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Antenatal and Postnatal Care Services and Maternal Mortality in Nigeria

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Abstract

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Doctoral Study Submitted in Partial Fulfillment

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Abstract

Nigeria has had a high maternal mortality rate per 100,000 live births since the 1990s. A possible contributing factor is that many Nigerian women are not aware of prenatal and postpartum pregnancy care-related services. The purpose of this study was to investigate the association between pregnancy-related care (access to antenatal services, maternal health education, and knowledge of prenatal and postpartum care) and maternal mortality in Nigeria. The theory of planned behavior forms the basis of this study. A cross-sectional quantitative study design was used to determine whether maternal mortality is influenced by pregnancy-related care. Secondary data collected by the Demographic and Health Surveys Program in 2018 were analyzed. The data set contains individual records on maternal mortality and related contributing risk factors for adverse health outcomes in Nigerian women aged 15-54. A nominal logistic regression was conducted to examine the association between antenatal care (number of antenatal visits, number of postnatal visits, checkup before discharge, and knowledge and use of contraception) and maternal mortality. The results indicate that antenatal care was significantly related to maternal mortality. Study findings support that increasing maternal health and knowledge can significantly reduce maternal mortality in developing countries. By improving women's access to pregnancy care, policymakers may reduce mortality rates in Nigeria resulting in positive social change.

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Section 1: Foundation of the Study and Literature Review

Introduction

Many women in developing parts of the world are unaware of the importance of healthy practices such as attending antenatal and postnatal clinics that help reduce maternal mortality. According to Nwajagu et al. (2017), Nigeria has high maternal death rates due to a lack of access to quality prenatal and postnatal services and a lack of awareness of maternal health practices. In this study, I explored the association between knowledge and use of prenatal/postpartum care services and maternal mortality among women in Nigeria.

Previous research has suggested that determinants of uptake of maternal health may be linked to the quality of healthcare, the behavior of individuals, or the socio environment (Hamal et al., 2020). A majority of the literature reviewed in Section 1 reinforces why government leaders need to understand the behavior of Nigerians and understand the meaning behind why they do things the way they do before trying to change the population's attitude towards maternal health services. If social determinants of health are identified and improved, the linkages between them and maternal healthcare are likely to be strengthened, decreasing maternal mortality rates (Hamal et al., 2020). This section also shows that increased intervention through prenatal and postnatal clinical visits can help reduce maternal mortality.

With an understanding of the solid norms and beliefs rooted in the population, health policymakers may develop strategies that help debunk myths about modern medicine and demonstrate to the people the positive impact that maternal healthcare can

have on the lives of mothers. Proper demand-side techniques may stimulate behavioral change, eventually leading to modern medicine being accepted in society as the new norm. In this case, both demand and supply need to be addressed to reduce the mortality rate among pregnant women. The gap between the accessibility of maternal services among this population is based on factors such as educational level, customs, beliefs, and social-economic factors (Hamal et al., 2020). This health inequality gap can be improved through civic education and adequate health policies to curb the high maternal mortality rates (Hamal et al., 2020).

It is also relevant for health policymakers and health workers to understand when maternal deaths occur and where intervention efforts need to be directed. According to Daviaud et al. (2017), 98.0% of maternal deaths occur in low- and middle-income countries. They are usually a result of complications during delivery, primarily due to low birth weight, premature birth, and prolonged labor. These deaths can be drastically lowered by having institutional births where skilled health workers can be able to provide the necessary care during this crucial time (Daviaud et al., 2017)

In Section 1, I stated the problem and purpose of the study and introduced the research questions (RQs) and corresponding hypotheses. Section 1 will also contain the literature review touching on the various vital variables relating to the RQs. I will also highlight the theoretical foundation supporting this study. Finally, I will examine the study's assumptions, scope, and delimitations, highlighting its potential generalizability.

Background

Most countries have had a high maternal mortality rate per 100,000 live births in the past few decades. Developed and developing countries have exhibited higher maternal mortality rates per 100,000 live births, with developing countries having the highest rates (Girum & Wasie, 2017). Like many countries globally, especially in the sub-Saharan and southern Asia regions, Nigeria has had a high maternal mortality rate per 100,000 live births since the 1990s. This region's hospitals and healthcare centers serve a relatively lower number of pregnant women (i.e., deliver pregnancy-related care services) than developed countries (Ekpenyong et al., 2019).

Developing and low-income earning countries exhibit higher maternal mortality rates per 100,000 live births than developed countries, partly attributed to inadequate pregnancy-related care services and facilities (World Health Organization [WHO], 2019). In September 2019, world data presented by WHO indicated that as of 2017, approximately 810 women per 100,000 live births passed away due to preventable pregnancy-related complications. The majority who passed away (94%) came from rural areas and low and middle-income regions (WHO, 2019). According to Alkema et al. (2016), sub-Saharan Africa and Southern Asia are among the areas that have experienced high percentages of maternal deaths. About 86% of the total maternal deaths worldwide were recorded in the two regions in 2017 (WHO, 2019).

Most maternal deaths occur between the last trimester of pregnancy and the first week after giving birth, known as the intrapartum period, majorly due to hemorrhages, hypertension, and sepsis, which are preventable if a pregnant mother receives proper pre

and postnatal services. Most maternal deaths occur at home and, more precisely, in rural areas where the poorest population resides. Postnatal services are also vital as they help prevent further maternal deaths through contraceptives that help space pregnancies and avoid the risk of late age pregnancies and the many risks associated with pregnancy complications.

Problem Statement

Many women in Nigeria and the sub-Saharan region are not aware of the best health education practices associated with prenatal and postpartum pregnancy care-related services and, as a result, receive poor services (Dairo & Atanlogun, 2018). Therefore, there is a need to determine why high maternal mortality rates and associated risk factors prevent pregnant women from receiving appropriate and timely pregnancy-related care services in Nigeria. Additionally, the Nigerian community has solid cultural beliefs that overshadow the importance of seeking professional health services during pregnancy, birth, and after child delivery (Ariyo et al., 2017). There is a need to determine how pregnant women and their families can avoid following cultural practices that contribute to maternal mortality and embrace professional health services. The results of this study can assist policymakers and healthcare workers in developing measures and implementing health education actions that may eliminate preventable maternal morbidity and mortality in Nigeria.

According to the United Nations Children's Fund (UNICEF, 2015), poverty and malnutrition pose a high risk of death for infants and children below 5 years. In 1990, maternal deaths in Nigeria stood at 57,000, while in 2000, 62,000 deaths were reported

before a steady reduction between 2000 and 2005 to 56,000 (UNICEF, 2015). However, between 2007 and 2015, the number of deaths rose from 57,000 to 58,000 (UNICEF, 2015). The maternal mortality rate first rose from 1,170 per 100,000 live births in 2000 to 946 per 100,000 live births in 2005 before a gradual decrease to 867 per 100,000 live births in 2010 and 814 per 100,000 live births in 2015. In 2017, Nigeria was reported to be among the top 15 countries that had a "very high alert" or "high alert" fragile state in terms of its maternal mortality rate (between 31 and 1,150) according to the Fragile States Index (WHO, 2019).

The world has made considerable strides towards increasing life expectancy, yet paradoxically, health inequality has continued to grow in low and high-income countries. Despite global economies making strides towards expanding healthcare services to low-income societies, inequality levels have not fallen as expected. According to Garcia-Prado (2019), policymakers and healthcare workers are now emphasizing changing people's behavior, patterns, and attitudes towards maternal healthcare. Garcia-Prado (2019) noted that the coverage of essential maternal healthcare services is often much lower in rural areas and among poor populations. Raising women's awareness of prenatal and postpartum pregnancy care-related services may be one way to address global inequities in healthcare.

Purpose of the Study

The purpose of this quantitative study was to explore the association between access and use of maternal healthcare services (antenatal, postnatal visits, and postnatal checks before discharge) and knowledge of contraceptive use and maternal mortality in

Nigeria. I focused on access to pregnancy-related care related to antenatal services and maternal health education services that may contribute to a reduction in complications during pregnancies that place women at risk of maternal mortality. In this study, I addressed risk factors associated with pregnancy-related care services. These services include; access to maternal healthcare services as measured by the number of antenatal visits during pregnancy, postnatal visits, postnatal checks before discharge, and the knowledge of contraceptive use to help space out births by preventing unplanned pregnancies. The study of these variables provided insight to determine appropriate access to care and education measures that governments can implement to reduce maternal deaths and prevent maternal complications. This study will focus on pregnancy care and how expectant and lactating mothers are made aware of pregnancy-related care and health education knowledge of pregnant women (Bell et al., 2018). The research also included examining the accessibility and the quality of healthcare services offered in various healthcare organizations and centers.

Nigeria has had high maternal death rates due to a lack of access to quality prenatal and postpartum services and a lack of awareness of maternal health practices (Nwajagu et al., 2017). In this study, I explored other factors that might limit access to better maternal healthcare services. Moreover, I examined the relationship between prenatal/postpartum care knowledge and maternal mortality rates per 100,000 live births in Nigeria. I sought to determine the strength of the association between these variables. To address the public health issue of maternal mortality, individuals need to be aware of

the causes of complications and the actions they can consider or take to reduce the adverse effects of maternal mortality.

Research Questions and Hypotheses

I used five variables from the 2018 Demographic and Health Survey (DHS) data set for the research. The variables include pregnancy-related death, number of entries in the pregnancy and postnatal care history, number of antenatal visits during the pregnancy, knowledge of contraceptive use, and health checkups before discharge after delivery.

RQ1: To what extent is there an association between access to antenatal care services as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria?

$H_0$1: There is no association between accessibility to antenatal care as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria.

H_a1: There is an association between accessibility to antenatal care as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria.

RQ2: To what extent is there an association between access to postnatal care services as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria?

$H_0$2: There is no association between accessibility to postnatal care as measured by the number of entries in the pregnancy care history and maternal mortality in Nigeria.

H_a2: There is an association between accessibility to postnatal care as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria.

RQ3: To what extent is there an association between delivery checkup service measured by postnatal check discharge after delivery and maternal mortality in Nigeria?

H_03: Delivery checkup services measured by postnatal check before discharge after delivery have no association with maternal mortality in Nigeria.

H_a3: Delivery checkup services as measured by postnatal check before discharge after delivery are associated with maternal mortality in Nigeria.

RQ4: To what extent is there an association between contraceptive use knowledge as measured by the knowledge of contraceptive use associated with maternal mortality in Nigeria?

H_04: There is no association between the knowledge of contraceptives as measured by the knowledge of contraceptive use and maternal mortality in Nigeria.

H_a4: There is an association between the knowledge of contraceptives use as measured by the knowledge of contraceptive use and maternal mortality in Nigeria.

RQ5: To what extent is there an association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of

contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

$H_0$5: There is no association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

H_a5: There is an association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

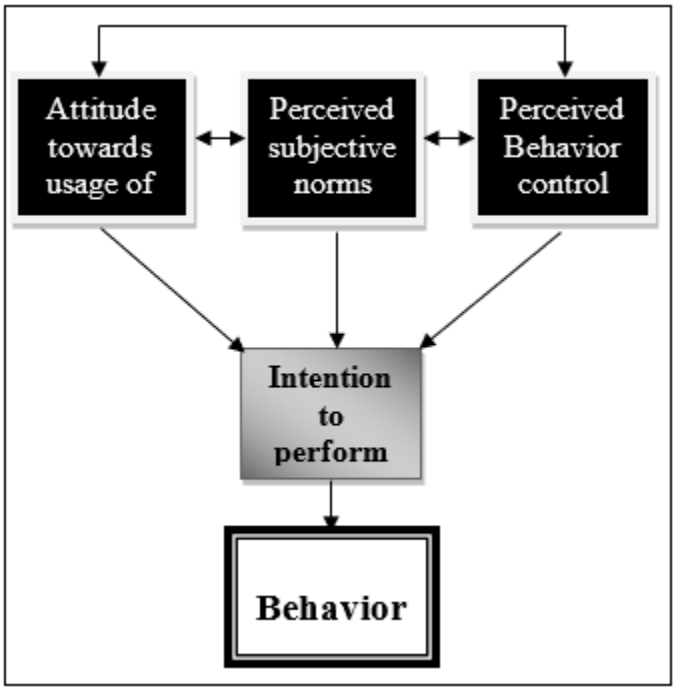
Theoretical Foundation

Ajzen developed the theory of planned behavior, which links a person's belief to their behavior. The theory looks at attitudes, subjective norms, and perceived behavioral control, which together shape an individual's behavior (see Figure 1). In relation to this study, the theory was helpful to understand how an individual's perception and norms can help influence the number of times they visit healthcare facilities during pregnancy, therefore reducing the risk of maternal and mortality. The link between the number of antenatal visits a pregnant mother takes to a healthcare facility and the number of

mortalities is an important variable in the study, making it essential to understand the link between the two metrics.

Figure 1

Theory of Planned Behavior



Note. Adapted from "The theory of planned behavior," by Ajzen, 1991, *Organizational behavior and human decision processes, 50*(2), 179-211 (https://doi.org/10.1016%2F0749-5978%2891%2990020-T). In the public domain.

Moshi et al. (2020) sought to determine how planned behavior influenced the decision by couples to give birth in healthcare facilities in a rural part of Tanzania. The researchers used a cross-sectional study design that targeted pregnant women and their spouses between June and October 2017. The questionnaire they used included three main areas: attitude towards usage of maternal services, perceived subjective norms towards the utilization of maternal services, and perceived behavior control towards maternal services utilization. Traditional gender roles may explain why female

correspondents had a better attitude towards using maternal services during pregnancy. Traditionally, men are supposed to be the financial providers. Respondents perceived that many had a less positive attitude towards maternal healthcare or giving birth in health facilities instead of the traditional home birth since it was more expensive. Although maternal healthcare is free in Tanzania, there are some hidden costs such as transport costs and the cost of staying in the facility that may be expensive to a large proportion of the population. Such costs affect the population's attitude towards the utilization of maternal services, increasing maternal mortality.

The causal relationship between prenatal care and maternal healthcare has recently been investigated in several developing countries. Awiti (2015) conducted a single-level and multi-level analysis to examine the effect of adequate prenatal care on infant health in Kenya. In this case, the indicator of infant health was measured using birth weight. The results from the research indicated that holding all other factors constant, the adequate use of prenatal care increases birth weight. Awiti recommended that prenatal care was an excellent way to promulgate the journey of reducing maternal mortality. From this research, policymakers must implement policies that encourage the adequate use of prenatal care, ensure the availability of skilled personnel in health institutions, and reduce the direct and indirect costs of accessing these services. Encouraging civil education may also help pregnant women to make the right choices for their health.

Prenatal care refers to the healthcare services provided to pregnant women throughout their period of pregnancy. In an ideal situation, quality prenatal care involves

tests that help service providers identify the risks of pregnancy and birth complications. It also involves providing advice to pregnant women on health matters, offering advice on proper nutrition, educating women about pregnancy and post-pregnancy hygiene and identifying any preexisting ailments that may pose a risk of complications (WHO, 2019). Not all small community-based hospitals can handle all these activities and, as such, should have good referral policies where treatment is unavailable (WHO, 2019). Suppose a pregnant woman attends these prenatal clinics. In that case, they can know more about what role they play in ensuring they deliver healthy children due to the professional advice given by doctors. Prenatal discussions help educate women about smoking and drinking alcohol practices that could harm unborn children and impede their development before and after pregnancy (Martinson & Reichman, 2016). Prenatal talks also help to prepare women for motherhood, especially first-time mothers who are often very anxious.

For women identified as having a high risk of complications during pregnancy and delivery, medical practitioners can plan and advise on what to do so as not to aggregate the risk. Once a threat is identified early, it is easy to help mitigate it by improving nutritional diet and preparing psychologically, among other medical interventions that can be done to ensure the mother and child's safety (Martinson & Reichman, 2016). Prenatal visits also help women to know what is normal for their bodies and what is not normal. Usually, women who can identify any abnormal signs such as prolonged pain or hemorrhaging can seek medical attention early, giving them a

higher chance of survival, unlike those who do not know the normal and abnormal signs during pregnancy (Martinson & Reichman, 2016).

Perceived social pressure significantly influenced the intention of both male and female candidates to use healthcare facilities when giving birth. According to Moshi et al. (2020), perceived behavior also significantly influences the intention to use maternal healthcare facilities. Male respondents perceived childbirth as usual and less risky and therefore preferred home births to hospital births. The perception of low risk may stem from a lack of knowledge about delivery and the risks associated with pregnancy. Overall, only one predictor was significant in influencing the decision to utilize maternal healthcare facilities. Despite many participants having the intention to use hospitals during childbirth, the intention was weak. The study's authors concluded that none of the domains associated with the theory of planned behavior significantly influenced the decision to birth in a health facility among male and female candidates, meaning that intention may not necessarily translate to action.

The Moshi et al., (2020) study directly contradicts a study conducted by Endalew et al. (2017), investigating the intention to use maternity waiting homes among pregnant women in Ethiopia and how the intention influenced their actions. Maternity waiting homes are temporary shelters for pregnant women located near health institutions and endorsed as one component of a comprehensive package to reduce maternal morbidity and mortality rates. The researchers concluded that all predictors of intention highly influenced the willingness to use maternity waiting homes in line with the theory of planned behavior.

Only 48.8% of the participants in Endalew et al.'s (2017) study intended to use maternity waiting homes. This statistic is a significant concern, given that the program intends to reduce the mortality rate among infants and pregnant women. The researchers identified a lack of health education and awareness, especially among husbands, as causes of the low prevalence of maternity waiting homes. The contrasting results from studies conducted in two developing countries supported the use of the theory of planned behavior as the main theoretical framework for this study to understand Nigeria's situation in a better way.

Previous researchers studying maternal mortality have considered the integration of social behavior and beliefs in people's choices. Many studies have shown that an increase in uptake of maternal services can lead to a reduction in maternal mortality rate holding all other factors constant. However, according to Adedini et al. (2015), various regional variations in the relationship mentioned above are due to income inequalities, norms, and beliefs. The researchers argued that understanding socio-cultural beliefs and norms is crucial in maximizing community-based programs' effects to help reduce the maternal mortality rate. The literature review in Section 1discusses the importance of quality healthcare services, and I also analyze studies of how poor-quality services contribute to increased maternal mortality rates.

According to Neal et al. (2015), in a survey conducted by WHO in 31 countries, people living in urban areas and receiving skilled attendance during birth was four times more than those living in rural areas. Prenatal care was also highly unequal among the poor and affluent populations. The rising inequality in the health sector causing a rise in

maternal deaths goes against any health development goals. Dickson et al. (2015) found that such deaths are preventable using cost-effective prenatal and postnatal services. However, the fact that no clear implementation strategy has been tried and tested to enable governments to implement such services seamlessly is an impediment.

Traditionally, most governments and international organizations have tried to increase the supply of healthcare to improve maternal health in areas where the maternal mortality rate is very high (WHO, 2019). Given that this strategy has not always worked, policymakers and healthcare advocates pay more attention to changing the population's demand patterns. More attention is placed on increasing the knowledge on the benefits of maternal healthcare and ensuring that the health facilities in place are easily accessible by the population (WHO, 2019). Understanding why the uptake of maternal healthcare services has been low could prove instrumental in changing people’s mindset about these services, thus reducing maternal deaths.

Although the cost of maternal healthcare services has been subsidized in most countries, accessing them remains a challenge to many because they require expensive services such as transport to the healthcare facility. Hidden costs in maternal healthcare, especially delivery by skilled professionals, deter individuals (WHO,2019). The heterogeneity of culture, beliefs, and norms in society also plays a crucial role in behavioral change. Many traditional practices and ideas go against modern healthcare practices, thus inhibiting any efforts put in place by the government to reduce maternal mortality.

According to the WHO (2019), 46.7% of low- and middle-income countries live in rural areas. However, rapid urbanization has helped disperse the rural population eroding traditional norms and beliefs and replacing them with modern healthcare services. The population dispersion has also been instrumental in increasing the prevalence of healthcare services in rural areas despite the income inequality between urban and rural areas. Traditionally, home delivery is the norm as it measures a woman's strength and health. Therefore, institutional births are not the norm, and most women shy away from them as a show of strength (WHO,2019). A woman also incurs many opportunity costs when leaving home and seeking healthcare services during birth. Women need to find alternative caregivers to care for their other children and tend to the needs of their family, such as cleaning and cooking duties. Policymakers need to have this in mind while stimulating demand for maternal healthcare services to ensure an incentive to incur the opportunity cost of seeking healthcare services.

Nature of the Study

I determined that the quantitative approach would be useful in collecting, summarizing, and analyzing relevant information linked to maternal mortality. It is preferred to use a cross-sectional quantitative study design when assessing the exposure and outcome of the participants (Setia, 2016). I used the quantitative method to evaluate the trends and patterns associated with the subject and ultimately conducted a statistical analysis to answer the RQs and test the hypotheses. It is easier to collect and summarize critical information with the quantitative approach and determine the relationship between variables (Bell et al., 2018). I coupled the quantitative technique with a

descriptive and inferential analysis to enhance the understanding of related concepts. The population under study consisted of all the women between the age of 15 and 49. The population consisted of 40,427 households with 189,656 household members. I determined that place of residence influenced maternal healthcare services; in the population under study, 54% of the respondents lived in rural areas while 46% lived in urban areas.

Literature Search Strategy

The literature review includes information relating to access to and knowledge of antenatal and prenatal services in Nigeria, the quality of these services, and how they directly influence the maternal mortality rate in Nigeria. The review includes studies using the theory of planned behavior on the relationship between the knowledge of antenatal/prenatal and postpartum care and mortality rate. Most of the literature review was published within five years from 2015-2020 to study more recent developments. Some of the articles help to explain the main theoretical framework supporting this study, which was the original theory of planned behavior. Behera and Kumar (2015) conducted a study using the theory of planned behavior as their reference to investigate whether the intention of breastfeeding among pregnant women in rural areas in India translated to exclusive breastfeeding once the women delivered. The study by Behera and Kumar is quite similar to this study, further validating the theory of planned behavior as the theoretical framework of this study.

Some of these databases used in conducting the literature review and information contained in the study were from sources such as the WHO, UNICEF, Wiley Online

Library, CINAHL, NCBI, and U.S. National Library of Medicine. I selected the articles for the review based on their relevance to the specific study. I picked some articles to bring out the different views on the subject matter, whereas I selected others for their conflicting results. The research reviewed here helps describe the variables used in this research further, explain their relationship to the problem statement, and give an overview of the cultural and demographic situation in Nigeria's country of study.

