Mothers age at first birth influences the level of mother's wellbeing in the households (s = 0.135, p<0.01). This implies that increase in mother's age at first birth will more likely improve the level of wellbeing of mothers in the households. Also, husband's education was a determinant of mother's wellbeing (s = 0.218, p<0.01). This implies that an increase the number of husbands who had formal education in the households will lead to an improve level of wellbeing for the wives. Onwumere (2015) reports that women who were married to men with formal education were more likely to have better maternal health outcomes and wellbeing. The is likely because men with formal education were more likely to have higher incomes, which could provide financial resources for their families. Additionally, educated men were more likely to be supportive of their wives' health, which could lead to better health outcomes and improved level of wellbeing.

Additionally, under the category of mothers who utilizes maternal health care facilites, mother's level of education influences mother's level of wellbeing (s= 0.112, p<0.01). This implies that increase in formal education among mothers who utilises maternal health care facilities will less likely improve the level of wellbeing of mothers. Similarly, mother's age at first and birth its square value among mothers who utilizes maternal health care facilities were determinant of the level of wellbeing of the mothers in the household (s= -0.407, p<0.01) and (s = -0.0001, p<0.01) respectively. This implies that an increase in mother's age at first birth and its square value among mothers who utilizes maternal health care facilities will less likely improve the level of wellbeing of mothers in agricultural households in rural Nigeria.

Also, among mothers who utilise maternal health care facilities, the sex of household head influences level of wellbeing in mothers ($s = -0.0418$, $p<0.01$). This implies that an increase in the number of households with female household head among mothers who had maternal health care utilisation will less likely improve the level of wellbeing of mothers. Having a male as household head improves the level of wellbeing of the household's member as earlier reported by Oni & Adepoju (2011). Lastly, family wealth index is a determinant of wellbeing among mothers who utilise maternal health care facility in the households ($s = -0.0595$, $p<0.01$). This implies that an increase in family wealth increase will less likely improve level of wellbeing of mother who utilise maternal health care facilities in the household. This is likely because use of maternal health care facilities entails spending more income which reduces the bulk available to the household per time.

Table 4.34: Effect of maternal health care utilisation on the wellbeing of mother

Variables	Coefficient	Std. Error	Z- value
Mother's wellbeing category			
Maternal health care Utilisation index	3.1086***	1.554	20.00
Household size	0.0308***	0.0070	4.38
Sex of household head			
Female	-0.0356	0.1033	-0.34
Husband's age	-0.0025	0.0168	-0.15
Mother's occupation			
Agriculture full-time	0.1381***	0.0470	2.91
Mother's age at first birth	0.1350***	0.0437	3.09
Husband's education			
Formal	0.2175***	0.0556	-3.91
Maternal health care utilization			
Mother's level of education			
Formal	-0.1124***	0.0093	-12.09
Mother's age at first birth	-0.0407***	0.0135	-3.02
Mother's age at first birth squared	-0.0001**	0.0000	-2.49
Sex of household head			
Female	-0.0418***	0.0162	-2.58
Wealth index	-0.0595***	0.0042	-14.03
Cut1	1.2120	0.3757	
Cut2	4.2087	0.3716	
Corr (e. maternal health care utilization, e. wellbeing categories)	-0.6465***	0.0391	-16.55
Number of observation	2751		
Log pseudo likelihood	-1180.2243		
Wald $chi^2(8)$	881.77		
Prob>chi^2	0.0000		

Source: Compilation from NDHS, 2018

4.7.1 Marginal Effects of Maternal Health Care Utilisation on Mother's Wellbeing

The results in Table 4.35 revealed that 1% increase in maternal health care utilisation index significantly decrease low wellbeing status (s = -0.093, p<0.1), increased moderate wellbeing status (s = 0.0912, p<0.1) in mothers. This implies that use of maternal health care facilities in mothers will improve mother's wellbeing. Also, 1% increase in household size will decrease low wellbeing (s = -0.0108, p<0.01), increase moderate wellbeing (s = 0.0105, p<0.01) and increase high level of wellbeing (s = 0.0003, p<0.5) in mothers within agricultural household. Furthermore, 1% increase in female as household head will increase low level of wellbeing (s = 0.057, p<0.1), decrease moderate level of wellbeing (s = -0056, p<0.5) and decrease high wellbeing (s = -0.0012, p<0.1) in mothers.

Also 1% increase in mother's fully engaged in agriculture relative to those partially engaged in agriculture will decrease low wellbeing (s = -0.048, p<0.01), increase moderate wellbeing (s = 0.006, p<0.01), and increase high wellbeing (s = 0.002, p<0.01) level of mothers. This implies that having more mothers fully engaged in agriculture will lead to an improved level of wellbeing in mothers. Additionally, 1% increase in husband's formal education will increase low wellbeing, (s = 0.077, p<0.01), decrease moderate wellbeing (s = -0.075, p<0.01), and decrease high wellbeing (s = -0.002, p<0.01) level of mothers.