In conducting the literature review, I also sought to study the impact of programs that seek to improve maternal mortality rates in society. I searched for literature on the cost-effective measures used by some governments and analyzed their impact on reducing maternal mortality rates. I used information from databases such as PubMed, Medline, and Econlit to study the recent methodologies used to describe this relationship, mostly in developing nations. Most studies used intermediate outcomes that include prenatal care and postnatal care. In contrast, others used the indicators of final health outcomes such as maternal mortality rate to assess the benefits of such services. However, it is impossible to summarize the results of all these studies using a single indicator despite them all having the same objective.

Some studies included in the literature review were not experimental or did not measure the impact of maternal services on maternal mortality rates. I included papers that did not directly relate to maternal healthcare as part of the studies due to their innovative nature that brought out an interesting and deeper perspective into the lives of citizens living in rural parts of Nigeria. This kind of knowledge could be evaluated and

eventually applied to form policies that will help to drive demand for maternal healthcare services, especially in rural areas.

Literature Review Related to Key Variables and/or Concepts

The literature review centers on the variables in the RQs and hypotheses, linking each variable to the dependent variable in this study (maternal mortality).

Maternal Mortality and Maternal Healthcare Services (Antenatal Care)

Adebowale and Udjo (2016) found that maternal death was lowest among women who have had access to Maternal Healthcare Services Access Index in Nigeria. The study was a cross-sectional study that included data from women between 15 to 49 years. It involved tracking the antenatal attendance, tetanus toxoid injection during pregnancy, delivery place, and birth attendants' skills. The study also looked deeper into sociodemographic factors, including maternal nutritional status and dietary intake during pregnancy and sanitation and maternal health knowledge. The study of such subjective matters assumed that correspondents were entirely honest about their situation. The results from this study were consistent with the literature available on the association and access of maternal healthcare and infant survival (WHO, 2019). This literature indicates that access to a formal health system during pregnancy increases the chance of using skilled attendants at birth, thus contributing to the mother's improved health, especially after delivery. This study significantly supports the first RQ of this study, which centers on whether there is an association between the number of antenatal visits and maternal mortality.

Fagbamigbe and Idemudia (2015), undertook a study to understand the barriers to prenatal care in Nigeria. The study revealed that one in every three pregnant women in Nigeria does not attend prenatal care services. The researchers chose to focus on nonusers of prenatal care services only to try and understand why they do not seek these essential services. The researchers analyzed 2,199 women who did not seek these services. Among the women who did not use antenatal services, 82.5% lived in rural areas, while 57.3% did not have any formal education. The most common reason for not seeking antenatal services was the lack of funds to pay for such services and the lack of funds to pay for transport to healthcare facilities. The researchers surmised that addressing the financial barriers could increase the use of antenatal and postnatal services among pregnant women, thus reducing the maternal mortality rate.

As discussed in Section 1, the high direct cost of accessing maternal healthcare services impedes the uptake of these services. Alfonso et al., (2015) accessed the impact on the distribution of health vouchers that allow women in rural Uganda to access prenatal care and institutional deliveries. The study concluded that the voucher system considerably improved the uptake of maternal care services. Previous studies (e.g., Ekpenyong et al., 2019) have shown that most of the population cannot afford the indirect costs associated with maternal healthcare despite the subsidization of maternal healthcare services.

In Uganda, women can redeem the vouchers offered for round trips to and from private and public healthcare facilities and pay for prenatal services. These vouchers helped cater to direct costs and covered many indirect costs associated with accessing

these services. This study concluded that the voucher strategy considerably improved the uptake of prenatal health services among the rural population in Uganda, increasing institutional births by about 9.0% and reducing maternal mortality rates. This cost-effective intervention proved to be a step in the right direction to reduce the mortality rate in Uganda.

The impact of the voucher system on the uptake of maternal healthcare services was also analyzed in Cambodia by Van de Poel et al. (2015). The voucher program comprised one universal scheme that distributed the health vouchers to all women while the other voucher system targeted women from a poorer background. Aside from simply distributing the vouchers, women who received the vouchers were also offered advice on safe delivery and necessary care and nutrition during pregnancy. Both variants of the voucher positively impacted the uptake of maternal health services, thus increasing the number and probability of having an institutional birth and the uptake of prenatal services. Unlike in Uganda, no data on cost was available to assess cost-effective measures.

Aside from the voucher system, other measures covering direct costs include community-based loan funds used to cover transport expenses to medical facilities in emergencies. According to Nowlise et al. (2015), women can use such loan funds to pool funds that can be borrowed during emergencies so that they can access timely medical care. These types of loans are available in countries such as Malawi, Nepal, and Nigeria and have increased the use of maternal health.

Wang et al. (2016), examined the effects of a non-cash incentive provided to mothers in Zambia and the impact the program has had on improving the uptake of maternal healthcare services. To encourage institutional delivery, the Zambian government started a program to provide mothers who deliver in hospitals a small package of infant care items that cost approximately USD 4.0. Such kits alone cannot wholly encourage the population to seek hospital deliveries in the rural parts of Zambia; they are a crucial reason why institutional deliveries have been on a rising trend in rural Zambia, consequently reducing maternal deaths.

To ensure the maternal mortality numbers are kept low, the Zambian government can scale up the cost-effective program to one that offers more education on maternal care. Countries like Kenya have also tested non-monetary incentives. New mothers delivering in hospitals located in rural or poor parts of Kenya receive free-treated mosquito nets to prevent malaria during their prenatal visits. This simple incentive has increased the uptake of such services among the target population by 11.7%.

Despite the promising results in using non-incentive measures to help increase the uptake of maternal services in different parts of the world, although more cost-effective than the traditional monetary incentives, it may not be as effective. Immediate payments to individuals can help impact behavior immediately, leading to relearning of a new behavior faster and reaching a more significant impact in the long run (Celhay et al., 2017).

A more recent study on the same topic by Ekpenyong et al. (2019), pointed out that education levels, income vs. cost of care, distance to healthcare facilities, staff

attitude, and women autonomy were factors determining the uptake of antenatal services among Nigerian women. Staff attitude is a factor that discourages pregnant women from seeking antenatal services since even if they go to the healthcare facilities, the healthcare staff are sometimes not available. They then have to come back another day, thus discouraging their efforts. Some of the medical staff did not have the proper skills, thus putting off some patients. According to Akinyemi et al. (2015), lack of training even for the health workers present in maternal healthcare facilities reduces antenatal care effectiveness.

Women's autonomy was also a new challenge introduced by the researchers. Here, some women complained they are not directly involved in making decisions affecting their bodies. Many claimed that their in-laws or husbands did not want them to leave the house and seek these services since they had to take care of the house chores and care for the other children despite being heavily pregnant. They claimed that they did not have a say when it came to seeking antenatal care. These two studies are significant since they look at the challenges of accessing antenatal care services from a quantitative and qualitative point of view. Identifying the problems can help see the broader picture of the social-economic factors in the country even as the study tries to come up with suggestions to reduce maternal and child mortality in Nigeria.

Maternal Mortality and Maternal Healthcare Services (Postnatal Care)

A more recent study done by Sageer et al. (2019), sought to investigate the link between maternal mortality rate and the quality of healthcare services offered to pregnant women during pregnancy, birth, and after delivery. The authors were keen to point out

that Nigeria still ranks second globally in maternal deaths and seek to determine the cause and contributory factors of maternal mortality in Ogun, a state in Nigeria. The data studied was from the statewide maternal and perinatal deaths surveillance and response (MPDSR), with data collected between 2015-2016. The data set assumed that all correspondents had filled in the questionnaire correctly and took the sample of 77 cases to represent the entire population well.

From the study, most maternal deaths were due to un-booked cases and delayed referrals to Secondary healthcare facilities from Primary healthcare centers, mission hospitals, or traditional birth attendants (TBAs), causing pregnant women to experience excessive bleeding due to prolonged labor, causing about 43.8% of maternal deaths. This study is significant since it shows evidence that low-quality healthcare procedures and systems contribute to maternal deaths. The study recommended that States review their healthcare programs to equip primary healthcare facilities to offer the proper antenatal care. States should also implement swift referrals for women who need transfers to larger referral facilities. The study also pointed out the need to increase knowledge among community members on the importance of starting and following up on antenatal care to identify complications early in the pregnancy and allow women to have access to experienced staff early enough in the pregnancy.

Postnatal care is also a critical factor in ensuring infants can survive past five years of life. For Nigeria, infants die majorly due to acute respiratory illnesses, diarrhea, among other preventable and treatable diseases. Therefore, it is crucial to follow up high-quality antenatal care with proper postnatal care for both the infant and the mother to

ensure adequate immunization and monitoring. The government should step in to ensure the quality of maternal healthcare provided is high to guarantee that women and children rip the full benefits of antenatal and postnatal healthcare services.

Factors such as the long distance from the community hospital to the women's homes also led to the program's discontinuation. The low infrastructural development in the region makes it hard for community members to seek maternal healthcare services, especially during the rainy season when the roads are impassable. Aside from the poor infrastructure, it is hard to find vehicles at night, which often acts as a deterrent to institutional delivery, especially for women who go into labor at night. The researchers proposed the establishment of a village-based healthcare system to tackle the problem of poor infrastructure. The village-based healthcare system would provide maternal healthcare services to women and infants who live in remote parts of the community.

Therefore, community health workers can be trained and equipped with the skills necessary to ensure proper maternal and child health. Such a program has worked in Cambodia, where the country adopted a village malaria worker system to help curb malaria infections. According to Canavati et al. (2016), community health workers are responsible for screening and treating malaria and facilitating referrals for severe cases. Setting up mobile clinics can be especially helpful in offering postpartum services, especially to women who may have undergone a complicated delivery but need to recover at home due to the high costs of admission in most hospitals relative to the population's income.

Maternal Mortality and Continuum Care

International bodies across the world have advocated for the concept of continuum care. Continuum care is an integrated series that stipulates the kind of care that women and children are supposed to receive at all times. Continuum care shows the continuity of care which brings together services from different medical practitioners that expectant mothers and children should promptly receive. The time dimension is a component of continuum care, and it includes service delivery during different periods of a child's life from childhood, adolescence, pregnancy, delivery, postpartum, and motherhood. Following these guidelines means that many pregnancies and delivery risks can be identified earlier, even before pregnancy, reducing the chances of occurrence (Kikuchi et al., 2016).

The program also emphasizes the importance of postnatal care and recommends at least three visits after birth. The program has a spatial dimension that comprises three stages that offer patient care. These stages include; clinical care, outreach care (in outpatient care), and family community care. Implementing all three stages in a quality manner is believed to reduce the maternal mortality rate. The three care stages indicate a reduction in neonatal death by approximately 21% and prenatal death by approximately 16% (Kikuchi, 2016). Although this strategy has shown promising results, low and middle-income countries are yet to implement it.

The continuum of care strategy has been adopted in Cambodia to try and reduce maternal and child mortality rates. Although approximately 60% of complete the necessary stage of care, the country has attained tremendous progress in lowering deaths

resulting from pregnancies. However, as with most parts of the world, the coverage of care varied greatly from one region to another, pointing towards a health inequality problem (Wang et al., 2015). The overall effect of implementing this program in Cambodia was an increase in the uptake of maternal healthcare services, with approximately 95% of pregnant women seeking antenatal care services, 83% preferring to deliver their children in hospitals. In comparison, 90% sought postnatal care services. The country's number of skilled birth attendants has also risen, making delivery in hospitals safer.

In the study conducted by Kikuchi et al. (2018), policies that encouraged women to adhere to the continuum of care reduced maternal mortality in Cambodia. The cross-sectional study took place in Ratanakiri Province, Cambodia, and involved a sample of 388 women who had given birth in the last two years. The researchers first had to identify the challenges causing women to fail to adhere to care services. Only a few studies have tried to identify challenges associated with adhering to the continuum of care. The effects of the disconnect on the infants' health and characteristics of women who discontinued the program were also of great importance in conducting this study.

The researchers collected data among the target population via face-to-face interviews and a Geographic Information System. The questionnaire used comprised different questions, such as social life, attitude towards maternal healthcare, and any memory of prenatal illnesses. One major shortcoming of the study was that the target population comprised women who had given birth two years prior and recollecting the exact details of how the pregnancy and delivery were may prove to be a challenging task.

The information recorded from the interviews had to be analyzed while having this in mind.

The study's findings identified that only 5% of women completed the continuum of care stages, with an overwhelming 18% of women not receiving antenatal, delivery, and postnatal care. This study was contradictory to a study conducted by Wang et al. (2015), who conducted similar research in the same part of Cambodia and concluded that 21% of women completed the continuum care stages. The difference in findings may, however, be purely due to the definition of variables. Wang et al. (2015) included women who received antenatal care at least once, yet Kikuchi et al. (2018), included only women who had attended at least four antenatal clinics.

Many women discontinued the program at the postnatal care stage. These findings also coincided with the fact that the supply of postnatal care services was the lowest among all the maternal care services. Many women confuse the care offered after delivery with postnatal care; however, the WHO (2019) stipulates that postnatal care is intervention after 48 hours of delivery. The second visit should be after 6-7 days; the last one should be at six weeks of birth. In this study, however, only a few women received postnatal care service, and none of the women within the study population completed all stages of postnatal care. This trend is worrisome as the rate of complications among mothers within the first few weeks of birth is very high. Women must, therefore, be encouraged to seek postnatal care services to reduce the maternal mortality rate. The study also concluded that women who did not seek such services had a higher frequency of prenatal complications, especially within the first month of birth.

Maternal Mortality and Knowledge and Use of Contraceptives

Contraception is the cornerstone of maternal health. The use of contraceptives helps to prevent unintended pregnancies. Contraception can also improve perinatal outcomes and child survival, mainly by lengthening inter-pregnancy intervals, reducing the chances of a high-risk pregnancy. A study by Chola et al. (2015), sought to determine the potential benefits and costs of modern contraceptive use in South Africa. The study utilized The Family Planning model in Spectrum, which projected the impact of modern contraception on pregnancies, abortions, and births in South Africa between 2015 and 2030. The model increased the CPR (Contraceptive Prevalence Rate) by 0.68 percentage points, and the coverage of essential maternal and child health interventions was increased by 5% annually. The researchers found that if CPR increased by 0.68% annually, the number of pregnancies would reduce by at least 0.3 million by 2030. Unintended pregnancies, abortions, and births decrease by approximately 20%, which means family planning can avert about 7,000 newborns and children and 600 maternal deaths.

Rodríguez-Aguilar (2018), introduced a new variable that is rarely studied but contributes to the mortality rate, especially in developing nations. In Brazil, almost 5% of maternal deaths occur due to abortion. Abortion, though illegal in Brazil, is used by approximately one in every nine expectant women to end unwanted pregnancies. The illegality of the matter means that medical practitioners cannot perform such procedures in hospitals. This forces women to seek these services in clandestine conditions where they may not get quality care before, during, and after the procedure. It is unknown how many women die annually from such procedures, but illegal abortion contributes

significantly to maternal mortality, especially in developing countries where abortion is illegal.

The research also identified other variables such as marital status and age that seem to affect the maternal mortality rate. Rodríguez-Aguilar (2018) found that single women were more vulnerable to maternal deaths than their married counterparts mainly because they felt abandoned and alone and failed to seek prenatal and antenatal healthcare services. Maternal deaths were also more common for women under 15 and those over 35 years likely to get pregnancy complications. Therefore, teen pregnancy was an issue that needed to be addressed through civic education and tailored communication directed to the young population.

Summary and Conclusion

It is clear that despite the need to increase the demand for maternal healthcare services among community members, more needs to be done on the supply side. Filby et al. (2016), identified that particular supply-side challenges contribute to increased maternal mortality, especially in developing countries. Lack of proper drinking water, lack of skilled personnel in rural community hospitals, and food contamination contribute highly to maternal mortality. Despite their limited capacity, experienced practitioners with low wages, inadequate training, and work overload are often demotivated. Such factors affecting the supply side contribute to the low demand for maternal healthcare services. The questionable quality of services makes it hard for women deeply rooted in their beliefs and norms on home delivery to unlearn and adopt new ones. Lack of

empowerment, especially among rural women, contributed to the low uptake of such services.

Most scholars engaged in similar research have used the qualitative approach. A study conducted by Figueiredo et al. (2018), used a cross-sectional approach to analyzing the qualitative data collected from face-to-face interviews, questionnaires, and interview recordings. The research, whose variables included healthcare professionals and maternal mortality rate, hypothesized that prenatal care offered by healthcare workers was effective in reducing the mortality rate. Using data collected from the sample population, the researcher tested the relationship between these variables.

The study concluded that healthcare workers played a vital role in increasing the uptake of quality maternal care services. Most participants agreed that they felt safe and encouraged to seek such services when healthcare workers improved their efforts to encourage individuals to use these series properly. Members of the community agreed that the concept of maternal health was alienated when healthcare workers made home visits to advise women on how to care for their unborn children and the importance of institutional births. Women were seen to respond better to healthcare workers who approached them at a more personal level. The education levels of a woman were also considered as a variable that could significantly affect maternal healthcare. Women with higher levels of education generally sought more preventive care measures than their counterparts, indicating a knowledge gap that needed to be filled through civic education.

Yaya et al. (2019), went further to research men's perception of barriers to antenatal care by pregnant women. According to the researcher, greater paternal

engagement is positively and directly related to improved utilization of antenatal care (Aborigo et al., 2018). Despite numerous studies proving this, very few men in Nigeria actively support their wives in seeking antenatal care services. The study sought to understand the men's perspective on barriers to utilizing antenatal care with the ultimate goal of increasing their involvement in maternal care. A qualitative study involved 128 people and analyzed data collected from community conversations with male elders in Edo, a rural area in Nigeria.

Community elders are considered role models and can be instrumental in promoting positive behavior among community members. From the study, the main barriers detected were gender roles, traditional treatment, and policy changes. According to the conventional gender roles, women are responsible for knowledge about maternal health. Many participants also believed that women resorted to traditional care and delivery due to the poorly equipped healthcare facilities in the communities. Generally, participants admitted that there was little knowledge about maternal healthcare in the community. They called for proper education on maternal healthcare services, especially for women, to reduce maternal mortality in the community. In conclusion, the study identified that community elders were in an excellent position to encourage a shift in behavior among men to promote their involvement in maternal health, especially in patriarchal societies.

According to Yaya et al. (2019), many people are aware of research that suggests that male involvement generally increases the uptake of maternal services. Despite this knowledge, very few men, especially in Nigeria, help their partners participate in

programs promoting maternal health. The traditional social gender stereotypes may be to blame in this situation since there are no clear roles for men in many communities to play in maternal health. Some women even disapprove of men's involvement in such matters since it is not the norm. Gender interventions can, therefore, also be a focus when health practitioners are conducting civil education among community members to debunk the myth that men should not be involved in ensuring the health of both women and children. The support offered by men can be a big boost to the uptake of maternal services, especially in rural areas where men are the heads of households.

In Nigeria, socio-demographic factors play a significant role in healthcare-seeking behaviors among the population. Adedokun and Uthman (2019), conducted a study to try and identify the women who are not utilizing free maternal healthcare services demographically. 66% of the global maternal mortalities occur in sub-Saharan Africa, where only 56% of births occur in a health facility. In Nigeria, less than 40% of births occur in a health facility despite hospital delivery being more efficient in reducing maternal mortality. The study used longitudinal data of women who have delivered over the period between 2014 and 2019. Regression models were used to analyze the strength and significance of the variables used in the study. The study uses spatial analysis to capture the locations where the phenomenon is prevalent in the country. More than 75% of those who did not use antenatal services had no formal education, and 92% of those who did not attend antenatal clinics did not deliver their children in hospitals.

The study noted that most of those who did not use maternal healthcare lived in the most socially and economically disadvantaged neighborhoods. Despite the free services, the distance to the facilities and other hidden costs were a deterrent to using such facilities.

Evidence-based knowledge on the trends and drivers of maternal mortality may help develop proper interventions needed to reduce the high mortality rate (Morakinyo and Fagbamigbe, 2017). The researchers used data from Nigeria Demographic and Household Surveys (NDHS) for the years between 2003 and 2013 to observe neonatal Mortality, Infant Mortality, and Under-five Mortality. The study concluded that certain factors such as the mother's age, birth interval, parent level of education, child's sex, residence, weight at birth, the skill of healthcare workers, and natural versus caesarian delivery influenced the three variables. Mortality rates were higher among mothers residing in rural areas and higher among those from poorer backgrounds. These findings are significant to this research since they depict that inequities in access to quality healthcare facilities before and after giving birth affect the mortality rate. The study also shows where the inequality stems, thus providing a reference point for policymakers who wish to fill the health inequality gap.

While most developing countries have tried to use campaigns to disperse information and educate the public, such campaigns may not have a clear impact on the rural population in terms of increasing the uptake of maternal healthcare despite their relatively low cost. Such strategies increase knowledge but fail to change the behavior of individuals. In some cases, the population's behavior changes during the campaign's

duration, but things go back to normal soon after it ends. The reason behind this could be low levels of education among the rural population. However, campaigns can be individualized or tailored to a specific community to ensure the knowledge imparted is helpful for years to come.

The government can employ more individuals to conduct the campaigns and ensure they have a one-on-one with community members to understand their background and address their concerns. Such interventions can use local agents such as trained women in the community to speak at women's groups since they are in a better position to address the concerns of the community members. According to Adam et al. (2014), such interventions have a significant impact on maternal behavior.

It is essential to ensure interventions are tailor-made for a specific population as it would be easier for people to incorporate a particular practice into their daily lives. Instead of conducting traditional campaigns, countries such as Brazil and Bangladesh have used the population's love for soap operas to communicate the importance of postnatal care and education, especially the use of contraceptives among the people. Brazil reported a decline in late and early pregnancies among the population, while in Bangladesh, the number of visits to family planning clinics increased. Therefore, it is essential to tailor education on maternal health services more relatable to ensure it can fully impact the population.

To impart knowledge to the young population, Rokichi et al. (2017) observed the impact of communication through text messages to young adults on learning about reproductive health. The study conducted in Ghana involved a randomized group of

female students aged between 14-24 years in Accra, the capital of Ghana. The researchers sent participants text messages containing reproductive health information as interactive engagement that entailed information disbursement and health quizzes for 3-15 months. The researchers opted to use text messaging as a way of campaigning since young people use their mobile devices more than any other electronic. The study concluded that such a form of communication provided a great potential to lower teenage pregnancy. This study affirms that governments should tailor campaigns to the target population to ensure maximum benefits.

In the rural parts of Kenya, as a bid to improve institutional delivery among the rural population, community health workers are actively involved in visiting women in their social groups and educating them on the knowledge of institutional delivery. The intervention by community health workers increased institutional delivery by 73.0% from the previous 56.0% in three regions. The uptake of maternal healthcare services also plays an essential role in the lives of children. Once a mother is educated on maternal and infant health, there is a higher chance this can reduce infant mortality. In terms of the Under 5 Mortality rate, the risk of death was higher for children from poor backgrounds because of poor sanitation and unclean drinking water, which can cause severe infections among young children. Children with a background where parents had little health education were also at the risk of high mortality since they may miss getting proper vaccination that may prevent them from contracting deadly illnesses. Maternal characteristics, therefore, play a significant role in maternal mortality, infant mortality, and Under 5 Mortality.