Furthermore, 1% increase in mother's formal educational status among those who utilises maternal health care facilities will lead to increase in low wellbeing (s = 0.119, p<0.01), decreased moderate wellbeing (s = -0.058, p<0.01), and decrease high wellbeing (s= -0.002, p<0.5) levels of mothers. Also, 1% increase in the age at first birth squared of mothers who utilizes maternal health care facility will increase low wellbeing (s = 0.0001, p<0.01), decrease moderate wellbeing (s = -0.0001, p<0.01), and increase high wellbeing(s = -3.9e-06, p<0.1))levels of mothers. Lastly, 1% increase in household wealth index among mothers who had maternal health care utilisation will lead to increase in low wellbeing (s = 0.052, p<0.01), decrease in moderate wellbeing(s = -0.058, p<0.01), and decrease in high wellbeing(s= -0.002, p<0.05) level of mothers

Table 4.35: Distribution of mothers by marginal effect of maternal health care utilisation on wellbeing

Variables	Low	Moderate	High
Mother's wellbeing categories			
Maternal health care utilisation index	-0.0939*	0.0912*	0.0027
Household size	-0.0108***	0.0105***	0.0003**
Sex of household head			
Female	0.0570*	-0.0557*	-0.0012*
Husband's age	0.0009	-0.0008	-0.0000
Women occupation			
Agriculture full-time	-0.0475***	0.0060***	0.0016***
Husband's education			
Formal	0.0772***	-0.0753***	-0.0019***
Mother's age at first birth	-0.0068	0.0066	0.0002
Maternal health care utilization			
level of education	0.1192***	-0.0578***	-0.0017**
age at first birth squared	0.0001**	-0.0001**	-3.9e-06*
Wealth index	0.0592***	-0.0575***	-0.0017**

Source: Compilation from NDHS, 2018.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This study examined the effect of maternal health care utilisation on child immunisation and mother's wellbeing among agricultural households in rural Nigeria. Data from 2018 Demography and Health Survey was used to achieve the objectives of the study. The data was analysed using descriptive statistics, ordinary least square regression, fuzzy set analysis, and extended ordered logit regression.

5.1 Summary of Results

The study profiled the immunisation status of children across various characteristics namely household characteristics, child characteristics and mother's characteristics. It also profiled the maternal health care utilisation variables across various characteristics and determines the levels of maternal health care utilisation in agricultural households in rural Nigeria. Also, the mean of the dimensions of wellbeing were determined and the levels of mother's wellbeing was assessed and profiled across various characteristics in agricultural households

Extended ordered logit regression was used to evaluate the effect of maternal health care usage on child immunisation status at different levels and to correct for bias in the analysis. This analysis examined the relationship between maternal health care use and child immunisation at various levels. Other factors that influence child immunisation in rural Nigerian farming households were also identified by the results. Additionally, extended ordered logit regression was used to analyse the relationship between variables relating to maternal health care utilisation and mothers' wellbeing. This method highlighted the impact of these variables at different levels while also accounting for bias.

The mean ages of mothers at first birth was 18.54± 3.79years, teenagers at first birth, between the ages of 12-18 years (54.12%), was employed partially into agriculture (65.43%) and were majorly Muslims (64.16%). Higher percentages (43.44%) of the household head were in their productive years (34-45 years) with mean age of 44.66± 9.92years. Larger proportion (51.84%) of the household were headed by male (94.15%), having formal education (55.18%), with 6-10 members and a mean household size of 8.30±3.64 persons. It was further revealed that more of the households were situated in North-West region of rural Nigeria (30.61%). More male children (51.47%) with average age of 15.93±9.64 months, 3rd born and above (90.66%) and were not weighed at birth (84.05%).

Results showed that 74.77% of mothers had prenatal care in other places asides health care facility, 76.74% started ante-natal care later than first trimester, while 23.74% of mothers had less than 4 ante-natal care visits. The mean number of ante-natal care visit received by mothers in agricultural household in rural Nigeria was 4.991±3.07. Furthermore, about 47.04% of mothers were assisted by unskilled birth attendance, 49.43% of them delivered at home while 82.22% of them had no post-natal care.

When all factors of maternal health care utilisation (pre-natal care, timing of ante-natal care, number of ante-natal visits, assisted delivery, place of delivery and post-natal care were taken into account), mothers who had no maternal health care utilisation on all variables were most prevalent in the northern zones (especially in the north-west and the north-east zones), in male-headed and poor households, and in large households. Additionally, it was discovered that adolescent mothers without formal education, who had agriculture as part- time occupation and with husbands in their productive years found it to be more common.

Low level of maternal health care utilisation was observed among 26.94% of mothers with mean value of 0.5381±0.232. Also, mothers nursing male children (51.96%) between the ages of 0-9months (32.24%) who were third born and above (85.56%) and were not weighed at birth (55.87%) dominates the category. It was also found to be more prevalent among mothers in male headed (89.47%) households with 6-10 members (49.53%), with household head in their productive years (38.73%) and had formal education.