Definitions

The study looks at the impact that antenatal and postnatal visits have on the maternal mortality rate. *Antenatal care* is a dichotomous variable according to the WHO. It is defined as a pregnant woman having had one or more visits with a trained medical practitioner during the pregnancy (Ataguba, 2018). The level of care varies between the developing and developed countries hence the broad definition. During the antenatal visits, women are psychologically prepared for childbirth, risk reduction, and overall wellness.

Postnatal care is the care given to a mother for the first six weeks after delivery. This guidance is necessary for the new mother due to the psychological and emotional changes immediately after delivery (Ataguba, 2018).

Maternal Mortality Rate is the number of pregnant women who lose their lives during pregnancy or within 42 days of giving birth to their child due to other reasons that are not accidental or incidental. Therefore, the mortality ratio is the ratio of women who lose their lives during this period per 100,000 live births (Sageer et al., 2018).

Assumptions

The primary assumption behind this study is that the maternal mortality rate is majorly affected by the number and quality of antenatal and postnatal visits a mother makes during and after giving birth. In reality, other factors affect the mortality rate, such as the mother's age, access to essential nutritional foods, sanitary conditions, and the surrounding climate.

The study also assumes the results from the study can be extrapolated to other developing countries as well, given that they are likely to be experiencing the same factors as the study area in Nigeria. The study also largely assumes that the quality of antenatal and postnatal care provided in the region is the same across the board. However, it is clear from previous studies that inequity does exist in the country's healthcare system.

Scope and Delimitations

Nigeria is considered one of the most populous countries in African, with over 200 million people. At the end of 2015, the approximated maternal mortality ratio was more significant than 800 deaths per 100,000 live births. The high mortality rate in the country reflects the inequity that exists in the region when it comes to access to sound healthcare systems (Bell et al., 2018). Poor women in remote areas of Nigeria are less likely to receive the necessary care offered during prenatal and postnatal healthcare visits. The women from this region are also less likely to have trained personnel caring for them during delivery.

The study focuses on identifying the role that antenatal and postnatal healthcare services play in reducing maternal mortality rates in the region. Although many other factors affect the mortality rate, this study will only analyze whether women can access such services. It will also focus on why some shy away from such services, how to ensure more women seek professional services during and after pregnancy, and overall, what effect an increase in uptake of such services can have on the maternal mortality rate.

Using secondary data via a cross-sectional design constituted a study limitation. The data may not have captured current development and advancements made by the government to improve the healthcare system. The cross-sectional research design cannot infer any causal relationship in the study. Therefore, the current research is unable to infer any causal relationship between the two variables. Lack of or insufficient and inaccurate birth and death registry in most health facility delivery in Nigeria healthcare facilities could distort the accuracy of the information used from the secondary source. Another delimitation of the study is the quantitative nature of the data, which may not accurately capture subjective experiences. The information recorded from participants may also not be free from bias.

Potential Generalizability

The study is carried out in the sub-Saharan region in Africa and is limited to a specific country, Nigeria. Not all information from the secondary data set, such as under-five mortality rates and malaria infection rates in Nigeria, is relevant during the analysis. Statistical analysis will also be limited to pregnancy-related care services and health education risk factors based on the availability of the data set questions. The data set to be analyzed is only limited to a few risk factors that could influence maternal mortality. There might be a lack of additional data sets with similar information for comparison with the DHS data set. It may be challenging to know whether the DHS samples were randomly selected from the population to represent the Nigerian people accurately.

Limitations of the Study

One of the limitations of this study is the use of secondary data via a cross-sectional design since the data may not have captured current development, and any advancements by the government to improve the healthcare system may not have appeared in the data set. Due to this limitation, the study results cannot infer any causal relationship between the variables

Another limitation is the NDHS data is the lack of or insufficient and inaccurate birth and death registry in most health facility delivery in Nigeria healthcare facilities which could distort the accuracy of the information used from the secondary source (NDHS, 2018).

Significance, Summary, and Conclusion

Researchers have conducted studies to identify the relationship between an increased risk of maternal mortality in Nigeria and the maternal health system (Olonade et al., 2019). There is also a correlation between maternal mortality and socio-cultural factors (Ariyo et al., 2017). Eneh (2017), also conducted a study on policy changes that showed a reduction of maternal mortality in Nigeria. However, limited studies address how Nigerians can embrace professional maternal healthcare services, the impact of pregnancy-related care services, knowledge on antenatal and postpartum services among women, and association with maternal mortality rate per 100,000 live births. The study results will influence social change by transforming Nigerians' socio-cultural practices and embracing professional maternal healthcare. The study can help raise awareness about the importance of pregnancy-related care services and knowledge on antenatal and

postpartum services among women. The study results can also help scholars and healthcare practitioners understand the factors influencing maternal mortality and the breadth of the problem and come up with innovative and evidence-based solutions. The research will provide data on maternal healthcare as a basis for formulating maternal healthcare programs and policies. Local governments in Nigeria will gain knowledge regarding the subject (the causes of maternal mortality) and determine the most appropriate ways of handling the issue (Bell et al., 2018). Public health officers can use it to inform the public, especially mothers susceptible to pregnancy complications, on possible actions that will enhance their well-being.

To enable the women to reap maximum benefits from prenatal visits, the WHO (2019) recommends that pregnant women go for at least four prenatal visits with skilled personnel before their delivery time. It is also advisable that women go in for their first prenatal visit within the first 4 months of their pregnancy to ensure they get the correct information early. WHO (2019) also offers further details on medical practitioners' procedures during each visit. These procedures guide medical practitioners to ensure they perform all the crucial procedures among any other tests that may be deemed necessary to determine the mother's health status

Based on the comprehensive literature review covered above, the ability of a pregnant woman to access quality antenatal and postnatal care directly influences maternal mortality (Tekelab et al., 2019). Studies researching the significance of antenatal care on maternal mortality have proven a strong positive relationship between the two variables. The impact of at least one antenatal care visit by a skilled healthcare

provider can reduce the risk of neonatal mortality by 39% in sub-Saharan African countries. As discussed in the literature review, some other socio-demographic, socio-cultural, and socio-economic issues, directly and indirectly, affect the maternal mortality rate. It is important to note that most governments in developing countries, including the Nigerian government, have taken significant steps to waive fees or eliminate medical expenses associated with antenatal services.

The high maternal mortality rate is a global issue, but the bulkier numbers are in sub–Saharan Africa and the southern parts of Asia. Most researchers seem to agree that proper health education needs to be conducted to these primarily affected communities even though free antenatal care is available. It is essential to understand how different cultural backgrounds affect the perception and behavior of a population. Each culture is unique, and reducing maternal mortality in each country should be approached differently. Governments should offer additional incentives to different members of society to ensure they access maternal healthcare services. Some researchers recommend that aside from subsidizing costs, governments can also send skilled healthcare workers to rural areas with no healthcare facilities to check up on pregnant mothers and young children routinely. These mobile clinics will especially be helpful to pastoralist communities who move around a lot (Phillips et al., 2017).

A majority of the literature analyzed in this section focuses on final and intermediate outcomes, for example, reducing maternal mortality and increasing the number of institutional births. While the final and intermediate health indicators are essential in tracking the progress made towards reducing maternal mortality, it is crucial

to remember that they do not guarantee success towards achieving the final goal of having a healthy population. The success of outcomes largely depends on the quality of healthcare services offered to women during the prenatal, delivery, and postnatal visits.

For example, increasing the uptake of maternal health services does not guarantee that the healthcare workers or the healthcare facilities are well equipped to perform all the necessary tests and procedures needed to reduce maternal mortality rates. Therefore, more attention needs to be towards ensuring that as the world aims to increase the prevalence of maternal healthcare services, governments and non-profit organizations strive to improve the quality of services offered in these institutions.

The focus on quantity over quality may be why a study conducted by Montagu et al. (2017), recorded an increase in institutional birth. Still, there was an insignificant decrease in maternal mortality rates. The researchers point to the need to increase the quality of services offered in rural clinics and improve the skills of the community health workers. Proper referral schemes should also be set up to ensure that if rural community hospitals are ill-equipped to deal with certain cases, the patients can be swiftly transferred to nearby and larger facilities better equipped to deal with the complication. A similar situation where an increase in the uptake of maternal healthcare services did not necessarily increase the quality of the services was reported by Triana (2016) in Indonesia. Policymakers should direct efforts towards measuring and improving quality and balancing the mix of incentives and strategies used to boost the demand for these services.

Policymakers should spark change among population members to promote the demand for maternal and child healthcare services. The governments can cover any direct costs associated with these services by eliminating user fees, offering health vouchers to the population for private and public healthcare, and setting up community funds for emergency purposes. The government can also be involved in social and cultural discussions at the community level through campaigns, reminders using community agents, visiting women groups, and other social networks to further educate the public on the importance of maternal health services. In addition to this, the government and non-profitable organizations can distribute pregnancy care packages with supplies such as mosquito nets to ensure pregnant mothers do not contract diseases such as malaria, which are preventable. Such an initiative is run by a non-profitable organization in Kenya that offers mothers in slum areas a pregnancy package with necessary guidelines and supplies that help to keep the expectant mother and unborn child safe.

Demand for healthcare should also spark healthy eating for pregnant and new mothers to ensure both the mother and the child are getting enough nutrients. As mentioned earlier, the use of contraceptives should also be taught in the community to ensure women can space their pregnancies to avoid health complications. Community members should know the importance of seeking medical intervention before, during, and after pregnancy. As a result of this, the maternal mortality rate is likely to reduce. The health of new mothers improves when they actively seek to get enough nutrients when pregnant and ensure they attend postpartum clinics. Women’s health is also likely

to increase by seeking maternal healthcare services, reducing the chances of anemia, birth complications, and reducing the overall mortality rate.

Most of the literature reviewed focuses on the importance of prenatal visits as well as institutional births. Very few pieces of literatures focus on the importance of postpartum visits, which are vital as many neonatal and maternal deaths occur at this time. Postpartum visits are also essential to monitor the progress of the child and the mother. These visits can also be helpful since mothers can ask their caregivers any questions they may have and, in turn, receive professional advice. These sessions are also crucial for the new parents to improve their mental health and gauge how well adjusted the family has been to the new child.

In many rural parts, it is almost impossible to find many skilled healthcare workers in clinics. Therefore, policymakers need to develop a framework to ensure that despite a low number of skilled workers in rural health facilities, traditional midwives from the community can be trained to identify any signs of pregnancy risks their community members may be. The involvement of midwives may also serve as a way to stimulate the demand for maternal healthcare services by women in rural areas since they will feel more comfortable with the help of their midwives. In this way, midwives can also improve their knowledge and assist their communities more significantly.

Not much recent research is available on sub-Saharan countries, which highly contributes to maternal mortality rates. To understand the underlying factors that inhibit the uptake and effectiveness of prenatal and postnatal clinical visits despite the effects of globalization. Many more researchers must examine the barriers to the uptake and

provision of these essential services. The perception of low quality in clinical facilities can lead women to shy away from institutional deliveries. In some instances, women have suffered severe complications simply because they cannot trust people working in healthcare facilities. Therefore, these skilled health workers need to form a good rapport with the community members and help address their concerns and understand their reservations on using maternal services. In many societies, women are the backbone of families; hence, they need to remain healthy throughout their pregnancy. Delivering proper conditions and in the presence of skilled medical practitioners and finally receiving the postpartum care they need will go a long way in ensuring maternal mortality rates decline and the quality of life for mothers even after delivery is maintained.

Section 2: Research Design and Data Collection

Introduction

The purpose of this quantitative study was to explore the association between access and use of maternal healthcare services (antenatal, postnatal visits, and postnatal checks before discharge) and knowledge of contraceptive use and maternal mortality in Nigeria. I considered access to pregnancy-related care related to antenatal services, maternal health education services that may contribute to a reduction in complications during pregnancies that place women at risk of maternal mortality. In this study, I addressed risk factors associated with pregnancy-related care services, which include; access to maternal healthcare services as measured by the number of antenatal visits during pregnancy, postnatal visits, and postnatal checks before discharge, as well as the knowledge of contraceptive use to help space out births by preventing unplanned pregnancies. Studying these variables will help determine appropriate access to care and education measures governments can implement to reduce maternal deaths and prevent maternal complications. These steps will focus on pregnancy care and how the expectant and lactating mothers are informed concerning pregnancy-related care and health education knowledge of pregnant women (Bell et al., 2018). The research also included an examination of the accessibility and the quality of healthcare services offered in various healthcare organizations and health centers.

Nigeria has had high maternal death rates due to a lack of access to quality prenatal and postpartum services and a lack of awareness of maternal health practices (Nwajagu et al., 2017). In the study, I explored other factors that might limit access to

better maternal healthcare services. Moreover, I examined the relationship between prenatal/postpartum care knowledge and maternal mortality rates per 100,000 live births in Nigeria. My goal was to determine the strength of the association between these variables. Individuals need to be aware of the causes of complications and the actions they can consider or execute to reduce the adverse effects related to the public health issue of maternal mortality.

Framework

I based the study on the theory of planned behavior. The theory has three constructs: attitude, subjective norms, and perceived behavioral control (Yoo et al., 2017). Perceived behavioral control, which centers on individuals' perceptions, may help understand people's perception of having antenatal visits during pregnancy and the number of entries in the pregnancy and postnatal care history, which are some of the variables in the research. Subjective norms involve people's beliefs, which would help to explain some of the perceptions and attitudes about family planning and their knowledge of contraceptives, which is another independent variable in the research. I examine respondents' perceptions of health checkups before discharge after delivery.

The theory of planned behavior explained the existing situation in Nigeria and how mothers in the country can adopt maternal practices and measures that may reduce maternal mortality. The theory also helped point out health issues related to antenatal and prenatal care. I used the principles of planned behavior to explore the relationship between maternal mortality and various variables, including maternal education and

literacy. Generally, I sought to determine how maternal mortality relates to antenatal and postpartum education.

The maternal mortality rate is a sensitive measure of health and the socioeconomic status of the community (WHO, 2019). A region or country experiencing high rates is often considered a remote or developing region. Maternal deaths are caused by demographic, social-economic, environmental, hygiene, and medical factors (Somefun & Ibisomi, 2016). The elements are behind the sequence of events that culminate in maternal complications and death (Somefun & Ibisomi, 2016). There are direct and indirect contributing factors. The indirect factors are social-economic and cultural factors, while direct factors are those linked to health and reproductive status, access to healthcare service, and healthcare behaviors. The outcome could be complications or death. Nevertheless, increasing access to quality maternal healthcare services can reduce death rates and pregnancy-related complications (WHO, 2019).

The secondary data set used in this study includes all the variables investigated in the research and other indirect contributing factors that influence maternal mortality. These indirect factors are mostly those that directly affect the variables, such as antenatal care services. Some of these factors include distance to the health center, quality of services offered at the center, level of education of the parents/mother, and the cost of such services. These factors are extensive and have a broad scope. So I primarily focused on the variables in the RQs while bearing in mind that the other factors indirectly affect maternal mortality. Such factors will, however, be highlighted more in the conclusion section of this study.

Research Design and Rationale

I concluded that the quantitative approach would be useful in collecting, assessing, summarizing, and analyzing relevant information linked to maternal mortality. A cross-sectional quantitative study design is used when the exposure and outcome of the participants are assessed (Setia, 2016). I used the quantitative method to determine the trends and patterns associated with the subject and ultimately conducted statistical analysis to answer the general RQs and confirm or reject the hypotheses. This method also allowed for exploration of the indirect factors that may have affected the variables being tested in this study and identified patterns associated with the population characteristics. It is easier to collect and summarize critical information with the quantitative approach and determine the relationship between variables (Bell et al., 2018). I combined the quantitative technique with a descriptive and inferential analysis to enhance the understanding of related concepts. To perform the inferential analysis, I used different statistical tests, such as testing the level of significance or the OR test to show the risk associated with the variables. The causal effect would have been difficult to determine using the variables tested.

I relied on secondary data from a reputable source for data analysis. The data set was collected in 2018 in a DHS in Nigeria. I used five variables for the study: pregnancy-related death, number of entries in the pregnancy and postnatal care history, number of antenatal visits during pregnancy, knowledge of contraceptive use, and health checkup before discharge after delivery. The NDHS data set examined all these variables differently, and data relating to each variable was collected separately. I tested the

variables overall to determine whether there was a significant relationship between them. I used the cross-sectional design to evaluate the relationship between access and use of antenatal services and maternal mortality in Nigeria as measured by the number of antenatal visits. I used the same data to test the relationship between postnatal care visits and maternal mortality in the same area. In looking at postnatal care, I also sought to determine the relationship between the aftercare services given after delivery and its link to maternal mortality.

Furthermore, I sought to find out the link between knowledge and the use of contraceptives and maternal mortality. Questions such as who decides on the use of contraceptives or how well available contraceptives are to the population are addressed in conclusion to this study. The use of secondary data in the study necessitated using a cross-sectional method of data analysis because the data from the DHS were already collected using the cross-sectional design. A cross-sectional design is preferred because it is cost-effective compared to other methods such as experimental or quasi-experimental research designs (Baker, 2017). It is also the most preferred design given the method used in data collection and the quality of data collected.

The data set also captured all the relevant variables in this study. In addition, it provided specific characteristics of the data set, such as age and location of participants, which are essential when inferring conclusions from the results obtained in the data set. Other characteristics provided include the geographical location of participants, such as urban or rural dwellings, level of education, and socioeconomic status.

For example, other design methods, such as the longitudinal design method, could not be used for analysis due to the method in which the secondary data was collected. The longitudinal design method would only be appropriate if the data had been collected over a period of time, but, in this case, the data were collected at a point in time over the same range of period. The longitudinal design was also not preferred because the data collected are to be used by policymakers to determine if the measures put in place between 2008 and 2018 (when the last NDHS data set was collected) have effectively improved access to healthcare services in the nation. This would bring Nigeria a step closer to achieving its Sustainable Development Goals. Policymakers can easily compare the results from this data set to the previous one collected in 2008 to determine which policies work and which do not. Given that the data set contains multiple variables, the outcomes and findings can create hypotheses requiring more in-depth research.

However, the cross-sectional method has several weaknesses, as highlighted by Creswell (2016), including biases from the participants and the researchers, misclassification, and recall. As highlighted in this subsection, using a cross-sectional method was a limitation to the study because the method can only help infer conclusions or determine correlations between variables but not help determine or establish any causal relationships. Therefore, this study and the use of the secondary data will not help determine whether low antenatal and postnatal visits cause maternal mortality. It will only help to determine the correlation between the variables specified in the RQs. The cross-sectional design cannot analyze patterns over time because it is collected at a specific period and not in the longitudinal format as highlighted before.

Methodology

The current study is a quantitative study guided by the nature of the RQs and the variables involved in the study. I based the RQs and the study variables on the data collected because I relied on secondary data. The RQs and the variables could therefore not go outside the data set chosen for this study. Thus, the methodological approach used in this study fits the use of secondary data, hence my use of the quantitative, cross-sectional research design. The quantitative design will help highlight more factors that indirectly affect maternal mortality, highlighting different population characteristics. Considering the implications of such research on health policies, it was essential to ensure that I undertook the qualitative cross-sectional study to encompass most maternal mortality factors.

Population

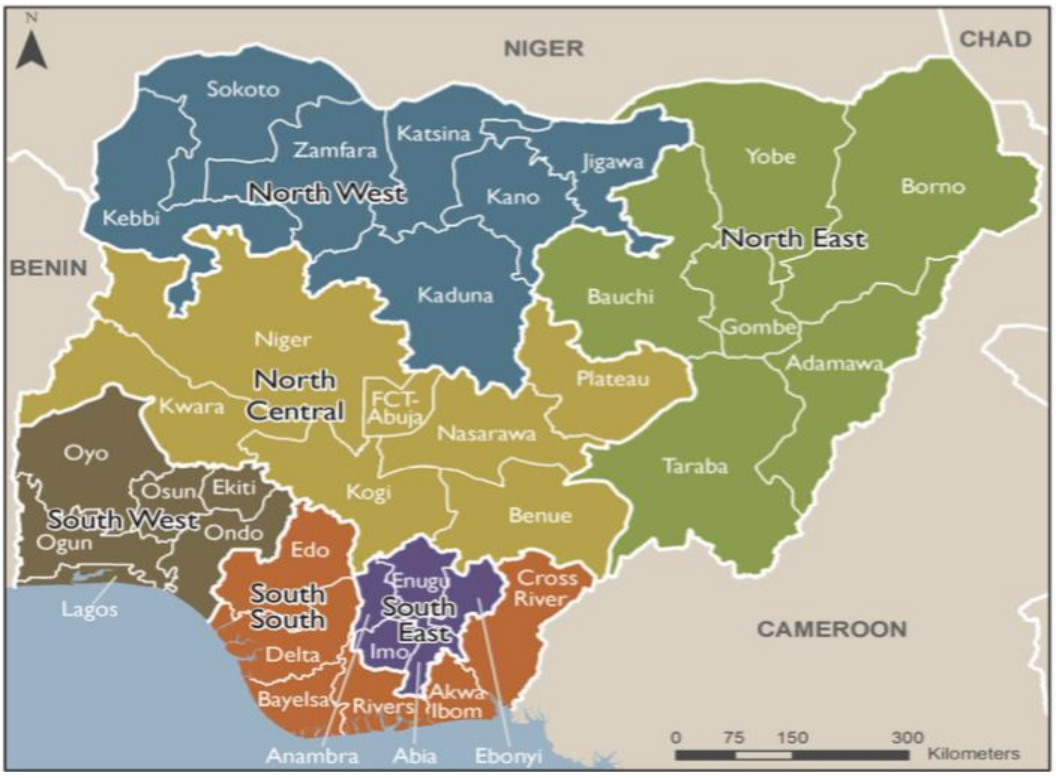
Nigeria is a West African country estimated to have around 195.9 million people as of 2018 (Olonade, 2019). Nigeria has six geographic zones: North Central (NC), North East (NE), North West (NW), South East (SE), South-South (SS), and South West (see Figure 2). In terms of religious beliefs, most people in the northern parts of the country practice the Muslim religion, while in the south, most people are Christians (Akinyemi et al., 2013). Nigeria is multitribal but has three populous tribes, namely the Igbo, the Yoruba, and the Hausa. Each tribe speaks a native dialect, but due to colonial influence, most people speak English across the country and is used as the language of communication, especially between people of different tribes (Akinyemi et al., 2013).