Mothers employment status, education, age at first birth, age square, household size, birth order, wealth index and media exposure were seen as factors affecting use of maternal health care facilities in the study area. More of the children in agricultural households in rural Nigeria missed out on all the vaccines. Higher percentages of children did not receive BCG (69.57%), Hepatitis B (77.83%), Polio 0 (78.70%), Polio 1 (72.81%), PENTA 1 (72.81%), Polio 2 (67.76%), PENTA 2 (79.17%), Polio 3 (83.06%), PENTA 3(86.37%), Polio o inactive (79.83%), and measles (78.19%) vaccine at birth. More of children in agricultural households were unimmunized (55.83%) with mean immunisation status of 1.493±0.594.

The distribution of unimmunized children across characteristics reveals that in agricultural households in rural Nigeria, unimmunized children were mostly prevalent in the northern zones, in households with husbands who had formal education (53.65%) and in large households (49.67%). It was also found to be more prevalent among teenage mothers (56.90%) with no formal education (59.64), who was partially employed into agriculture (64.13%) with husbands in their productive years (42.64%).

Additionally, male children (52.15%), who were 3rd born and above (89.97%), 10-18 months old (32.66%) and were not weighed at birth (83.79%) were prevalent among the unimmunized children in the households. More of the unimmunized children were majorly from mothers who had no maternal health care utilisation on pre-natal care (73.24%).

The dimension of mother's autonomy with mean value of 0.831±0.54 contributes majorly to the wellbeing status of mothers in agricultural household in rural Nigeria. Majority of mothers in agricultural households were moderately poor with mean wellbeing index of 0.424±0.167. Generally, in agricultural households in rural Nigeria, mothers who had low wellbeing were mostly prevalent in male-headed households (88.95%), with husbands who had formal education (80.67%), and in large households (34.51%). It was also found to be more prevalent among mothers with husbands in their productive years in the north east zone (21.66%). However, more mothers in the southern zone (53.21%) had low wellbeing relative to those in the northern zone (46.81%).

The marginal result of the extended ordered logit regression analysis revealed that maternal health care utilization will increase partially immunised status in children by 0.042 while

husband's education will increase partially and fully immunized status in children by 0.068 and 0.025 respectively. Also, maternal health care utilisation will increase moderate wellbeing status in mothers by 0.091 while it reduces mother's low wellbeing status by 0.094. Other determinants of wellbeing status in mothers in agricultural households in rural Nigeria were household size, sex of household head, women occupation and husband's education.

5.2 Conclusion

Based on the findings from the study, it was established that low level of maternal health care utilisation was high among mothers in agricultural households in rural Nigeria especially among those in the North-west and North-east zone. The study affirmed that maternal health care utilization improves wellbeing status of mother's in agricultural households in rural Nigeria.

Furthermore, it was established from the study that more children were unimmunized than those who were either partially or fully immunised. In addition, the study affirmed that most of the unimmunized children were majorly from mothers who had no maternal health care utilisation across its indicators.

Also, mothers who had low wellbeing were prevalent in North-east zone of Nigeria. It was further established from the study that the dimension of mother's autonomy contributes significantly to the wellbeing status of mothers in agricultural household in rural Nigeria.

The peculiarity of prevalence of low maternal health care utilisation, unimmunized children, and low wellbeing status in mothers in the Northern zones of Nigeria especially in the north-west and north- east zone was established in the study.

5.3 Policy Recommendations

The following recommendation was derived from the results of the study;

- Non-governmental organization and policy makers should look into ways of empowering a girl child through education and eradication of early marriage among mothers especially in the north west and east zone in rural Nigerian.

- Awareness should be increased by the ministry of health on the need for mothers to use health care facilities prior, during and after pregnancy.
- The government should try to create mini health centres in major markets across states where pregnant mothers can have their ante-natal care, vaccines can be administered to children and first aid services can be provided.
- the Government should look into improving and expanding the agricultural sector of the economy to employ more in order to improve the wellbeing status of the mothers thereby aiding better utilization of maternal health care facilities and improved child immunisation status
- Health and information ministries should increase awareness campaigns on the need for husbands to grant their wives some level of autonomy so that they can make decision that will boosts their level of wellbeing thereby improving their health status and that of their children.
- Higher percentages of the unimmunised children and more mothers with low maternal health care utilisation were found in poor households. It is highly necessary for government to put in place programmes that will improve the livelihood and welfare of rural households at large.

5.4 Contributions to knowledge

i. It was established from the study that maternal health care utilisation influenced partial immunisation status in children.
ii. This study affirmed that maternal health care utilisation improves wellbeing status of mothers.
iii. Mothers who had low wellbeing status were prevalent in North East zone.
iv. It was established from the study that there are more children who were unimmunised than those who were either partially or fully immunised.
v. Unimmunised children were highest in the North West and North East zones of rural Nigeria and were products of mothers who had low maternal health care utilisation.
vi. Having agriculture as full-time occupation by the mothers improved their level of wellbeing, improve the immunization status of their children and encourage use of maternal health care facilities

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