Nigeria is ranked second globally in the number of maternal deaths worldwide (WHO, 2019), hence necessitating the need to do more research in the area and find out why the high maternal mortality rate and how this can be remedied. I used a secondary source of data from the DHS to understand the correlation between the variables under study and develop recommendations for the way forward to address the challenges that women face when pregnant and after the pregnancy. I also analyzed the characteristics of the population members in the study to determine what other factors—say, social-economic factors--affect the variables investigated in this study.

The study covered the whole of Nigeria. Nigeria has 36 states, which are all divided into local government areas (LGAs), and the LGAs are further subdivided into wards. The Federal capital is Abuja, as seen in Figure 2 (DHS, n.d.). According to the 2006 National Population Health Survey, each locality in the country is further subdivided into convenient areas called census enumeration areas (EAs). These EAs are the primary units referred to as a cluster in the 2018 DHS study. Figure 2 contains a map of Nigeria.

Figure 2

Map of Nigeria



Note. Adapted from *Demographic and Health Survey 2018*, by National Population Commission and ICF, 2019 (https://www.dhsprogram.com/pubs/pdf/FR359/FR359.pdf). In the public domain.

2018 DHS Data Population

To increase the reliability and validity of the research, I used a secondary data set from a reputable source. The secondary data set source is the Nigeria: Standard DHS, 2018 data set from the DHS Program (2018) named NGIR7ASV -Individual Recode. DHS is a reputable program funded by the United States Agency for International Development (USAID). It was formed in 1984 and is known for data collection and dissemination in the field of health. DHS has over 400 surveys in more than 90 countries,

including Nigeria (DHS, n.d.). The NDHS data contains survey data that indicates the average number of maternal mortalities per year and data on specific causes or contributory factors. The data set was collected in conjunction with local authorities to ensure validity and understand Nigerian citizens' characteristics pertaining to maternal health.

The Ministry of Health allowed the DHS to collect data in the country by giving consent and contributing towards building the questionnaire and creating specific parameters necessary in the data collection. The National Population Council also collected the DHS data to help researchers subdivide the country into manageable sections to ensure the sampling method used is as unbiased as possible. It is a good representative of the whole population of Nigeria. The National Bureau of Statistics provided information on the population and social-economic status of different parts of the country to help the data collectors prepare up-to-date data on demographic and health indicators in the country.

The population under study is the Nigerian population consisting of all women between 15 and 49. The population selected for the study consisted of 41,668 households for the sample. Out of this sample, 40,427 were successfully interviewed, translating to a 99% response rate. The women interviewed were 41,821, while the men were 13,311. The average household size from the sample population was 4.7 persons, with urban areas coming in at 4.3 persons. In comparison, the rural areas had an average of 5.0 persons, with 82% of these households having men as the head of the house.

Table 1 includes age parameters for the study population.

Table 1

Population Parameters

		Age (years)		
		Households	Women	First birth
N	Valid	41,668	15,236	41,821
	Missing	0	26,585	0
M		31.03	29.29	20.4
Mdn		26.00	28.00	30.9
Minimum		1	15	15
Maximum		284	49	49

The median age at first birth among women aged 25-49 is 20.4 years, and this means that half of **the** women aged 25-49 give birth for the first time before age 21. The median birth interval came in at 30.9 months, indicating that subsequent deliveries occur within less than two years after the first birth. The correlation between wealth and fertility was an inverse relationship. 70% of women interviewed were married, while only 57% of their male counterparts were in a marriage union.

The prevalence of contraceptive use was relatively low among married women at around 17%, while the total demand for contraceptives among the study population was 36%. (DHS, n.d.). This indicates a gap in the health sector about the knowledge and availability of contraceptives to the population. Knowledge and use of contraceptives can help women space out their births more, giving time for their bodies to fully recover before another pregnancy and preventing the possibility of having a high-risk pregnancy. In terms of antenatal visits, 67% of the women in the study claimed to have gone for at least one visit from a skilled healthcare provider before birth in the five years preceding

birth. 39% of live births happened in healthcare facilities meaning that the women had a higher probability of receiving after delivery care services from a qualified health practitioner, with 42% of the women in the study receiving these services within two days of delivery.

Sampling Procedures Used to Collect Data

The 2018 DHS data employed a stratified sampling technique due to the nature of the study and the geographical characteristics of the population. The primary sampling units are the EAs identified using information from cartographic material demarcating each EA and the LGA population estimates from the census. The researchers then estimated the number of households in each EA and distinguished adequately between urban and rural EAs for the sample frame. This process was done before the sample selection, where all EAs were classified under urban or rural based on the predetermined minimum size of urban areas. The predetermined size was obtained from the 2017 definition of urban areas, which constituted localities with more than 20,000 people. These were the criteria used to classify the EAs into either urban or rural.

The sample used in the 2018 DHS data set was stratified in two stages (DHS, n.d.). The first step was to classify all the states and the Federal capital either as urban or rural areas. In this stage, 1400 EAs were selected based on probability which utilized the household size in the specific EA. The researchers then carried out a household listing operation in all selected EAs, and this served as a sampling frame for the selection of households in the second stage. In the second step, a fixed number of 30 households were

selected in every cluster using an equal probability measure yielding 42,000 households. Random selection of these households was then carried out through computer programming, and interviews were only conducted in these pre-selected households. The interviewers did not replace, remove, or add any households to the pre-selected group to avoid bias during the actual interview stage. The fieldwork questionnaire collected basic background information on the fieldworkers assisting with data collection and their supervisor, but no personal identifiers were attached to the data file from these questionnaires (NDHS, n.d.).

This method yielded a non-proportional allocation of the sample in the different states. As a result, sampling weights were applied to the data file to cater for possible differences in the response rates to ensure the results obtained would represent the whole country. Sampling weights were calculated based on sampling probabilities obtained separately at each sampling stage and for each specific cluster. The survey was successfully carried out in 1,389 clusters after 11 clusters with deteriorating security during fieldwork were dropped. Some of the clusters affected were in Zamfara, Lagos, Borno, Sokoto, and Katsina.

In terms of the questionnaires used, before implementation, questionnaires were sent to government officials, non-governmental organizations, and international donors who were requested to comment and give their inputs on the questionnaire. After finalization, the questionnaires were translated from English to native Nigerian languages such as Yoruba, Igbo, and Hausa. The translation was done to ensure that all selected households/ participants would receive the questionnaire in the most comfortable

language. The 2018 NDHS used computer-assisted personal interviewing (CAPI) to assist in data collection. The potential trainers of the fieldwork staff underwent a pretest training to ensure they were well conversant with the NDHS questionnaire and procedures to understand the context of the questionnaire and interpret it in the different languages used. Forty-five participants from other parts of the country took part in the pretest. The pretest training took approximately three weeks, with most participants having prior experience in NDHS data collection. The staff carried out a test interview in eight clusters, and the questionnaire was subsequently amended based on the feedback obtained from these pre-interviews.

The main fieldwork participants were selected through a strict vetting process that took place at the state level. Potential fieldworkers were asked to take a computerized test, written test, and complete a personal interview to ascertain their competency levels before qualifying for the fieldwork participants' training. The potential field workers came from different parts of the country and spoke different native languages. Most of the participants had prior experience with data collection, having collected data for previous NDHS surveys. The 358 participants underwent a 4-week training on data collection, procedures, and instruments employed in the fieldwork practice. They were also guided through the questionnaire through case studies, presentations, and role play (NDHS, n.d.). The participants were also trained on the use of Computer- Assisted Personal Interviewing (CAPI) in conducting interviews. Ultimately, the participants had to take tests, quizzes and participate in in-class exercises to ascertain their training comprehension. From this exercise, 37 supervisors and 37 field editors were identified

based on their performance. Similarly, 74 male and 111 female interviewers were selected as enumerators, while the rest were kept as reserves.

In terms of gaining access to the data, the 2018 NDHS data can be obtained from the DHS website. All one needs is to register on the DHS website, create a new project request with a project title and a brief description of the purpose of the study the individual intends to carry out. The DHS program reviews the request within 24 hours of a particular working day, between Monday and Friday, and provides notifications to the requesting party on whether access has been granted or more information is needed from the requesting party for the program to provide one with access to the data set. Researchers can only request country-specific data since the DHS database has data sets for several other countries that the DHS collects data on. Data sets have been classified according to different surveys, and researchers are only granted access to the surveys necessary to complete their research. Individuals can then download the surveys they have access to in various formats depending on their preference or the data analysis method to be used.

The data used was preferred due to its credibility, given that the steering committee members are part of well reputable organizations both in the government and non-governmental organizations. The NDHS data collected an array of information that is part of the sustainable development goals and data, especially health indicators. This survey was intended to be used by researchers, policymakers, and program managers when developing and improving health programs that are part of the country's Sustainable Development Goals (SDGs).

The sample size is determined using power analysis using the following formula:

$$N = \frac{Z^2_{\propto/2} \times P(1-P)D}{E^2}$$

Where E is the precision (margin of error * P), p is the prevalence of the events, D is the design effect, and Z is the deviation from the level of significances obtained from the normal distribution table (Suresh & Chandrashekara, 2012). The effect size is determined from the previous studies conducted in the field of maternal health, which is 0.66 (Wondemagegn et al., 2018). The margin of error for the study is 10%. The alpha level of 0.05 is used in most academic studies (Suresh & Chandrashekara, 2012). The power level used is 0.95, which gives the probability of rejecting the null hypothesis when it is not valid. The design effect, D, is 1 since the sample is randomly selected.

$N = \frac{1.96^2 \times 0.2(1-0.2)1}{0.02^2}$ =1537. Therefore, the minimum sample size needed for the research is 1537 respondents.

Instrumentation and Operationalization of Constructs

Operationalization

RQ1 seeks to measure the extent to which there is an association between access to antenatal care services (as measured by the number of visits) and maternal mortality; the access to antenatal care is the independent variable which is thought to affect the dependent variable, in this case, maternal mortality. The NDHS study investigated the antenatal care coverage within the country by asking women in the survey whether or not they had received antenatal care during their pregnancies from a professional healthcare

service provider. However, the antenatal visits and maternal mortality are not mutually exclusive since women did not go for any antenatal service yet still gave birth and remain in good health.

From the DHS survey, 67% of the women who participated in the survey and had given birth in the five years preceding the survey received antenatal care services from a skilled health provider, with 57% reporting they had made over four antenatal care visits before giving birth during their last pregnancy. This is still, however, way below the recommended eight visits by the WHO. The study also analyzed the components of antenatal care to determine the quality of care offered to expectant mothers. The most common components were blood pressure checks and urine and blood sample checks done during the antenatal care visits.

RQ2 sought to determine the association between access to postnatal care services as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria. The dependent variable, in this case, would still be maternal mortality, while the independent variable is access to postnatal care services. Similar to RQ1n, these two variables are not mutually exclusive, but this study seeks to test the association between the two variables. Here, the NDHS data sought to determine the number of women in the study who had received maternal post checkup care. From the study results, 42% of women who had given birth in the preceding two years of the study had received postnatal care in the first two days of giving birth.

According to the WHO, half of the maternal deaths occur within 24 hours of delivery. Women who give birth outside a health facility should go in for a postnatal

checkup within 12 hours of delivery. Of the 42% who received postnatal care within two days of delivery, only 35% received care from a doctor, nurse, or midwife. However, it is essential to note that women receiving postnatal care in Nigeria have increased from 30% recorded in the 2008 NDHS survey, indicating a commendable improvement. 81% of women who deliver in healthcare facilities are more likely to get postnatal care than those who do not.

RQ3 seeks to measure the extent to which there is an association between delivery checkup service as measured by postnatal check discharge after delivery and maternal mortality in Nigeria. Here, maternal mortality remains the dependent variable as it is affected by the independent variable, delivery checkup services. Women who give birth in health facilities are more likely to receive delivery checkup services from qualified health providers than women who give birth through midwives or at home. The first few hours after birth are the most crucial in terms of after-delivery care. Only 36% of women claimed to have received after delivery care services within the first 4 hours after delivery.

The RQ4 seeks to understand the extent to which there is an association between knowledge of contraceptives use as measured by the knowledge of contraceptive use associated and maternal mortality in Nigeria. Here, the two variables involved are maternal mortality and knowledge of contraceptives as measured by the NDHS data set. Maternal mortality is the dependent variable affected by the independent variable, which is the knowledge of contraceptives.

The RQ5 seeks to understand the relationship between all four independent variables: access to antenatal care services, postnatal care services, delivery checkup service, knowledge of contraceptives use, and the dependent variable, maternal mortality as measured by death and pregnancy. Multiple regression is used to analyze this relationship between the four independent variables and dependent variable.

According to the NDHS data set on contraceptive use and knowledge, 66% of those using family planning methods had jointly agreed to use contraceptives after discussing it with their partners. In contrast, the rest had made their decisions alone. Among the married non-users of contraceptives, 41% of women had decided not to use contraceptives jointly with their husbands, 38% had decided on their own. In comparison, 19% had reported that it was their husbands' decision not to use any method of family planning. Exposure to family planning was also tested. It was reported that 65% of women and 56% of the male correspondents had not heard about family planning from the four media sources tested (radio, newspaper, television, and mobile phone). In terms of characteristics of participants, women in urban areas are more likely to have a health provider discuss family planning methods with them than women in rural areas, thus increasing their knowledge on family planning, increasing the chance of making use of the available methods to them. The operationalized definition of maternal mortality in this study is the deaths of mothers before delivery or within 42 days of delivery or termination of pregnancy. Likewise, the antenatal care services were operationalized as pregnancy care received from skilled providers, such as doctors, nurses/midwives before

birth. Postnatal care was operationalized as the care provided to women within 24 hours if delivered in a health facility and 12 hours if delivered outside a health facility.

Table 2 includes the definition and measurement of study independent variables.

Table 2

Definition and Measurement of Independent Study Variables

Variable name	Definition of variable	Value	Measure of variable
Postnatal check before discharge	If the respondent was checked before being discharged	0 = No 1 = Yes	Nominal
Number of antenatal visits during the pregnancy	The number of times the respondent visited healthcare for antenatal care	0 to 1 antenatal visit 2 to 3 antenatal visits 3 to 4 antenatal visits over 5 antenatal visits	Nominal
Knowledge of contraceptive use	The method of family planning that the respondent knew	0 = knows no method 1 = Knows only folkloric method 2 = knows only traditional method 3 = knows modern method	Nominal
Number of entries in the pregnancy and postnatal care	Entries in pregnancy and postnatal care roster	0 to 1 postnatal care entries 2 to 3 postnatal care entries 3 to 4 postnatal care entries 5 or more postnatal care entries	Nominal

Table 3 includes the definition and measurement of study dependent variables.

Table 3

Definition and Measurement of Study Dependent Variable

Variable name	Definition of variable	Value	Measure of variable
Maternal mortality	Reported case of a woman's death either before, during, or after pregnancy.	0 = Death not related 1 = Died while pregnant 2 = Died during delivery 3 = Since delivery 4 = 6 weeks after delivery 5 = 2 months after delivery	Nominal

Table 4 includes the definition and measurement of controlling measurable variable.

Table 4

Definition and Measurement of Controlling Measurable Variable

Variable name	Definition of variable	Value	Measure of variable
Age	Respondent's current age.	15 – 49	Scale

Data Analysis Plan

The data were analyzed using the SPSS software version 23, which contains a variety of statistical tests. The descriptive analysis was mainly used to help describe the frequency and counts of the variables described above using the different RQs. The frequency was mainly used to measure the nominal variable, in this case, the dependent variable, maternal mortality, where there was either a case or no case. Ordinal variables such as prenatal and antenatal care visits were also measured using frequency where there was healthcare provided or not. The frequency of visits or the quality of visits measured

by the number of services received could be represented in a table format or in charts that show the distribution pattern.

Different charts and graphs will be used to represent the variables of interest depending on the variables measured. For example, maternal mortality is a mutually exclusive variable since the mother either survived or died before birth or within 42 days of delivery. The antenatal care and postnatal care variables could also be expressed nominally since they are also mutually exclusive. All the above variables meet the regression assumption of binary logistic since they can be measured as nominal, categorical, or continuous variables.

For this study, a beta of 20% will be used with a statistical power of 80% to ensure there is no chance of a Type II error. The pre-determined level of significance of 95% will be applied to make the chosen confidence level to remain at 5% with an alpha of 0.05; this covers the chance of a Type I error. These were used to determine the statistical significance of the correlation between the four variables, maternal mortality, antenatal care services, postnatal care services, and knowledge of contraceptives, as the basis of inferential analysis. The variables were analyzed further using covariate analysis in the regression model. The covariant analysis is considered to reduce errors and biases.

To determine statistical significance, the results obtained were interpreted using the p-value measure to determine whether the obtained p-value was less than or greater than the predetermined alpha value. The risk of maternal mortality occurrence (dependent variable) was analyzed against the independent variables (antenatal care visits, postnatal care visits, after delivery care, and knowledge of contraceptives) and was quantified

using estimation. The null hypothesis was rejected when the p-value was less than the predetermined alpha of 0.05 ($p<0.05$). However, the study failed to reject the null hypothesis when the obtained p-value was greater than the predetermined alpha value ($p>0.05$).

In terms of risk assessment, when the OR value is less than 1, the exposure was negative, meaning the independent variable had a negative effect on the dependent variable, maternal mortality. When the OR variable is equal to 1, there is no difference in the exposure since there is no difference in risks between the variables. If the OR value is greater than 1, then the exposure was positive, meaning the independent variable had a positive effect on the dependent variable. The rejection of the null hypothesis, for instance, in RQ1, means there is an association between access to Antenatal care services during pregnancy and maternal mortality. The sign of the OR variable then shows whether the relationship is positive or negative. If the OR variable is negative or lower than 1, the more a pregnant mother visits antenatal care, the lower the chances of maternal death.

Table 5 includes the description of variables/research questions

Table 5

Description of Variables/Research Questions

Research Questions	Independent Variables (IV) and Measurement	Dependent Variables (DV) and Measurement	Statistical Analysis
RQ1	Number of antenatal visits during the pregnancy (Categorical)	Maternal death – categorical	Nominal Logistic regression

RQ2	Number of entries in the pregnancy and postnatal care (Categorical)	Maternal death – categorical	Nominal logistic regression
RQ3	Respondent's health checkup before discharge (Categorical)	Maternal death – categorical	Nominal Logistic regression
RQ4	Knowledge of contraceptive use (Categorical)	Maternal death – categorical	Nominal logistic regression
RQ5	Number of antenatal visits during the pregnancy (Categorical), Number of entries in the pregnancy and postnatal care (Categorical), Respondent's health checkup before discharge (Categorical), and Knowledge of contraceptive use (Categorical)	Maternal death – categorical	Multivariate Regression

Research Questions and Hypotheses

I analyzed five variables from the 2018 DHS data set. The variables include Pregnancy-related death, Number of entries in the pregnancy and postnatal care history, Number of antenatal visits during the pregnancy, Knowledge of contraceptive use, and health checkups before discharge after delivery.

RQ1: To what extent is there an association between access to antenatal care services as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria?

Null hypothesis: There is no association between accessibility to antenatal care as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria.

Alternative hypothesis: There is an association between accessibility to antenatal care as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria.

RQ2: To what extent is there an association between access to postnatal care services as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria?

Null hypothesis: There is no association between accessibility to postnatal care as measured by the number of entries in the pregnancy care history and maternal mortality in Nigeria.

Alternative hypothesis: There is an association between accessibility to postnatal care as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria.

RQ3: To what extent is there an association between delivery checkup service as measured by respondent's health checkup before discharge and maternal mortality in Nigeria?

Null hypothesis: Delivery checkup services as measured by postnatal check before discharge after delivery have no association with maternal mortality in Nigeria.

Alternative hypothesis: Delivery checkup services as measured by postnatal check before discharge after delivery have an association with maternal mortality in Nigeria.

RQ4: To what extent is there an association between knowledge of contraceptives use as measured by the knowledge of contraceptive use associated and maternal mortality in Nigeria?

Null hypothesis: There is no association between the knowledge of contraceptives as measured by the knowledge of contraceptive use and maternal mortality in Nigeria.

Alternative hypothesis: There is an association between the knowledge of contraceptives use as measured by the knowledge of contraceptive use and maternal mortality in Nigeria.

RQ5: To what extent is there an association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

Null hypothesis: There is no association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

Alternative hypothesis: There is an association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of

contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

Threats to Viability

An empirical study should contain information on external and internal validity. The validity of a study is simply the degree to which the study measures what it claims to measure. Validity is important because it helps researchers determine what type of tests to use to ensure they use the ethical and cost-effective methods that genuinely measure the idea in question. This study uses secondary data to try and analyze the relationships between the variables. Secondary data in itself brings several challenges of validity and reliability. The study's validity may be affected by the bias from the sampling technique used to collect the data. This section shall discuss any known factors that may have affected the internal and external validity of the study given the secondary data. Solutions to address these validity concerns are also in this section.

External Validity

According to Metge (2011), external validity is the extent to which the outcomes of a certain study can be generalized to other members of the population using the same procedural measures. External validity refers to or looks at the generalizability of a study. Transferability is also a term used in external validity, primarily used in qualitative research designs to determine whether results obtained from a study are transferable to situations with similar characteristics.

External validity is threatened when a study fails to consider the interactions of the variables measured in the real world (Metge, 2011). Some of the threats to external

viability in this study include selection bias, which describes an interviewer's bias when selecting the participants to include in the data set after the survey. Sample features were also another threat to external viability. Some features of a particular sample say their geographical location may be wholly or partly responsible for the conclusions made in the study. This factor, therefore, makes generalizability harder and inaccurate.

Some situational factors such as time of day, location of the interview, characteristics of the researchers, or the rapport between the researchers and the participants can affect the quality of answers given by the respondents. If the respondents were not facing the same factors, then results may be skewed, making it hard to generalize the findings obtained from the study. Any cause-and-effect relationship observed by the interviewers during data collection or pre and post-tests may disappear since the data set does not provide any of these. Thus, the cause-and-effect relationship may disappear entirely from the data set, proving to be one of the most significant limitations of this study that seeks to determine the relationship between maternal mortality and the knowledge and use of maternal health services.

The interviewing stage may also be a source of external validity in this study since different interviewers interacting with various participants collected the data. A large number of participants and interviewers means there may have been a lack of consistency in the interview process due to the different characters involved in the collection of data stage. A participant’s characteristics may have influenced their attitude towards the interviewer, thus influencing the interview outcome. The different

personalities of the interviewers may also affect how they interacted with participants or influence their interpretation of the interview responses.

To try and overcome this barrier, the DHS interviewers were previously trained invariably before interviewing the participants to try and reduce bias and help the researchers remain objective during the interview process. This is to ensure the interview process is as consistent as possible to ensure all participants face the same conditions during the interview to avoid distorting the study's findings, in turn preventing Type I or Type II errors. The Type I error is committed when individuals reject a true null hypothesis, while the Type II error is committed when individuals fail to reject a false null hypothesis.

To ensure the interviewers' characteristics did not interfere with the study's findings, eligible interviewers were trained. They were taken through several pre and post evaluation; supervision was also conducted in the pilot stages and randomly throughout the study. Best practices and commonly acceptable processes were also applied and implemented when training the potential interviewers. Training areas also included data collection approaches, how to administer the questionnaire to the participating individuals. The potential interviewers received training orally and in tests to ensure they were eligible to conduct the study. Mock interviews were also conducted under supervision to ascertain the eligibility of the interviewers. Candidates who were weaker were provided with remedial lessons to ensure the interviewer bias was eliminated from the data set, thus reducing external validity.

To address the issues associated with external validity, the 2018 DHS data set sampling approach of households was a randomized selection of nationally representative eligible participants (women 15-49 years old from different parts of the country). The random selection was to increase the diversification of samples to ensure they covered people from all geographical areas and individuals with different socio-economic status. One shortcoming, however, is that the predictive factor was not randomly assigned to the representative sample. Due to this, Spatio-temporal predictions that help form conclusions from data collected time and space (different geographical locations) are not possible to perform for this study (Isensee et al., 2020). Therefore, this threat to external validity should guide as a cautioning factor for the intended audience when implying generalization. Cause and effect relationships could also not be determined using the data. Instead, the conclusion and results were limited to correlational observations made within the target population selected in this current study.

Internal Validity

Internal validity is one crucial factor in any research design and continues to be the main focus for researchers. Internal validity is the basic minimum, and without it, the experiment is virtually uninterpretable (Flannelly, Flannelly & Jankowski, 2018). Internal validity describes whether or not an experimental condition has an impact or not. Simply put, whether there is sufficient evidence to support the claim. The internal consistency of results, reliability of the instruments used to draw conclusions, design, and sample method used in the study determine internal validity. Researchers use several statistical tools to determine the level of validity and reliability of a study.

The first statistical measure is known as Cronbach's alpha which is a measure of internal consistency. This tool determines how closely related a set of items are as a group. The Cronbach's alpha is more of a coefficient of reliability and consistency. If the alpha test is low, either the test conducted is too short, or the items have very little in common. As defined earlier, validity is the extent to which an instrument measures what it ideally should measure. Zohrabi (2013) proposes that internal validity may be obtained when an independent researcher reanalyzes the information to similar findings as to the original researcher. Validity can be measured using both empirical and theoretical evidence. The empirical assessment is based on quantitative analysis and involves statistical analysis, and the theoretical assessment is based on qualitative studies. It is where an idea of a construct is translated into an operational measure primarily by a panel of experts who rate each item and determine the items' suitability in defining the construct.

Construct validity is mainly used in studies with much subjectivity and refers to whether a test measures the construct adequately and efficiently (Zohrabi 2013). This is an example of a theoretical assessment where a concept, idea, or behavior is translated to a functioning and operating reality, helping determine a relationship within variables and justifying that relationship. The 2018 DHS data collection instrument used to operationalize the construct validity of maternal mortality is the interview approach using different questionnaires.

There are several ways that internal validity can be threatened during a study. The first way is through attrition which is simply when participants are dropping out of a

study making the results biased since the results will only be from those parties that did not choose to leave. The second threat is an experimental bias where the researchers may behave differently with some participants leading to biased results. Sometimes researchers ask participants to recall past information if a particular occurrence took place many years before; a participant may have recollection bias and may be unable to recall the events consistently and as accurately as they happened. They may forget precisely how a specific event made them feel. This bias may affect the statistical regression since participants may fall in the extreme ends of the spectrum, not due to the passage of time but rather the effect of time on their recollection ability. In the case of this study, the respondents may fail to recall how many times they visited a healthcare facility for postnatal and antenatal care services. They may fail to remember their knowledge of contraceptives, say when they were giving birth, and so on. Regular testing or research on the same group of participants may also be a threat to internal validity. Suppose an individual is given a test more than two times. In that case, they are likely to change or alter their answers to reflect a favorable situation but not necessarily true. This will distort the results and affect the conclusion and findings from the study.

In this study, the relationship between maternal mortality and antenatal, postnatal care, and knowledge of contraceptives, one barrier to internal validity is the source of data type. In the 2018 DHS data collection, existing instrument tools were used. The secondary data source was not tailored to fit or measure a specific community in Nigeria or target a particular culture or economic status of households in Nigeria. As a result, the content validity of the instruments, including the primary data collection instrument, the

questionnaire, lacked the completeness of tailored cultural competency components. Another challenge to internal validity in the current study is the sampling method used. The 2018 DHS data collection used was a non-probability method that involves stratified random selection, which did not involve a random assignment of the participants. This approach is inherent in non-experimental studies.

Statistical validity is the process that allows an individual to form a reasonable conclusion about the relationship between predictor and outcome variables based on the significance levels. Threats to statistical conclusion validity may be influenced by inadequate statistical power, sample size, effect size, and measurement validity. Major strategies often used to mitigate against the possibility of threats to internal validity include the use of low inference descriptors. An example of this is the use of factual questions that can be readily quantified or counted instead of using high inference descriptors which are categories of behaviors that cannot be observed directly and have to be inferred.

Having multiple researchers also helps to reduce individual bias, especially when conducting surveys and personal interviews. However, researchers must remember that the interviewers must receive training before researching to determine what is required during the data collection process and how questionnaires are administered to participants. To enhance internal viability, one can also use relevant peer-reviewed documents that analyze similar variables or propose a similar correlation to support their analysis and cement the conclusion's validity. The researchers can also mechanically record the interviews and keep the questionnaires for easier reference for reanalysis, or an

independent investigator wants to determine the validity of the findings. This process can easily increase the reliability of the data included and cement the study's internal validity.

Ethical Procedures

The primary investigators of the 2018 DHS secondary data in Nigeria were the National Population Commission (NPC), an affiliation of the Federal Government of Nigeria. The ICF, an affiliate of the DHS Program, was also on board to provide technical assistance during the study. The Federal Government of Nigeria and the institutional review board (IRB) approved the proposal to conduct the 2018 DHS survey or study (DHS, n.d.). All participants were made aware of informed consent before the start of the interview. The consent was approved for the 2019 DHS questionnaire for use in an interview of eligible households', individual women, and individual men participants. The questionnaires used in the study adopted the DHS-7 questionnaires, which reflected the characteristics of the population and the health issues relevant to Nigeria's population.

Due to the nature of the questions, ethical considerations limiting emotional burden had to be put in place. Some questions, such as recalling the death of a wife or mother, can bring back traumatizing memories to the participants. The approach taken for these questions was considered carefully to deal with the situation during the interview process. As a result, counseling approaches were implemented and employed in cases where it is needed. Overall, the purpose of DHS data collection was to understand participants' social environment and estimate how much women in the survey had access and made healthcare visits for their prenatal and antenatal checks and how many male

and female people had knowledge of family planning methods. A self-assessment fieldwork questionnaire was used to collect additional information about the fieldworkers administering the questionnaires.

The DHS data can be found on the DHS website, but one must create a project request inquiry to access the data. The request must include a project title and a description of the proposed research that the data is needed to help perform. The DHS reviews all requests within 24 hours and grants the requesting party the data or requests more information on the proposed research. This data is granted per country, and upon request and approval, the requesting individual obtains all the unrestricted data available for the specific country. Some of the restricted data sets in the 2018 DHS data include HIV and GIS data. Getting these sets of data requires more scrutiny and follows a more rigorous request process due to the sensitive nature of the data. Researchers granted access to such data have to agree to a new set of terms of use and sign a consent form. Data sets are easily downloadable in different formats from the DHS page.

Summary

The RQs necessitated the use of a quantitative method that adopted a cross-sectional design. The cross-sectional design is mainly used to assess the prevalence and incidence of an outcome and measure the strength of the correlation between the variables in the study. Secondary data was used due to its availability and affordability when conducting this quantitative research instead of using primary data, which was not a feasible option when carrying out this research. I ensured the secondary data used in this research was from a reliable source from the DHS, a reputable program funded by the

United States Agency for International Development (USAID). It was formed in 1984 and is known for data collection and dissemination in the field of health. DHS has ed in over 400 surveys in more than 90 countries, including Nigeria (DHS, n.d.). Data on maternal deaths in Nigeria and specific causes or contributory factors of these deaths was used in this study. The areas covered in the methodology section of this dissertation lay the foundation through which the results in Section 3 and the interpretation of the result and application to professional practice in Section 4 were formulated.

Section 3: Presentation of the Results and Findings

Introduction

I investigated the association between pregnancy-related care (access to antenatal services and maternal health education knowledge of prenatal and postpartum care) and maternal mortality in Nigeria. The study variables included five variables from the 2018 DHS data set. The variables included pregnancy-related death, number of entries in the pregnancy and postnatal care history, number of antenatal visits during the pregnancy, knowledge of contraceptive use, and health checkups before discharge after delivery. Each variable was analyzed separately to address the corresponding RQs. The analysis of variables aimed to show whether a correlation exists between maternal mortality and each of the other five variables. The RQs and hypotheses for the study were as follows:

RQ1: To what extent is there an association between access to antenatal care services as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria?

$H_0$1: There is no association between accessibility to antenatal care as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria.

H_a1: There is an association between accessibility to antenatal care as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria.

RQ2: To what extent is there an association between access to postnatal care services as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria?

$H_0$2: There is no association between accessibility to postnatal care as measured by the number of entries in the pregnancy care history and maternal mortality in Nigeria.

H_a2: There is an association between accessibility to postnatal care as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria.

RQ3: To what extent is there an association between delivery checkup service measured by postnatal check discharge after delivery and maternal mortality in Nigeria?

$H_0$3: Delivery checkup services as measured by postnatal check before discharge after delivery have no association with maternal mortality in Nigeria.

H_a3: Delivery checkup services as measured by postnatal check before discharge after delivery have an association with maternal mortality in Nigeria.

RQ4: To what extent is there an association between knowledge of contraceptives use as measured by the knowledge of contraceptive use associated and maternal mortality in Nigeria?

$H_0$4: There is no association between the knowledge of contraceptives as measured by the knowledge of contraceptive use and maternal mortality in Nigeria.

H_a4: There is an association between the knowledge of contraceptives use as measured by the knowledge of contraceptive use and maternal mortality in Nigeria.

RQ5: To what extent is there an association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

H_05: There is no association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

H_a5: There is an association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

This section will present the study results regarding the variables in the RQs and hypotheses, which were analyzed and tested for association. The section will include identifying the variables and determining the independent and dependent variables in each RQ. I will also describe how NDHS collected the data. The data quality will be assessed based on collection methods and the data collectors' ability to collect accurate data. The response rate for each of the questions referring to the variables in the RQ will also be highlighted to show the generalizability of the results to the chosen participants. Once this is established, the characteristics of the selected demography will be analyzed, and the sampling methods used to determine the demography will be scrutinized to control for external validity.

In terms of the analysis, basic univariate analyses were conducted on the variables to justify their inclusion and determine any patterns that may come up. To describe and characterize the variables, I will use descriptive statistics. The assumptions involved in the statistical models that were performed were also analyzed. The hypotheses testing was done using the appropriate statistical tests given the nature and quantity of the data. Conclusions on whether to reject or fail to reject the null hypothesis were then drawn from the results of these tests. Finally, the post hoc analyses of the statistical tests used were analyzed if applicable to the variables in question.

Accessing the Data Set for Secondary Analysis

I used the 2018 NDHS data set for the analysis of the variables in question. This data set is a secondary data set collected in Nigeria, the country of interest, covering all the variables in the RQs and hypotheses. The DHS staff collected the data, who were

residents of Nigeria recruited, trained, and tested their abilities before participating in data collection. The data were collected from residents of Nigeria, and the study areas were spread across the country to avoid bias and form a proper representation of the whole population of Nigeria.

To gain access to this data set, one needs to create an account with the DHS website. After logging in, individuals request access to the Nigerian data set and are notified of the request's status after a day or so. Once the request has been granted, the data set is available upon logging into the website. The Nigerian data set is available for download in different formats. The minimum estimated sample size for the study to be viable had to generate a statistical power of 80%. In this study, each RQ had a different number of participants for the statistical analysis, given the nature of data collection.

The 2018 NDHS data had complete information on 1,112 participants surveyed for maternal mortality cases. I described most aspects of the data collection in Section 3 of this study. The researchers used the stratified sampling method to select participating households from across Nigeria then used a survey method with the help of a well-detailed and reviewed questionnaire to collect the data needed for the study.

The researchers were recruited on a merit basis, given that a majority of the applicants had participated in data collection for DHS before. After the stages of recruitment, the chosen participants were then trained over the course of 4 weeks to ensure that they understood the purpose of the study, the data needed to form conclusions, and the structure of the questionnaire. The group also took several quizzes to determine their comprehension of the material and pick only the best to participate in the

fieldwork exercise. The participants also took part in a pretest stage where they conducted a test run for the data collection with test subjects among the population. These pretests were done to give participants a feel of what would happen during the actual data collection process and help the recruiters point out areas of weakness that need to be tackled before the actual data collection process began.

A total of 41,668 households took part in the data collection process through the stratified survey method, but only 40,666 were occupied. Of the occupied households, 40,427 were successfully interviewed, yielding a response rate of 99%. The urban population yielded a response rate of 99.3%, while the areas identified as rural yielded a response rate of 99.5%. Among the households interviewed, 42,121 women aged 15-49 were identified for individual interviews. The female interviews were completed by 41,821 women, yielding a response rate of 99%.

The NDHS interviewed women between 15-49 years of age, with 54% of those interviewed being under 30 years. Most (70%) of the female population interviewed were married and living with their partner, while 25% had never been married. In terms of geographical location, this distinction is essential given that place of residence, more often than not, determines access to services and information about health and other aspects of life (NDHS, 2018). A majority (54%) of those interviewed lived in rural areas. Education is also an essential factor in determining and influencing personal behavior, as promulgated by the study's theoretical foundation, the theory of planned behavior, which links a person's belief to their behavior. The theory looks at how attitudes, subjective norms, and perceived behavioral control together shape an individual’s behavior. In the

NDHS population, 35% of women had no formal education, while only 11% of the participating population had received more than high school education. Of the 35% with no formal education, 51% dwell in rural areas. This affirms the theory of how geographical location determines access to information.

The variable linked to the knowledge of contraceptives and ultimately their use was linked closely to the ability of the population to obtain information from media sources. More than 56% of the women interviewed had no access to the three media sources (newspaper, television, and radio). Here, the rural-urban gap is more evident given that at least 51% of women in urban areas watched television at least once a week compared to 17% in rural areas. With the onset of e-health platforms in Nigeria, internet usage among the population was measured since such media directly influence access to healthcare needs or assistance in the country. Only 30% of the women population interviewed claimed to use the internet at least once a week.

Among the female respondents, 65% were employed. The employment rate generally increases with an increase in the level of education (NDHS, 2018). Only 9% of the employed female population were in professional careers or held managerial positions; 18% of employed women did not receive payment for their work. In terms of representation of the chosen sample to the population, the method used to select the sample was the stratified sampling method, applied to all parts of the country to represent the population better. Stratification was done in two stages. In the first stage, the population was divided into urban and rural areas. In the second stage, the selection

process was based on a proportional probability meaning the larger the number of households in a stratum, the more allocation they would get in the final selection.

Due to the nonproportional allocation of the sample size selected from different states and the possible differences in response rates, the NDHS researchers used sampling weights added to the data collected so that the results would be represented at the national level. Due to the stratification stages of selection used, the question of external validity may arise regarding how representative the sample is to the population of Nigeria. I addressed external validity in Section 3; however, representation was achieved by assigning size probability to the sample size in the second selection stage. The disadvantage of this is that the predictive factor was not randomly assigned to the representative sample but instead was assigned based on the number of households in a particular stratum making, Spatio-temporal predictions impossible to perform. Table 6 shows the variables in the RQs and indicates the variable type for this specific study.

Table 6

Variable and Variable Type

Variable	Variable Type
Death during Pregnancy	Dependent Variable
Antenatal Care	Independent Variable
Delivery Checkup Services	Independent Variable
Postnatal Care	Independent Variable
Knowledge of contraceptive use	Independent Variable

Results

Descriptive Analysis

Descriptive statistics helps researchers understand more about the characteristics of the data sets by providing observations and summaries about the data (Conner, 2017).

Descriptive statistics can help to identify patterns in a data set, helping to form conclusions easier. They, however, do not provide tangible data to form conclusions; they help provide the foundation for research acting as a preliminary base for forming conclusions. Table 7 shows the number of responses for each variable in the RQs used in the study.

Table 7

Descriptive Statistics

Statistics						
		Maternal Mortality and Pregnancy-Related Deaths	Entries in Pregnancy and Postnatal Care Roster	Number of Antenatal Visits During Pregnancy	Knowledge of Any Method	Respondent's Health Checked Before Discharge
N	Valid	35598	41821	41821	41821	41821
	Missing	6323	0	0	0	0

Each variable shall now be analyzed separately based on the RQs. The dependent variable maternal mortality as measured by pregnancy is also a categorical variable divided into five categories: death not related to maternal healthcare, died while pregnant, died during delivery, died 6 weeks after delivery, and died 2 months after delivery. Table 8 shows the crosstabs summary of the association between maternal mortality and the dependent variables present in the five RQs.

Table 8

Descriptive Statistics: Maternal Mortality and Pregnancy-Related Death

Death and Pregnancy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Death not related	29519	70.6	83.2	83.2
	Died while pregnant	4002	9.6	11.3	94.4
	Died during delivery	1451	3.5	4.1	98.5
	Since delivery	360	.9	1.0	99.5
	6 weeks after delivery	154	.4	.4	100.0
	2 months after de livery	12	.0	.0	100.0
	Total	35498	84.9	100.0	
Missing	1.5	4986	11.9		
	2.5	1049	2.5		
	3.5	189	.5		
Total	System Total.	99	.2		
		6323	15.1		
		41821	100.0		

In terms of univariate analysis of the variables, 41,821women were interviewed on the number of antenatal visits they had attended. This specific variable can be categorized as a discrete variable that has been treated as a continuous predictor for data analysis. The data collectors asked the women about the number of antenatal visits they had attended during their last pregnancy to measure access to antenatal care. According to the results from the study, 5948 women (14.1%) either did not attend or just had one antenatal visit during their pregnancy. The modal (most frequent) number of antenatal visits among the population was 3 to 4 visits, represented by 54.4% of the participants who undertook antenatal visits before giving birth. Table 9 shows a summary of the descriptive statistics for the variable number of antenatal visits;

Table 9

Descriptive Statistics: Number of Antenatal Visits

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 to 1 antenatal visit	5948	14.2	14.2	14.2
	0 to 3 antenatal visits	3210	7.7	7.7	21.9
	3 to 4 antenatal visits	22745	54.4	54.4	76.3
	Over 4 antenatal visits	9918	23.7	23.7	100.0
	Total	41821	100.0	100.0	

The number of antenatal visits made by participants ranges from 0-20 visits per pregnancy. Table 10 shows the test of between-subject effects, which measures the ability of the variables to account for variations in the dependent variable (Budiu,2018). The significant value of the variable, the number of antenatal visits, in table 10, is below the pre-selected p-value=0.05. Therefore, the independent variable number of antenatal visits is significant in explaining variations in the dependent variable maternal mortality in Nigeria as measured by Sibling's death. This already alludes to what the chi-square model might conclude once the inferential analysis is performed for the RQ.

Table 10

Test of Between-Subject Effects: Number of Antenatal Visits

Source	Type III of Sum of Square	DF	Mean Square	F	Sig.	Partial Eta Squared	Nocent Parameter	Observed Power
Corrected Model	79.108a	21	3.767	2.485	.000	.083	52.185	.999
Intercept	392.497	1	392.497	258.918	.000	.310	258.918	1.000
M14$1	79.108	21	3.767	2.485	.000	.083	52.185	.999

Error	871.650	575	1.516
Total	2759.000	597	
Corrected Total	959.757	596	

a. R Squared = .083 (Adjusted R Squared= .050)
b. Computed using alpha = .05

Table 11 shows the next variable, the number of participants who received a health check before being discharged, is a categorical variable where participants were required to answer yes or no. This variable, unlike the one discussed above, is categorical since the responses are finite. All 41,821participants were asked to answer yes or no to the question of whether they had received a health checkup before being discharged. 40,309 of the participants responded that they had received health checkup services before being discharged compared to 1,512 respondents representing 3.6% who had not received any checkup before discharge. Table 11 shows the descriptive statistics surrounding this independent variable.

Table 11

Descriptive Statistics: Respondent's Health Checked Before Discharge

Respondent's health checked before discharge					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	1512	3.6	3.6	3.6
	Yes	40309	96.4	96.4	100.0
	Total	41821	100.0	100.0	

The test of between-subject effects measures the ability of the variables to account for variations in the dependent variable (Budiu, 2018). Table 12 below shows the results

from the test conducted on this variable. The significant value of the variable, respondent's health checked before discharge, in table 12 is above the pre-selected p-value=0.05. The independent variable respondent's health checked before discharge is therefore not significant in explaining variations in the dependent variable maternal mortality in Nigeria as measured by Sibling's death. This already alludes to what the chi-square model might conclude once the inferential analysis is performed for the RQ, but more tests will need to be performed to reject the null hypothesis.

Table 12

Test of Between-Subject Effects: Respondent's Health Checked Before Discharge

Source	Type III of Sum of Square	DF	Mean Square	F	Sig.	Partial Eta Squared	Nocent Parameter	Observed Power
Corrected Model	.112a	1	.112	.090	.765	.000	.090	.060
Intercept	351.586	1	351.586	281.15	.000	.538	281.150	1.000
M62$1	.112	1	.112	.090	.765	.000	.090	.060
Error	301.377	241	1.516					
Total	902.000	243						
Corrected Total	301.490	596						

a. R Squared = .000 (Adjusted R Squared = -.004)
b. Computed using alpha = .05

The third independent variable is the access to postnatal care services as measured by the number of entries in the pregnancy and postnatal care history. For this variable, the researchers used the number of entries in the pregnancy and postnatal care roster to measure the frequency of postnatal care visits made by women in a healthcare facility. The variable was classified as categorical, with the frequency of visits running from 0-4

visits. Postnatal care visits entail giving care services to the mother and the newborn baby between birth and the first six weeks of life. The WHO recommends that new mothers get at least three postnatal care visits between the delivery date and the sixth week of life.

The number of postnatal visits made by participants ranges from 0-4 visits per pregnancy. Figure 3 shows the frequency of visits across the participants in the study; From Figure 3, 515 out of the 1,112 participants, which represent 46.3%, did not go for any postnatal care services. Only 3.5% of the participants met WHO's recommended number of postnatal visits, which is a minimum of three visits. Figure 3 shows the descriptive statistics surrounding this independent variable.

Figure 3

Frequency of Postnatal Visits Among Participants

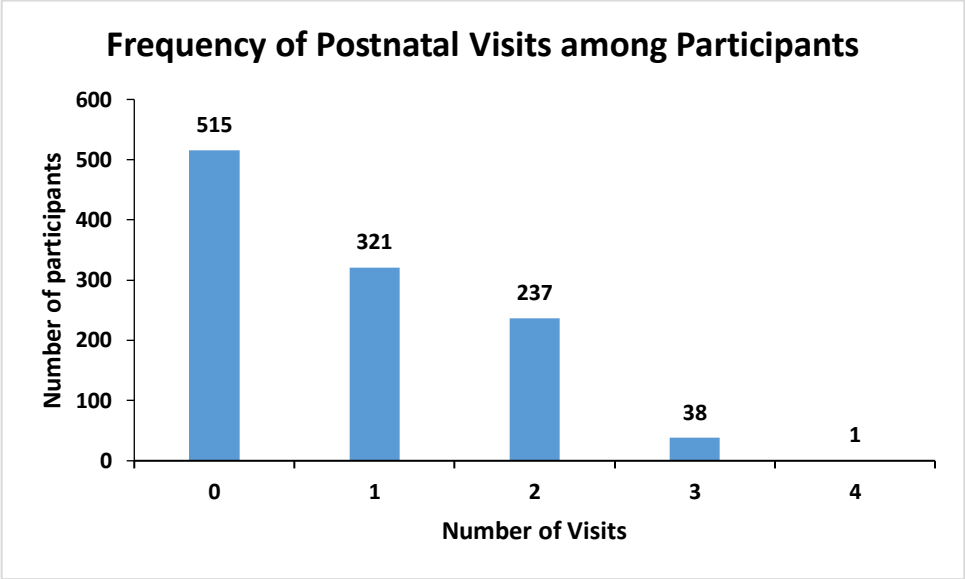


Figure 13 shows entries in the pregnancy and postnatal care roster

Table 13

Descriptive Statistics: Entries in pregnancy and postnatal care roster

Entries in pregnancy and postnatal care roster					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 to 1 postnatal care entries	31392	75.1	75.1	75.1
	2 to 3 postnatal care entries	10313	24.7	24.7	99.7
	3 to 4 postnatal care entries	108	.3	.3	100.0
	5 or more postnatal care entries	8	.0	.0	100.0
	Total	41821	100.0	100.0	

The test of between-subject effects measures the ability of the variables to account for variations in the dependent variable (Budiu, 2018). Table 14 below shows the results from the test conducted on this variable.

Table 14

Tests of Between-Subject Effects: Entries in Pregnancy and Postnatal Care Roster

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power
Corrected Model	46.870a	4	11.717	9.187	.000	.032	36.747	1.000
Intercept	138.115	1	138.115	108.285	.000	.089	108.285	1.000
V417	46.870	4	11.717	9.187	.000	.032	36.747	1.000
Error	1411.957	1107	1.275					
Total	4273.000	1112						
Corrected Total	1458.826	1111						

a. R Squared = .032 (Adjusted R Squared = .029)

a. Computed using alpha = .05

The fourth independent variable is contraceptives use as measured by the knowledge of contraceptive use. This variable is measured in a categorical form where the respondent had one of four choices to base their answer. The respondent either knew no method, knew only folkloric methods, knew only traditional methods or knew the modern methods of contraception. Table 15 shows the descriptive statistics surrounding this independent variable.

Table 15

Descriptive Statistics: Knowledge of contraceptive methods

Knowledge of any method					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Knows no method	3320	7.9	7.9	7.9
	Knows only folkloric method	74	.2	.2	8.1
	Knows only traditional method	148	.4	.4	8.5
	Knows modern method	38279	91.5	91.5	100.0
	Total	41821	100.0	100.0	

The test of between-subject effects measures the ability of the variables to account for variations in the dependent variable (Budiu, 2018). Table 16 shows the results from the test conducted on this variable. The significant value of the variable, knowledge of contraceptive, in table 16, the test of Between-Subject Effects, is above the pre-selected p-value of 0.05. Therefore, the independent variable knowledge of contraceptive use is not significant in explaining variations in the dependent variable; maternal mortality in

Nigeria is measured by death and pregnancy. This indicates that the Chi-square model might not be enough to conclude not rejecting the null hypothesis. More tests will need to be performed to reject the null hypothesis.

Table 16

Test of Between-Subject Effects: Knowledge of Contraceptives

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Nocent Parameter	Observed Power
Corrected Model	5.341a	3	1.780	1.357	.254	.004	4.072	.363
Intercept	21.220	1	21.220	16.176	.000	.014	16.176	.980
V301	5.341	3	1.789	1.357	.254	.004	4.072	.363
Error	1453.485	1108	1.312					
Total	4273.000	1112						
Corrected Total	1458.826	1111						

a. R Squared =.004 (Adjusted R Squared =.001
b. Computed using alpha =.05

Table 17, multiple regression table, shows the relationship between the dependent variable, death, and pregnancy, and the independent variables, Entries in pregnancy and postnatal care roster, Number of Antenatal visits during pregnancy, Knowledge of any method, and Respondent's health checked before discharge. The regression equation gives the relation; $y = 1.366 + 0.074m - 0.07n - 0.024p + 0.058q$ where y, m, n, p, and q are the death and pregnancy, entries in pregnancy postnatal care roster, Number of Antenatal visits during pregnancy, Knowledge of any method, and Respondent's health checked before discharge values respectively.

Table 17

Multiple Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	1.366	.026		52.419	.000	1.315	1.417
	Entries in pregnancy and postnatal care roster	.074	.008	.052	9.701	.000	.059	.089
	Number of Antenatal visits during pregnancy	-.070	.004	-.104	-19.304	.000	-.077	-.063
	Knowledge of any method	-.024	.004	-.031	-5.787	.000	-.032	-.016
	Respondent's health checked before discharge	.058	.017	.018	3.384	.001	.024	.092

a. Dependent Variable: Death and Pregnancy

Inferential Analysis for the Research Questions and Hypotheses

The RQs and hypotheses in the study were addressed inferentially in this current study based on the predetermined statistical measures:

- p-value or significance value = 0.05 or 5%.
- Confidence intervals of 0.095 or 95%

Statistical Assumptions

The study, just like any other statistical study, must have general assumptions that need to be made to ensure test results are reliable. A normality test is conducted to run the t-test and the analysis of variance, which are some of the tests required to test the hypotheses. The assumption of linearity is necessary when conducting a regression test.

The last general assumption is the equality of variance, which is essential when conducting the ANOVA test (Flatt & Jacobs, 2019).

The association between the variables present in the RQs will be tested using nominal logistic regression on SPSS. As with both non-parametric and parametric tests, it is assumed that the data were obtained through random selection. However, it is possible to find inferential statistics used when data are from convenience samples rather than random samples. In such a case where the random sampling assumption may be violated, researchers are encouraged to perform several replication studies, essentially obtaining the same results to gain enough confidence in the results obtained. Each non-parametric test has its specific assumptions as well. The assumptions include:

The first assumption is that the values within each variable should be in the form of frequencies or count and not necessarily any transformation of the data such as percentages. The second assumption is that each test subject must only contribute to one cell. In our case, each participant was only required to fill in one answer for all the questions that the variables in the RQs rely on. The next assumption is the independence of the study groups. There were no paired data instances in the NDHS data set and study collection process, so this assumption was upheld.

The tests also assume that there are two variables and, in most cases, the two are categorical variables measured nominally, but the inclusion of ordinal data is permitted (Rana & Singhal, 2015). The test has no limit on the number of categories a variable can have, but if a variable has many categories, the last assumption of the test may not be met, making it hard to interpret the results using the chi-square level of significance/ chi-

square statistic. The final assumption is that the minimum expected count in at least 80% of the cells should be 5, and no cell should have an expected count of less than one. More categories mean running the risk of having cells with expected counts that were less than 5 or, in some instances, zero.

The assumption of mutual exclusivity was also upheld by the data set used. Mutual exclusivity dictates that a participant can only select one option in the categorical variable. For example, if the categorical variable is fitness levels, then the participant cannot be both fit and unfit at the same time. The likelihood ratio test measures the goodness of fit of two competing statistical models. The Intercept Only row describes a model that does not control for any predictor variables and simply fits an intercept to predict the outcome variable. The Final row indicates a model with the specified predictor variables. Chi-Square is used to determine whether the model fits significantly better as compared to an empty model. The likelihood ratio chi-square from table 18 is 771.005 with a p-value < 0.0001 indicating that the model as a whole fit significantly better than an empty model with no predictors.

Table 18

Model Fitting Information

	Model Fitting Criteria	Likelihood	Ratio	Test
Model	-2 Log Likelihood	Chi-Square	Df	Sig
Intercept Only	1436.204			
Total	665.199	771.005	50	.000

The goodness-of-fit test complements the model fitting information by assessing how well the model used in analysis fits the data given (see Table 19). The chi-square in

the Pearson row indicates whether the model fits the data well. Large chi-square values are generally a sign that the model is not a good fit for the data. For a more accurate measure, it is generally acceptable to use the significant level. As a rule of thumb, a $p<0.05$ indicates the model does not fit the data well. From table 19, the p-value of 0.709 is greater than 0.05, meaning the model fits the data well enough

Table 19

Goodness-of-Fit model

	Chi-Square	Df	Sig.
Pearson	232.346	245	.709
Deviance	236.981	245	.632

.

The pseudo-R-Square is similar to the R^2 in a linear regression model, which indicates the proportion of change that the model can explain. The multinominal logistic regression uses several pseudo R^2 as shown in table 19 above, given that R^2 cannot be determined by a model with a categorical dependent variable. Most researchers rely on or use the Cox and Snell R^2 because it is more conservative. Therefore, the results can be interpreted to mean that the combined variables in the model only account for 2.1% of the variations in the independent variable. However, the results from table 20 are not weighted heavily as the likelihood ratio tests below because the R^2 tested are in effect pseudo and not real as in the linear regression models.

Table 202

Pseudo R-Square

Cox and Snell	.021
Nagelkerke	.031
McFadden	.018

Table 21 shows the Likelihood Ratio of Test Variables

Table 21

Likelihood Ratio of Test Variables

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	665.199[a]	.000	0	.
Entries in pregnancy and postnatal care roster	728.711	63.512	15	.000
Number of Antenatal visits during pregnancy	1159.360	494.161	15	.000
Knowledge of any method	733.548	68.349	15	.000
Respondent's health checked before discharge	681.107	15.907	5	.007

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.
a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Research Question 1 Inferential Analysis

RQ1: To what extent is there an association between access to antenatal care services as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria?

$H_0$1: There is no association between accessibility to antenatal care as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria.

H_a1: There is an association between accessibility to antenatal care as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria.

Table 22 shows the relationship between the variable, maternal mortality, and access to antenatal care as represented by the number of antenatal care visits. Column B indicates the coefficient of the variables which predict the change in log odds of membership in the target group. The column Exp (B) shows the odds ratio reflecting the change in odds concerning death while pregnant for every one-unit increase in the predator variable. Values greater than 1 indicate the likelihood of falling into the target group vs. the other non-target group. Values less than 1 indicate the likelihood of falling into the other non-target groups. For the lower and upper bounds, if 1 (odds ratio) falls between the lower and upper bound, it is an indication that the predator is significant and vice versa is also correct for the value 1 not falling between the upper and lower bounds.

Table 22

Died while Pregnant Antenatal Visits*

		B	Std.Error	Wald	Df	Sig.	Exp (B)	Lower Bound	Upper Bound
Died While Pregnant	[Number of Antenatal visits during pregnancy=1	-.596	.103	33.418	1	.000	.551	.450	.674
	[Number of Antenatal visits during pregnancy=2]	-.471	.120	15.393	1	.000	.625	.494	.790
	[Number of Antenatal visits during pregnancy=3]	-.212	.097	4.792	1	.029	.809	.669	.978

	[Number of Antenatal visits during pregnancy=4]	0[c]	.	.	0	.	.	.	.

For the relationship between died while pregnant and antenatal visits, all antenatal visits had a negative coefficient for the died. In contrast, although 3-4 antenatal visits, the pregnant target group was a non-significant predictor (significant value =0.029). The results from column B indicate that antenatal visits and death while pregnant are inversely related. The higher the number of antenatal visits, the less likely a woman is to die while pregnant. In this case, all Exp (B) values in table 23 are less than one indicating that an individual receiving antenatal care is less likely to die while pregnant than the other maternal mortality categories.

Table 23

*Since Delivery*Number of Antenatal Visits*

		B	*Std.Error*	*Wald*	*Df*	*Sig.y*	*Exp (B)*	*Lower Bound*	*Upper Bound*
	Intercept	*-1.375*	*4284.59*	*.000*	1	1.000			
Number of antenatal visits Since delivery	[Number of Antenatal visits during pregnancy=1]	.251	.197	1.627	1	.202	1.285	.874	1.889
	[Number of Antenatal visits during pregnancy=2]	-.352	.256	1.892	1	.169	.704	.426	1.161
	[Number of Antenatal visits during pregnancy=3]	.114	.198	.331	1	.565	1.121	.760	1.653
	[Number of Antenatal visits during pregnancy=4]	0[c]	.	.	0	.	.	.	.

For the relationship between delivery (between delivery and six weeks post-delivery) and antenatal visits, all antenatal visits had a positive coefficient for the died since delivery target group except those who have 2-3 antenatal visits. However, all the values are non-significant predictor (significant value> 0.05). The results from column B indicate that antenatal visits and death since delivery have a mixed relationship. The optimum number of visits is identified at 2-3 visits since, at this point, the coefficient indicates a negative relationship. In this case, two of the Exp (B) values in the table above are more than one indicating that an individual receiving antenatal care visits of 0-1 and 3-4 are more likely to die since delivery than the other maternal mortality categories. The odds of an individual who received 2-3 antenatal visits dying since delivery are lower than 1, indicating the less likelihood of death in this category. However, it is important to remember that all these values are not significant, as shown in table 24.

Table 24

*6 weeks after Delivery*Number of Antenatal Visits*

		B	*Std.Error*	*Wald*	*Df*	*Sig.y*	*Exp (B)*	*Lower Bound*	*Upper Bound*
6 weeks after delivery	*Intercept*	-1.269	.816						
	[Number of Antenatal visits during pregnancy=1]	-2.242	.361	.	0	.	.106	.052	.216
	[Number of Antenatal visits during pregnancy=2]	-.622	.270	38.536	1	.000	.537	.316	.911
	[Number of Antenatal	-.847	.226	5.325	1	.021	.429	.275	.668

visits during pregnancy=3]								
[Number of Antenatal visits during pregnancy=4]	0[c]	.	14.003	1	.000	.	.	.

For the relationship between died after 6 weeks and antenatal visits, all antenatal visits had a negative coefficient for the died while pregnant target group and all predators were significant (significance value<0.05). The results from column B indicate that antenatal visits and death after 6 weeks are inversely related. In this case, all Exp (B) values in the table above are less than one indicating that an individual receiving antenatal care is less likely to die after 6 weeks of delivery as compared to the other maternal mortality categories. In our table above, all antenatal visits are not significant since the odds ratio of 1 does not fall between the lower and upper bounds.

For the relationship between 2 months after delivery and antenatal visits, all antenatal visits had a negative coefficient for the died after 2 months of delivery target. However, all the values are non-significant predictor (significant value> 0.05). The results from column B indicate that antenatal visits and death after 2 months of delivery are inversely related. In this case, all Exp (B) values in table 24 are less than one indicating that an individual receiving antenatal care is less likely to die after 2 months of delivery as compared to the other maternal mortality categories. However, it is important to remember that all these values are not significant, as shown in table 25.

From the above analysis, the antenatal parameter visit is only significant in explaining death while pregnant and death after 6 weeks of delivery. In both cases, antenatal visits and the two maternal mortality categories are inversely related. We can

therefore reject the null hypothesis and conclude that there is an association between antenatal visits and maternal mortality for death during pregnancy and death after 6 weeks of delivery

Table 25

*2 months after Delivery*Number of Antenatal Visits*

		B	*Std.Error*	*Wald*	*Df*	*Sig.y*	*Exp (B)*	*Lower Bound*	*Upper Bound*
	Intercept	-3.70	.673	30.352	1	.000			
	[Number of Antenatal visits during pregnancy=1]	-1.59	1.160	1.885	1	.170	.204		.021
2 Month After delivery	[Number of Antenatal visits during pregnancy=2]	-.275	.922	.089	1	.765	.759		.125
	[Number of Antenatal visits during pregnancy=3]	-.419	.786	.285	1	.594	.657		.141
	[Number of Antenatal visits during pregnancy=4]	0[c]	.	.	0	.	.		.

It is critical to note that other variables affecting antenatal visits, such as the quality of services during the visit and the components of the ANC visits, are not measured/ accounted for by the RQ. According to the NDHS 2018 data, only 17% of the women who had received antenatal care services obtained these services from a qualified doctor. Therefore, each participant's quality of the benefits will vary depending on where they obtain these services.

Research Question 2 Inferential Analysis

RQ2: To what extent is there an association between access to postnatal care services as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria?

$H_0$2: There is no association between accessibility to postnatal care as measured by the number of entries in the pregnancy care history and maternal mortality in Nigeria.

H_a2: There is an association between accessibility to postnatal care as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria.

Table 26 shows the relationship between the variable maternal mortality and access to postnatal care services as represented by the number of entries in the pregnancy and postnatal care history. Column B indicates the coefficient of the variables which predicts the change in log odds of membership in the target group. The column Exp (B) shows the odds ratio reflecting the change in odds concerning death while pregnant for every one-unit increase in the predator variable. Values greater than 1 indicate the likelihood of falling into the target group vs. the other non-target group. Values less than 1 indicate the likelihood of falling into the other non-target groups. For the lower and upper bounds, if 1 (odds ratio) falls between the lower and upper bound, it is an indication that the predator is significant and vice versa is also correct for the value 1 not falling between the upper and lower bounds.

For the relationship between died while pregnant and entries in postnatal care entries, all entries had a positive coefficient for the died since delivery target group except those who have 3-4 visits. However, all the values are non-significant predictor (significant value> 0.05). The results from column B indicate that postnatal visits and death since delivery have a mixed relationship. The optimum number of visits is identified at 3-4 visits since, at this point, the coefficient indicates a negative relationship. In this case, the conclusions under Exp (B) do not make logical sense since postnatal care is administered after birth, so death while pregnant and postnatal entries cannot be related. It is, however, important to remember that all these values are not significant.

Table 26

*Died While Pregnant*Entries in Pregnancy and Postnatal Care Roster*

		B	*Std.Error*	*Wald*	*Df*	*Sig.y*	*Exp (B)*	*Lower Bound*	*Upper Bound*
Died While Pregnant	[Entries in pregnancy and postnatal care roster=1]	.224	2427.38	.000	1	1.000	1.25	.000	.[b]
	[Entries in pregnancy and postnatal care roster=2]	.034	2427.38	.000	1	1.000	1.03	.000	.[b]
	[Entries in pregnancy and postnatal care roster=3]	-.409	2427.38	.000	1	1.000	.664	.000	.[b]
	[Entries in pregnancy and postnatal care roster=4]	0[c]	.	.	0	.	.	.	.

For the relationship between delivery (between delivery and six weeks post-delivery) and postnatal care roster, all postnatal visits had a negative coefficient for the died since delivery target group except those who have 2-3 postnatal visits. All the values are non-significant predictors (significant value>0.05). The results from column B indicate that postnatal visits and death since delivery have a mixed relationship. The optimum number of visits is identified at 3-4 visits since, at this point, the coefficient indicates a negative relationship. In this case, two of the Exp (B) values in the table above are less than one showing that an individual taking postnatal visits of 0-1 and 3-4 are less likely to die since delivery as compared to the other maternal mortality categories. The odds of an individual who received 2-3 postnatal visits dying since delivery is higher than 1, indicating more likelihood of death in this category. However, it is essential to remember that all these values are not significant, as shown in table 27.

Table 27

Since Delivery Entries in Pregnancy and Postnatal Care Roster*

		B	*Std.Error*	*Wald*	*Df*	*Sig.y*	*Exp (B)*	*Lower Bound*	*Upper Bound*
Since delivery	Intercept	-1.375	4284.59	.000	1	1.000			
	[Entries in pregnancy and postnatal care roster=1]	-.254	4284.59	.000	1	1.000	.775	.000	.[b]
	[Entries in pregnancy and postnatal care roster=2]	.023	4284.59	.000	1	1.000	1.023	.000	.[b]
	[Entries in pregnancy and postnatal care roster=3]	-.012	4284.59	.000	1	1.000	.988	.000	.[b]

	[Entries in pregnancy and postnatal care roster=4]	0[c]	.	.	0	.	.	.	.

For the relationship between 6 weeks after delivery and postnatal care roster, all postnatal visits had a negative coefficient for the died after 6 weeks of delivery target group except those who had 3-4 postnatal visits. All the values are non-significant predictors (significant value>0.05). The results from column B indicate that postnatal visits and death since delivery have a mixed relationship. In this case, two of the Exp (B) values in the table above are less than one indicating that an individual taking postnatal visits of 0-1 and 2-3 are less likely to die since delivery as compared to the other maternal mortality categories. The odds of an individual who received 3-4 postnatal visits dying since delivery is higher than 1, indicating more likelihood of death in this category. However, it is essential to remember that all these values are not significant, as shown in table 28.

Table 28

6 weeks After Delivery Entries in Pregnancy and Postnatal Care Roster*

		B	*Std. Error*	*Wald*	*Df*	*Sig.y*	*Exp (B)*	*Lower Bound*	*Upper Bound*
6 Weeks After Delivery	Intercept	-1.269	.816						
	[Entries in pregnancy and postnatal care roster=1]	-.211	.821	.066	1	.797	.810	.162	4.043
	[Entries in pregnancy and postnatal care roster=2]	-.096	.820	.014	1	.907	.909	.182	4.530

[Entries in pregnancy and postnatal care roster=3]	.899	.000	.	1	.	2.456	2.456	2.456
[Entries in pregnancy and postnatal care roster=4]	0[c]	.	.	0	.	.	.	.

For the relationship between 2 months after delivery and postnatal care roster, all postnatal visits had a negative coefficient for the "died 2 months after delivery target group. All the values are non-significant predictors (significant value>0.05). The results from column B indicate that postnatal visits and death since delivery have an inverse relationship. In this case, two of the Exp (B) values in the table above are less than one indicating that an individual taking postnatal visits of 0-1 and 2-3 are less likely to die since delivery as compared to the other maternal mortality categories. The odds of an individual who received 3-4 postnatal visits dying since delivery is higher than 1, indicating more likelihood of death in this category. However, it is essential to remember that all these values are not significant, as shown in table 29.

It is critical to note that other variables affecting postnatal visits, such as the quality of services during the visit and cultural beliefs that may hinder women from seeking such services, have not been accounted for in this model. According to the NDHS 2018 data, only 35% of the women who had received postnatal care services obtained these services from a qualified doctor or nurse, indicating a variation in quality among the parties.

Table 39

2 months After Delivery Entries in Pregnancy and Postnatal Care Roster*

		B	*Std. Error*	*Wald*	*Df*	*Sig.y*	*Exp (B)*	*Lower Bound*	*Upper Bound*
2 Months After Delivery	Intercept	-3.70	.673	30.352	1	.000			
	[Entries in pregnancy and postnatal care roster=1]	-.500	.731	.468	1	.494	.607	.145	2.542
	[Entries in pregnancy and postnatal care roster=2]	-.363	.000	.	1	.	.696	.696	.696
	[Entries in pregnancy and postnatal care roster=3]	-15.3	7485 .66	.000	1	.998	2.192	.000	.[b]
	[Entries in pregnancy and postnatal care roster=4]	0[c]	.	.	0	.	.	.	.

Research Question 3 Inferential Analysis

RQ3: To what extent is there an association between delivery checkup service as measured by postnatal check discharge after delivery and maternal mortality in Nigeria?

$H_0$3: Delivery checkup services as measured by postnatal check before discharge after delivery have no association with maternal mortality in Nigeria.

H_a3: Delivery checkup services as measured by postnatal check before discharge after delivery have an association with maternal mortality in Nigeria.

Table 30 shows the relationship between the variable maternal mortality and delivery checkup services as measured by postnatal check discharge after delivery. Column B indicates the coefficient of the variables which predicts the change in log odds

of membership in the target group. The column Exp (B) shows the odds ratio reflecting the change in odds concerning death while pregnant for every one-unit increase in the predator variable. Values greater than 1 indicate the likelihood of falling into the target group vs. the other non-target group. Values less than 1 indicate the likelihood of falling into the other non-target groups. For the lower and upper bounds, if 1 (odds ratio) falls between the lower and upper bound, it is an indication that the predator is significant and vice versa is also correct for the value 1 not falling between the upper and lower bounds.

For the relationship between the death of pregnant and the respondent's health checked before discharge, the entry had a negative coefficient for the died since the delivery target group. However, the value is a non-significant predictor (significant value> 0.05). The results from column B indicate that respondent's health checked before discharge and died while pregnant have an inverse relationship. In this case, the conclusions under Exp (B) do not make logical sense since the respondent's health checked before discharge is administered after birth, so death while pregnant and respondent's health cannot be compared.

Table 30

*Died while Pregnant*Respondent's Health Checked Before Discharge*

		B	Std.Error	Wald	Df	Sig.	Exp (B)	Lower Bound	Upper Bound
Died While Pregnant	[Respondent's health checked before discharge=0]	.380	.200	3.625	1	.057	1.462	.989	2.162
	[Respondent's health	0[c]	.	.	0	.	.	.	.

	checked before discharge=1]								

For the relationship between since delivery (between delivery and six weeks post-delivery) and respondent's health checked before discharge, the entry had a negative coefficient for the died since delivery target group. However, the value is non-significant predictors (significant value>0.05). The results from column B indicate that respondent's health checked before discharge and death since delivery have an inverse relationship. In this case, the Exp (B) value in table 31 is less than one indicating that an individual who has their health checked before discharge is less likely to die since delivery as compared to the other maternal mortality categories. The odd ratio is significant in table 30 since the value 1 falls between the lower and upper bounds.

Table 31

*Since Delivery*Respondent's Health Checked Before Discharge*

		B	Std.Error	Wald	Df	Sig.y	Exp (B)	Lower Bound	Upper Bound
Since Delivery	Intercept	-1.375	4284.59	.000	1	1.000	.901	.392	2.070
	[Respondent's health checked before discharge=0]	-.104	.424	.060	1	.806	.	.	.
	[Respondent's health checked	0c	.	.	0	.			

	before discharge=1]								

For the relationship between six weeks, post-delivery, and respondent's health checked before discharge; the entry had a negative coefficient for the died after 6 weeks of the delivery target group. However, the value is non-significant predictors (significant value>0.05). The results from column B indicate that respondent's health checked before discharge and death 6 weeks after delivery have an inverse relationship. In this case, the Exp (B) value in table 32 above is less than one indicating that an individual who does not have their health checked before discharge is less likely to die six weeks post-delivery as compared to the other maternal mortality categories. In table 32 above, the odd ratio is significant since the value 1 falls between the lower and upper bounds.

Table 42

*6 weeks after Delivery*Respondent's Health Checked Before Discharge*

		B	Std.Error	Wald	Df	Sig.	Exp (B)	Lower Bound	Upper Bound
6 Weeks After Delivery	Intercept	-1.269	.816				.793	.274	2.291
	[Respondent's health checked before discharge=0]	.232	.541	.184	1	.668	.	.	.
	[Respondent's health checked before discharge=1]	0c	.	.	0	.			

For the relationship between two months, post-delivery and respondent's health checked before discharge; the entry had a strong negative coefficient for the died after 2 months of the delivery target group. However, the value is non-significant predictors (significant value>0.05). The results from column B in table 33 indicate that respondent's health checked before discharge and death 2 months after delivery have an inverse relationship. In this case, the Exp (B) value in the table above is equal to 1, indicating that an individual who does not have their health checked before discharge is more likely to die 2 months post-delivery as compared to the other maternal mortality categories.

Table 33

*2 months after Delivery*Respondent's Health Checked Before Discharge*

		B	Std. Error	Wald	Df	Sig.	Exp (B)	Lower Bound	Upper Bound
2 Months After Delivery	Intercept	-3.70	.673	30.352	1	.000			
	[Respondent's health checked before discharge=0]	-13.603	1477.7	.000	1	.993	1.236	.000	.b
	[Respondent's health checked before discharge=1]	0	.	.	0	.	.	.	.

It is critical to note that other variables affecting postnatal checkups after delivery, such as the quality of services offered and the service provider, are not measured/ accounted for by the RQ. According to WHO, approximately half of maternal deaths occur within the first 24 hours after delivery. In line with WHO guidelines, Nigeria's safe motherhood program recommends that women who deliver in a health facility receive a

postnatal healthcare check within the first 24 hours after delivery, while those who give birth outside a health facility should be referred for postnatal checks in health facilities within 12 hours after delivery. According to the NDHS 2018 data, only 42% of mothers who gave birth in the 2 years preceding the survey reported seeing someone for a check within the first 2 days after birth.

Research Question 4 Inferential Analysis

RQ4: To what extent is there an association between knowledge of contraceptives use as measured by the knowledge of contraceptive use associated and maternal mortality in Nigeria?

$H_0$4: There is no association between the knowledge of contraceptives as measured by the knowledge of contraceptive use and maternal mortality in Nigeria.

H_a4: There is an association between the knowledge of contraceptives use as measured by the knowledge of contraceptive use and maternal mortality in Nigeria.

Table 34 shows the relationship between the variable maternal mortality and knowledge of contraceptive use. Column B indicates the coefficient of the variables which predicts the change in log odds of membership in the target group. The column Exp (B) shows the odds ratio reflecting the change in odds concerning death while pregnant for every one-unit increase in the predator variable. Values greater than 1 indicate the likelihood of falling into the target group vs. the other non-target group. Values less than 1 indicate the likelihood of falling into the other non-target groups. For

the lower and upper bounds, if 1 (odds ratio) falls between the lower and upper bound, it is an indication that the predator is significant and vice versa is also correct for the value 1 not falling between the upper and lower bounds.

Table 34

*Died while pregnant*Knowledge of any method*

Died While Pregnant		B	Std. Error	Wald	Df	Sig.	Exp(B)	Lower Bound	Upper Bound
	[Knowledge of any method=0]	.020	.105	.036	1	.850	1.02	.830	1.254
	[Knowledge of any method=1]	.155	.679	.052	1	.820	1.17	.308	4.420
	[Knowledge of any method=2]	.636	.394	2.608	1	.106	1.89	.873	4.083
	[Knowledge of any method=3]	0[c]	.	.	0	.	.	.	.

For the relationship between died while pregnant and knowledge of any method, all the coefficients are positive for the died while pregnant target group. However, the values are non-significant predictor (significant value> 0.05). The results from column B indicate that knowledge of contraceptive use and died while pregnant have an inverse relationship. In this case, all the Exp (B) values in table 35 are greater than 1, indicating that an individual who knows modern methods is less likely to die during pregnancy than one who knows has no knowledge of any method, those who know only traditional methods and those who only know folkloric methods as well as the other maternal mortality categories.

Table 35

*Since Delivery*Knowledge of Any Method*

		B	Std. Error	Wald	Df	Sig.	Exp(B)	Lower Bound	Upper Bound
Since Delivery	Intercept	-1.375	4284.59	.000	1	1.000			
	[Knowledge of any method=0]	.426	.176	5.867	1	.015	1.531	1.085	2.160
	[Knowledge of any method=1]	.892	.917	.946	1	.331	2.441	.404	14.733
	[Knowledge of any method=2]	-14.421	939.311	.000	1	.988	5.45E-7	.000	.[b]
	[Knowledge of any method=3]	0[c]	.	.	0	.	.	.	.

For the relationship between since delivery (between delivery and six weeks post-delivery) and knowledge of any method, all the coefficients are positive for the since delivery target group except the individuals who know traditional methods. However, the values are non-significant predictors (significant value> 0.05) except for the knowledge of no method predictor. The results from column B indicate that knowledge of contraceptive use and died since delivery have a mixed relationship. In this case, all the Exp (B) values in the table above are greater than 1, indicating that an individual who knows modern methods is less likely to die since delivery as compared to one who knows has no knowledge of any method, those who know only traditional methods and those who only know folkloric methods as well as the other maternal mortality categories.

For the relationship between 6 weeks after delivery and knowledge of any method, all the coefficients are positive for the "died 6 weeks after delivery" target group except those who know folkloric methods. However, the values are non-significant predictor (significant value> 0.05). The results from column B in table 36 indicate that knowledge of contraceptive use and died after 6 weeks of delivery have a mixed relationship. In this case, all the Exp (B) values in the table above are greater than 1, indicating that an individual who knows modern methods is less likely to die 6 weeks after delivery as compared to one who knows has no knowledge of any method, those who know only traditional methods and those who only know folkloric methods as well as the other maternal mortality categories.

Table 36

*6 weeks after Delivery*Knowledge of Any Method*

		B	Std. Error	Wald	Df	Sig.	Exp(B)	Lower Bound	Upper Bound
6 Weeks After Delivery	Intercept	-1.269	.816						
	[Knowledge of any method=0]	.172	.309	.310	1	.578	1.188	.648	2.178
	[Knowledge of any method=1]	-13.752	2412.824	.000	1	.995	1.066E-6	.000	.[b]
	[Knowledge of any method=2]	.604	1.068	.320	1	.572	1.829	.225	14.844
	[Knowledge of any	0[c]	.	.	0	.	.	.	.

	method=3]								

For the relationship between died 2 months after delivery and knowledge of any method, all the coefficients are all negative for the "died 2 months after delivery" target group. However, the values are non-significant predictors (significant value> 0.05). The results from column B indicate that knowledge of contraceptive use and died 2 months after delivery have an inverse relationship. In this case, all the Exp (B) values in the table above are greater than 1, indicating that an individual who knows modern methods is less likely to die 2 months after delivery as compared to one who knows has no knowledge of any method, those who know only traditional methods and those who only know folkloric methods as well as the other maternal mortality categories (see Table 37).

Table 37

*2 months after Delivery*Knowledge of Any Method*

		B	Std. Error	Wald	Df	Sig.	Exp(B)	Lower Bound	Upper Bound
2 Months After Delivery	Intercept	-3.70	.673	30.352	1	.000			
	[Knowledge of any method=0]	-14.125	1125.18	.000	1	.990	7.34	.000	.[b]
	[Knowledge of any method=1]	-14.092	8710.66	.000	1	.999	7.58	.000	.[b]
	[Knowledge of any method=2]	-14.353	5637.19	.000	1	.998	5.83	.000	.[b]
	[Knowledge of any method=3]	0[c]	.	.	0	.	.	.	.

Post-hoc Analysis of Statistical Tests

The assumption of homogeneity was used when performing the statistical tests above. For the Post-hoc analysis, the ANOVA test will test the four variables except for the dependent variable maternal mortality, as shown by the sibling's death and pregnancy. Post-hoc analysis tests were not performed for this variable, given that it has fewer than three groups. The p-value should be above .05 to meet the assumption of homogeneity of variance (Li, 2015). If the test of homogeneity of variances yields a p-value below .05, then the assumption of homogeneity of variance is violated. The test for homogeneity of variances is Levene's test of homogeneity of variance.

Certain assumptions usually have to be met by the data analyzed to run a one-way ANOVA test. The first assumption is the independent variables should consist of two or more categories. The next assumption is the independence of observations. This means that there is no relationship between the observations in each group or between the groups themselves. There must be different participants in each group, and no participant should be in more than one group. The next assumption is that there should be no outliers, that is, single data points within the data that do not follow the usual data points (Kim, 2017). Given the nature of the variables and the questionnaire structure, it would be hard for the data set to violate this assumption, given that the participants were restricted to several responses during the data collection stage. The following assumption is that the dependent variable should be normally distributed for each category of the independent variables. The last assumption is the homogeneity of variables which will be

tested below using the Levene Statistic. For the variable number of antenatal visits, the test of homogeneity table.

From these results, it is clear that the variable number of antenatal visits did not meet the assumption of homogeneity, given that the pre-selected p-value (0.05) is lower than the significant level of the variable (based on mean). In such a scenario, the non-parametric equivalent of the Levene Statistic can be used to measure the homogeneity of the variables. The significance based on the median is used here, and the significance value is higher than the predetermined p-value (.057>0.05), indicating that the assumption of homogeneity has not been violated in this case, and a One-Way ANOVA test can be performed. Below is Table 38 summarizing the output from the ANOVA analysis.

Table 58

Test of Homogeneity of Variances: Number of Antenatal Visits

		Levene Statistic	df1	df2	Sig.
Maternal death and pregnancy	Based on Mean	3.938	20	575	.000
	Based on Median	1.559	20	575	.057
	Based on Median and with adjusted df	1.559	20	502.205	.058
	Based on trimmed mean	3.490	20	575	.000

The ANOVA ($F(21,596) = 2.485$, $p = .000$) results indicate a statistically significant difference between group means. From table 39, the significance value is 0.000 ($p = .000$), which is below 0.05. and, therefore, there is a statistically significant difference between groups in the number of antenatal visits taken by pregnant women in Nigeria.

Table 39

ANOVA: Number of Antenatal Visits

Maternal death and pregnancy					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	79.108	21	3.767	2.485	.000
Within Groups	871.650	575	1.516		
Total	950.757	596			

From these results in table 40, it is clear that the variable respondent's health checked before discharge met the assumption of homogeneity of variance, and a one-way ANOVA test can be conducted given that the pre-selected p-value (0.05) is higher than the significant level (based on mean). The assumption of homogeneity was therefore not violated.

Table 40

Test of Homogeneity of Variances: Respondent's Health Checked Before Discharge

		Levene Statistic	df1	df2	Sig.
Maternal death and pregnancy	Based on Mean	0.597	1	241	0.440
	Based on Median	0.090	1	241	0.765
	Based on Median and with adjusted df	0.090	1	238.037	0.765
	Based on trimmed mean	0.489	1	241	0.485

The ANOVA ($F(1,242) = 0.090$, $p = .765$) results indicate whether there is a statistically significant difference between group means. From the table 41, the significance value is approximately 0.765 (i.e., $p = .765$), which is above 0.05. and,

therefore, there is no statistically significant difference in maternal mortality and respondent's health checked before discharge.

Table 41

ANOVA: Respondent's Health Checked Before Discharge

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.112	1	0.112	0.090	0.765
Within Groups	301.377	241	1.251		
Total	301.490	242			

From table 42, the variable knowledge of contraceptives did not meet the assumption of homogeneity of variance, given that the pre-selected p-value (0.05) is lower than the significant level. In such a scenario, the non-parametric equivalent of the Levene Statistic can be used to measure the homogeneity of the variables. The significance based on the median is used here, and the significance value is higher than the predetermined p-value (.0150>0.05), indicating that the assumption of homogeneity has not been violated in this case, and a One-Way ANOVA test can be performed. Below is a table summarizing the output from the ANOVA analysis.

Table 42

T*est of Homogeneity of Variances: Knowledge of Contraceptives*

		Levene Statistic	df1	df2	Sig.
Maternal death and pregnancy	Based on Mean	8.154	2	1108	.000
	Based on Median	1.903	2	1108	.150
	Based on Median and with adjusted df	1.903	2	1081.640	.150
	Based on trimmed mean	5.802	2	1108	.003

The ANOVA (F(3,1111) = 1.357, p = .254) results indicate a statistically significant difference between group means. From table 43, the significance value is 0.254 (p = .254), which is above 0.05. and, therefore, there is no statistically significant difference in the knowledge of contraceptives and maternal mortality in Nigeria.

Table 43

ANOVA: Knowledge of Contraceptives

Maternal death and pregnancy					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.341	3	1.780	1.357	.254
Within Groups	1453.485	1108	1.312		
Total	1458.826	1111			

The tests above show that postnatal care, as indicated by the entries in the pregnancy and postnatal care roster, did not meet the assumption of homogeneity of variance given that the pre-selected p-value (0.05) is lower than the significant level. In such a scenario, the non-parametric equivalent of the Levene Statistic can be used to measure the homogeneity of the variables. The significance based on the median is used here, and the significance value is still lower than the predetermined p-value (.0000<0.05), indicating that the assumption of homogeneity has been violated. A One-Way ANOVA test is performed with this in mind. Table 43 summarizes the output from the ANOVA analysis

Table 6

Test of Homogeneity of Variances: Entries in Pregnancy and Postnatal Care Roster

		Levene Statistic	df1	df2	Sig.
Maternal death and pregnancy	Based on Mean	18.996	3	1107	.000
	Based on Median	9.209	3	1107	.000
	Based on Median and with adjusted df	9.209	3	1029.716	.000
	Based on trimmed mean	18.892	3	1107	.000

The ANOVA (F(4,1111) = 9.187, p = .000) results indicate a statistically significant difference between group means. From table 44, the significance value is 0.000 (i.e., p = .000), which is below 0.05. and, therefore, there is a statistically significant difference in the number of postnatal care visits made by pregnant women in Nigeria and maternal mortality.

Table 7

ANOVA: Entries in Pregnancy and Postnatal Care Roster

Maternal death and pregnancy					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	46.870	4	11.717	9.187	.000
Within Groups	1411.957	1107	1.275		
Total	1458.826	1111			

Research Question 5 Inferential Analysis

RQ5: To what extent is there an association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery

checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

$H_0$5: There is no association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

H_a5: There is an association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

The multiple regression model summary table (table 45) below shows that 1.7% of maternal death is predicted by the access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use. This is shown by the coefficient of determination (R Square) value of 0.017. The multiple correlation coefficient (R), 0.129, shows the quality of the prediction of maternal death

by the four independent variables, which is a poor level of prediction. The ANOVA table 45 shows that the model is statistically significant F (4, 35493) = .379, p < .0005.

Table 45

Multiple regression model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.129[a]	.017	.017	.616	.017	150.545	4	35493	.000

a. Predictors: (Constant), Respondent's health checked before discharge, Knowledge of any method, Entries in pregnancy and postnatal care roster, Number of Antenatal visits during pregnancy

Table 46

ANOVA: Entries in Pregnancy and Postnatal Care Roster

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	228.514	4	57.129	150.545	.000[b]
	Residual	13468.815	35493	.379		
	Total	13697.329	35497			

a. Dependent Variable: Death and Pregnancy

b. Predictors: (Constant), Respondent's health checked before discharge, Knowledge of any method, Entries in pregnancy and postnatal care roster, Number of Antenatal visits during pregnancy

The multivariate coefficients table, table 47, shows the estimated model coefficients details. The multivariate model shows that the regression equation gives the relationship between the dependent and independent variables; $y = 1.366 + 0.074m - 0.07n - 0.024p + 0.058q$ where y, m, n, p, and q are the death and pregnancy, entries in

pregnancy and postnatal care roster, Number of Antenatal visits during pregnancy, Knowledge of any method, and Respondent's health checked before discharge values respectively. The associations of the variables are statistically significant, with significance values less than 0.05.

Table 47

Multivariate Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	1.366	.026		52.419	.000	1.315	1.417
	Entries in pregnancy and postnatal care roster	.074	.008	.052	9.701	.000	.059	.089
	Number of Antenatal visits during pregnancy	-.070	.004	-.104	-19.304	.000	-.077	-.063
	Knowledge of any method	-.024	.004	-.031	-5.787	.000	-.032	-.016
	Respondent's health checked before discharge	.058	.017	.018	3.384	.001	.024	.092

a. Dependent Variable: Death and Pregnancy

Summary

In this chapter, the variables present in the RQs were analyzed to determine the relationship between them and the magnitude of the relationship between them. I examined the effects of the four independent variables; antenatal care, postnatal care,

postnatal check before discharge, and knowledge and use of contraceptives to determine their effect and relationship with maternal mortality in Nigeria. I conducted descriptive analyses to describe the distribution pattern, frequency, and counts of the women who received antenatal care services, prenatal care before discharge, and knowledge of the use of contraceptives. Following the descriptive evaluation, an inferential analysis was done for the five RQs without accounting for socio-economic factors such as education level, income, and underlying factors that put women in great danger during delivery. Other characteristics such as personal and cultural beliefs were not in the study, but they will be discussed in the next section when describing the results and forming conclusions from the studies conducted. This study sought to analyze the relationship between maternal mortality and other variables such as maternal healthcare (antenatal visits, postnatal visits, and post-delivery checkups before discharge) and knowledge and use of contraceptives as thought factors to affect the maternal mortality rate. The factors affecting the independent variables were, however, not examined. Such factors include socio-economic factors and healthcare quality, among others that are theoretically known to influence the variables in question. From the statistical results obtained, it is clear that the variables in the RQs were significant in explaining differences in the dependent variable. The interpretation and findings of the study are discussed at length in Section 4.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

The main aim of this study was to investigate the association between pregnancy-related care (access to antenatal services and maternal health education knowledge of prenatal and postpartum care) and maternal mortality (pregnancy-related deaths in Nigeria). In Section 3, I analyzed the variables separately in line with the RQs. The variables included in the study were pregnancy-related death, number of entries in the pregnancy and postnatal care history, number of antenatal visits during the pregnancy, knowledge of contraceptive use, and health checkups before discharge after delivery. The analysis of variables was intended to show whether a correlation exists between maternal mortality and each of the other five variables.

In Section 3, I analyzed the variables to determine the type and magnitude of their relationship. The first level of analysis used was descriptive analyses, which were used further to describe the population's distribution pattern, frequency, and counts under analysis. Inferential analysis was then conducted individually for the five RQs to determine the relationship between independent and dependent variables. Out of the four independent variables measured in this study, antenatal care was a statistically significant variable in explaining maternal mortality. All the variables, number of antenatal visits, number of postnatal visits, checkup before discharge, and knowledge and use of contraceptives, were significantly associated with the dependent variable, maternal mortality. In Section 4, I shall interpret the findings in Section 4, highlight several

limitations of the study, and offer recommendations drawn from the results and conclusions.

Interpretation of the Findings

Research Question 1

RQ1: To what extent is there an association between access to antenatal care services as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria?

$H_0$1: There is no association between accessibility to antenatal care as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria.

H_a1: There is an association between accessibility to antenatal care as measured by the number of antenatal visits during pregnancy and maternal mortality in Nigeria.

I conducted the statistical analyses in line with the RQs. RQ1 sought to establish whether there was a relationship between the number of antenatal visits taken by the mother and maternal mortality, which was measured at different stages, including died while pregnant, since delivery (between birth and 6 weeks postdelivery), 6 weeks after delivery, and 2 months after delivery. For the relationship between died while pregnant and antenatal visits, all antenatal visits had a negative coefficient for the died while pregnant target group indicating an inverse relationship. The higher the number of antenatal visits, the less likely a woman was to die while pregnant. This implies that holding all other factors constant, a woman who attends more antenatal visits is less

likely to die while pregnant due to pregnancy complications. The antenatal care data used in this study included only that offered by a skilled healthcare provider such as a nurse, midwife, or doctor.

For the relationship between since delivery (between delivery and 6 weeks postdelivery) and antenatal visits, all antenatal visits had a positive coefficient for the died since delivery target group except those who had 2-3 antenatal visits. The results indicate that antenatal visits and death since delivery have a mixed relationship, and the optimum number of visits is 2-3 because the coefficient indicates a negative relationship.

For the relationship between died after 6 weeks and antenatal visits, all antenatal visits had a negative coefficient for the died while pregnant target group and all predictors were significant ($p < 0.05$). The results indicate that antenatal visits and death after 6 weeks are inversely related. Therefore, the results imply that a woman who attended the antenatal visits before birth is less likely to die at 6 weeks postdelivery than one who did not attend these visits. For the relationship between 2 months after delivery and antenatal visits, all antenatal visits had a negative coefficient for the died after 2 months of delivery target. However, all the values are nonsignificant predictor ($p > 0.05$). The non-significant values cannot be used to draw a conclusion in this study.

From the analysis, the antenatal parameter visit is only significant in explaining death while pregnant and death after 6 weeks of delivery. In both cases, antenatal visits and the two maternal mortality categories are inversely related. Therefore, I rejected the null hypothesis and concluded that there was an association between antenatal visits and maternal mortality for death during pregnancy and death after 6 weeks of delivery. This

conclusion is supported by studies carried out by other researchers showing that increased access to antenatal healthcare, especially in developing countries such as Uganda and Zambia, has reduced maternal mortality (Wang et al., 2016).

According to Wang et al. (2016), Zambia implemented a non-cash incentive program to try and increase the uptake of antenatal healthcare services. The result of the incentive was that the uptake of antenatal services increased in the country, leading to a direct reduction in maternal mortality. The same result was also observed in Uganda, where vouchers were offered to pregnant women enabling them to pay for their prenatal round trips to and from healthcare facilities and antenatal healthcare services. According to Alfonso et al. (2015), these vouchers increased the uptake of antenatal services, and the government recorded reduced mortality rates.

The results from the statistical test and the work done around antenatal care and maternal mortality show that maternal mortality and antenatal care are inversely related. The theoretical framework for this study, the theory of planned behavior, can explain why some women do not take up antenatal services. According to the NDHS data, younger women aged 20-34 years are more likely (69%) to seek antenatal care services than their older counterparts. This could be due to the level of education given that younger people in Nigeria are more educated than their older counterparts. Only 45% of women with no education demanded antenatal activities compared to 97% with secondary education.

The increase of formal education has shed some light on the benefits of antenatal care, replacing past beliefs of ”at-home care” with the behavior to seek proper antenatal

services. Most (93%) of women in the highest wealth quintile are likely to seek antenatal care services compared to only 41% of women in the lower quintile. This indicates that disposable income must also be a factor affecting the decision whether to seek antenatal care or not.

Research Question 2

RQ2: To what extent is there an association between access to postnatal care services as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria?

$H_0$2: There is no association between accessibility to postnatal care as measured by the number of entries in the pregnancy care history and maternal mortality in Nigeria.

H_a2: There is an association between accessibility to postnatal care as measured by the number of entries in the pregnancy and postnatal care history and maternal mortality in Nigeria.

I tested the variables in RQ2 the same way as for RQ1. The conclusions do not make logical sense for the relationship between died while pregnant, and entries in postnatal care entries as postnatal care is administered after birth, so death while pregnant and postnatal entries cannot be related. For the relationship between since delivery (between delivery and 6 weeks postdelivery) and postnatal care roster, all postnatal visits had a negative coefficient for the died since delivery target group except those who have 2-3 postnatal visits. All the values are nonsignificant predictors (p >0.05). The optimum

number of visits is identified at 3-4 visits since, at this point, the coefficient indicates a negative relationship.

For the relationship between 6 weeks after delivery and postnatal care roster, all postnatal visits had a negative coefficient for the died after 6 weeks of delivery target group except those who had 3-4 postnatal visits. All the values are nonsignificant predictors (p >0.05). The results indicate that postnatal visits and death since delivery have a mixed relationship. For the relationship between 2 months after delivery and postnatal care roster, all postnatal visits had a negative coefficient for the died 2 months after delivery target group. All the values are nonsignificant predictors (p >0.05). The results indicate that postnatal visits and death since delivery have an inverse relationship.

The results from the statistical test and the work done around postnatal care and maternal mortality show that the two variables are inversely related. The theoretical framework for this study, the theory of planned behavior, can explain why some women do not take up postnatal services. According to the NDHS data, 81% of women who give birth in healthcare facilities are more likely to receive a postnatal health check within 2 days of delivery than 15% of women who deliver outside medical centers. The decision on where to deliver seems to affect the attitude towards seeking postnatal care services. The majority (61%) of women in urban areas are also likely to seek and receive postnatal care within 2 days of delivery compared to 30% in rural areas.

It is clear from this statistic that postnatal care increases with more education and wealth. The negative relationship between postnatal care and maternal mortality should motivate policymakers to ensure that widespread knowledge of the benefits of postnatal

care is spread to the population and the price of such services subsidized to encourage the uptake of these services. This may close the education and wealth gap that deters some women from seeking such services.

Research Question 3

RQ3: To what extent is there an association between delivery checkup service as measured by postnatal check discharge after delivery and maternal mortality in Nigeria?

$H_0$3: Delivery checkup services as measured by postnatal check before discharge after delivery have no association with maternal mortality in Nigeria.

H_a3: Delivery checkup services as measured by postnatal check before discharge after delivery have an association with maternal mortality in Nigeria.

RQ3 centered on the relationship between maternal mortality and respondent's health checked before discharge. I examined the variable maternal mortality in the same way, similar to the other RQs. For the relationship between the death of pregnant and the respondent's health checked before discharge, the entry had a negative coefficient for the died since the delivery target group. In this case, the conclusions do not make logical sense given that the respondent's health checked before discharge is administered after birth, so death while pregnant and respondent's health cannot be compared.

For the relationship between since delivery (between delivery and 6 weeks postdelivery) and respondent's health checked before discharge, the entry had a negative coefficient for the died since delivery target group. However, the value is nonsignificant predictors ($p > 0.05$). For the relationship between 6 weeks, postdelivery, and respondent's health checked before discharge; the entry had a negative coefficient for the

died after 6 weeks of the delivery target group. However, the value is nonsignificant predictors ($p > 0.05$). The results indicate that respondent's health checked before discharge and death 6 weeks after delivery have an inverse relationship. For the relationship between 2 months, postdelivery and respondent's health checked before discharge; the entry had a strong negative coefficient for the died after 2 months of delivery target group. However, the value is nonsignificant predictors ($p > 0.05$). The results indicate that respondent's health checked before discharge and death 2 months after delivery have an inverse relationship.

Even though all the variables are nonsignificant in this study, there is a negative correlation between maternal mortality and checked before discharge. The WHO (2018) advocates monitoring/continuum care because a checkup after delivery helps medical professionals monitor the patients' health early enough before the postnatal checks. A skilled medical doctor can do checkups after delivery, and the traditional midwives as these delivery services are done to ensure that both the mother and the newborn infant are in good health.

Research Question 4

RQ4: To what extent is there an association between knowledge of contraceptives use as measured by the knowledge of contraceptive use associated and maternal mortality in Nigeria?

$H_0$4: There is no association between the knowledge of contraceptives as measured by the knowledge of contraceptive use and maternal mortality in Nigeria.

H_a4: There is an association between the knowledge of contraceptives use as measured by the knowledge of contraceptive use and maternal mortality in Nigeria.

RQ4 focused on the relationship between knowledge of any contraceptive method and maternal mortality. I similarly tested the variables as the other RQs. For the relationship between died while pregnant and knowledge of any method, all the coefficients are positive for the died while pregnant target group. However, the values are nonsignificant predictor ($p > 0.05$). The results indicated that knowledge of contraceptive use and died while pregnant have an inverse relationship. This indicates that an individual who knows modern methods is less likely to die during pregnancy than one who knows no knowledge of any method, only traditional methods, only folkloric methods, and the other maternal mortality categories.

For the relationship between since delivery (between delivery and six weeks post-delivery) and knowledge of any method, all the coefficients are positive for the since delivery target group except the individuals who know traditional methods. However, the values are non-significant predictors (significant value> 0.05) except for the knowledge of no method predictor. For the relationship between 6 weeks after delivery and knowledge of any method, all the coefficients are positive for the "died 6 weeks after delivery" target group except those who know folkloric methods. However, the values are non-significant predictor (significant value> 0.05). In this case, an individual who knows modern methods is less likely to die 6 weeks after delivery, as compared to one who

knows, has no knowledge of any method, those who know only traditional methods, and those who only know folkloric methods as well as the other maternal mortality categories

In the relationship between died 2 months after delivery and knowledge of any method, all the coefficients are all negative for the “died 2 months after delivery” target group. However, the values are non-significant predictors (significant value> 0.05). The results indicate that knowledge of contraceptive use and died 2 months after delivery have an inverse relationship. In this case, an individual who knows modern methods is less likely to die 2 months after delivery than one who knows has no knowledge of any method, those who know only traditional methods, and those who only know folkloric methods as the other maternal mortality categories.

According to the NHS data, contraceptives are more common among women living in urban areas than those living in rural areas. The analysis further dissects down into the use of modern and traditional methods. Approximately 29% of women living in urban areas use modern forms of contraceptives compared to only 2% living in rural areas who use modern methods. Education also plays a crucial role in the choice of contraceptives used by women; from the NDHS data, modern contraceptives are higher (23%) among those who have received at least a secondary education compared to 4% among those with no education. The traditional methods of contraceptives, such as the rhythm method used by most women, were ineffective mainly because over half the women who misused this method perceived the fertility period, making the method not as effective.

This study is grounded on the theory of planned behavior which seeks to understand how culture and beliefs may affect maternal mortality. According to the survey done and the NDHS data, over 66% of married women relied on their partners to make decisions surrounding contraceptives. This is in line with the traditional culture in most states, where men make most decisions. Therefore, women take a laid-back approach when deciding the methods of contraceptives to be used. This laid-back approach also impacts the knowledge of contraceptives among individual women.

Maternal mortality and use of contraceptives are inversely related despite the coefficients from the analysis being non-significant for this study. The use of contraceptives can lower the maternal mortality rate by preventing high-risk births, births to women who are too young or too old, and close birth intervals. A study conducted by Ahmed, Li, Liu, and Tsui in 172 countries on whether contraceptives prevent maternal deaths concluded that an increase in the use of contraceptives in developing countries could lower the maternal mortality rate by at least 25%.

Research Question 5

RQ5: To what extent is there an association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

$H_0$5: There is no association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

H_a5: There is an association between access to antenatal care services as measured by the number of antenatal visits during the pregnancy, access to postnatal care services as measured by the number of entries in the pregnancy, delivery checkup service as measured by postnatal check discharge after delivery, knowledge of contraceptives use as measured by the knowledge of contraceptive use, and maternal mortality in Nigeria?

The multiple regression performed for this RQ measured the association between the dependent and independent variables as promulgated by the study's theoretical foundation, the theory of planned behavior that links a person's belief to their behavior. The theory looks at the attitude, subject norms, and perceived behavioral control, which together shape an individual’s behavior. From the above analysis, 1.7% of maternal deaths are explained by a combination of the independent variables. Although there is a low form of correlation, all variables are statistically significant in the model equation. The analysis of the individual variables paints a better picture of how the individual variables relate to maternal mortality. Antenatal care services, access to postnatal care

services, delivery checkups, and knowledge of contraceptives significantly influence maternal mortality.

Limitations of the Study

One of the limitations of this study is the use of secondary data via a cross-sectional design since the data may not have captured current development, and any advancements by the government to improve the healthcare system may not have been captured in the data set. Due to this limitation, the results from the study cannot be used to infer any causal relationship between the variables. The quantitative nature of the data may fail to capture subjective experiences accurately since the questionnaire used is not open-ended. The information recorded from participants may also not be free from bias. Some may not have felt comfortable answering personal and sensitive questions such as the method of contraceptives used.

Another limitation is the NDHS data is the lack of or insufficient and inaccurate birth and death registry in most health facility delivery in Nigeria healthcare facilities which could distort the accuracy of the information used from the secondary source (NDHS, 2018). The lack of completeness of some data may have impacted the internal validity of the study. The data set to be analyzed is only limited to a few risk factors that could influence maternal mortality. The research does not involve additional data sets with similar information for comparison with the DHS data set. This means it is impossible to know whether the samples were randomly selected from the population or accurately represent the Nigerian population.

The limitation of generalizability comes about due to selection bias, which describes an interviewer's bias when selecting the participants to include in the data set after the survey. The features of the samples collected may be due to their geographical location being wholly or partly responsible for the conclusions made in the study. This factor, therefore, makes generalizability harder and almost inaccurate.

Recommendations

RQ1 focused on the relationship between antenatal care services and maternal mortality. A negative relationship was identified between these variables indicating that maternal mortality can be reduced by increasing the frequency of antenatal care services. The uptake of antenatal care services has been low, especially in developing countries, is due to the cost of antenatal care services and traditional beliefs. According to the 2019 poverty and inequality report, 40 percent of Nigerians live below poverty (World Bank, 2020). This shows that the ability to afford healthcare services may be difficult for most people in the country. It may be necessary for the government to consider subsidizing healthcare charges to the level most people can afford, especially pregnant women and children. As analyzed above, in Nigeria, most women living in urban areas who have received education or are considered wealthier are more likely to seek antenatal care services than their counterparts.

Most developing countries such as Uganda, Zambia, and Kenya have adopted an incentive to encourage women to seek antenatal care services. Policymakers in Nigeria can incorporate an incentive system such as a non-cash voucher system to subsidize the cost of antenatal care and encourage more women, especially from low-income areas, to

seek out these services. Notwithstanding, policymakers should also address the shortcomings of traditional beliefs where some communities are either against or do not believe in modern medicine and opt to do things the traditional ways. While changing people's beliefs can be difficult, policymakers can incorporate modern medicine into the traditional beliefs simply to ensure mothers are more comfortable.

One way to do this is to educate the traditional midwives on the importance of antenatal care services. The midwives can be instrumental in convincing women to seek out these services more. The midwives can also be trained on performing standard antenatal check-ups on pregnant women to make them more comfortable with the process even before they go to the health centers for the complete checkup. According to Chukwuma et al. (2019), monetary incentives can increase the uptake of antenatal care services, reducing the risk of maternal deaths due to unskilled care. The study, however, found that seeking such services is just a part of the equation; ensuring the quality of services provided in the healthcare centers is vital to ensure the communities can reap from the health gains of skilled healthcare. The combination of professional services and the increased number of women seeking these services will likely reduce maternal mortality rates in Nigeria.

RQ2 focused on the relationship between postnatal care services and maternal mortality. A negative relationship was identified between these variables indicating that maternal mortality can be reduced by increasing the uptake of postnatal care services despite the coefficients not being significant. The WHO approximates that half of the maternal deaths occur within 24 hours of delivery. In line with this statistic, the Nigerian

Government recommends that women who give birth receive care from a professional medic within the first 24 hours of giving birth for those in a health facility. For the women who have home births, the recommended time for a postnatal check by a medical professional is 12 hours. According to the statistics from the NDHS data, education, wealth, and choice of birthplace play a crucial role in determining the uptake of postnatal care services.

Policymakers need to educate the public on the importance of delivery in healthcare facilities which will, in turn, increase the chances of new mothers getting access to postnatal services. In terms of wealth, Chukwuma et al. (2019) researched whether cash incentives can increase the number of referrals for postnatal care done by TBAs. The incentive offered to the TBAs was 25% of their average income earned per pregnancy. This study showed that the cash incentive increased the number of women receiving postnatal care services due to referrals from the TBAs. The study also showed that access to postnatal care was only part of the problem; accessing skilled medical services remains a challenge. Policymakers should focus on the quality and cost of postnatal care, which may prevent women from seeking postnatal care services despite the referrals by the TBAs. Policymakers should also focus on quality and cost to complement the awareness being done by the TBAs.

RQ3 focused on check-up services after delivery and maternal mortality. Check-up services are essential to ensure the newborn and the mother are in good health. Since not all women give birth in medical centers, traditional midwives should also be trained to perform immediate check-up services after delivery to ensure they check the initial

health of the newborn and mother even before they get a chance to seek postnatal care services. Policymakers should design training sessions that guide the traditional midwives on what to check for immediately after delivery. For the women who give birth in medical facilities, doctors and nurses should have a checklist to lookout for any complications resulting from delivery. This will ensure that the mothers are in good health, and the postnatal care services will complement the checkup done before discharge.

RQ4 focused on the relationship between contraceptive use and maternal mortality. The use of contraceptives was divided into traditional and modern methods of contraceptives. In developing countries, the leading causes of maternal mortality include unsafe abortions, sepsis, and hemorrhage, which are some emergency conditions that sometimes cannot be prevented by antenatal care services. Such services may therefore be ineffective in avoiding some of the leading causes of maternal mortality. The proper use of contraceptives can prevent leading causes of maternal mortality, such as unsafe abortions since people can decide the right time to have children and not undergo unsafe abortions. The government can increase awareness of the modern methods of contraceptives available to women. Policymakers should also ensure all hospitals are equipped with professionals who can help women understand the different methods available to them and ensure they train them on the proper use of these contraceptives.

Providing total care for pregnant women can significantly reduce maternal mortality. This study analyzed different aspects of the total care recommended by the WHO for pregnant women, such as antenatal care, postnatal care, use and knowledge of

contraceptives, and check-up services before discharge from the hospital. While the provision and uptake of these services are expected to reduce maternal mortality, improving the quality of these services will improve their efficiency. This study, however, does not analyze the effects of the quality of these services on maternal mortality. Other studies can analyze this research gap to encourage policymakers to improve the quality of healthcare services in medical facilities. Further research can also be conducted to examine the benefits of training the traditional midwives on modern procedures when performing check-ups and how such pieces of training can be used to reduce maternal mortality.

RQ5 combines the four factors influencing maternal death: patient's health checked before discharge, knowledge of methods of contraceptives, pregnancy, and postnatal care checkups, and attendance to antenatal visits during pregnancy. Patient's health checked before discharge, knowledge of methods of contraceptives, pregnancy, and postnatal care checkup, and attendance to antenatal visits during pregnancy directly influences maternal deaths. A combined effort to deal with each issue calls for a structural arrangement of Nigeria's ministry of health to facilitate and follow up on these issues. Nurses need to be empowered through training and motivation to ensure they conduct their roles competently. This way, they will ensure every mother is checked before discharge and given proper guidance. Health community workers need to be equipped with knowledge and materials to train women who do not need to visit healthcare facilities during pregnancy and after delivery. They should also convince

people of the importance of family planning and teach them the various family planning methods.

Implications for Professional Practice and Social Change

The findings in this study provide the information needed to inform public health policy decisions in Nigeria. The government should ensure barriers such as education and wealth do not deter pregnant women from seeking maternal services. These gaps can be breached by subsidizing the cost of maternal healthcare services and ensuring there is widespread education on the benefits of seeking such services. The report released by the National Bureau of Statistics concerning Nigeria's poverty and inequality implies a need for an intervention to deal with poverty (The World Bank, 2020).

The government needs to determine the statistics of individuals who can access healthcare services and highlight the barriers people encounter. Improving infrastructure would ease accessibility to healthcare facilities and attract more investors in the health sector to provide care to the communities. Equipping learning institutions with materials and personnel and conducting community health awareness campaigns would enlighten more people on the benefits of reaching out to healthcare professionals to get help. The education and knowledge can be passed through regional campaigns headed by traditional midwives familiar with the people in a specific region.

Part of the knowledge given should be around the cost of such services, as some people believe the cost of the services is too high, deterring them from seeking maternal healthcare services. This combination of practices will likely create change among women to seek these services from medical professions, reducing preventable maternal

deaths. Knowledge of using contraceptives is crucial in maintaining a healthy community. Men and women need to be taught the importance of contraceptives and their proper use. There is a need to demystify contraceptive use since there are unmet needs for family planning, especially in developing countries, due to myths and misconceptions behind contraceptives (Sinai et al., 2020). This culture shift will also influence generations to come ensuring the maternal mortality numbers keep declining over the years in Nigeria.

Conclusion

Out of the four independent variables measured in this study, antenatal care was a statistically significant variable in explaining maternal mortality. All the variables, number of antenatal visits, number of postnatal visits, checkup before discharge, and knowledge and use of contraceptives were significantly related to the dependent variable, maternal mortality. This indicates that total care for a pregnant woman is critical in reducing the number of maternal deaths. Due to their affordability, the quality of care needs to be improved even as more women are encouraged to seek out these services, especially in government facilities. In the long run, the positive social change that will result from this study is that the government needs to do more to reduce the knowledge gap of these services as well as subsidize the prices of such services to ensure they are accessible to everyone, including the not so wealthy in the society.

While other factors such as level of education were not tested in the study, the NDHS data set used for this study included the education level and status of women who took part in this study, helping to form conclusions on how such characteristics affected

the uptake of maternal healthcare services. These social factors identified as hindrances to the uptake of maternal healthcare services need to be addressed by the governed to reduce maternal mortality. Moreover, this study can be used as training material. Public health officers can use it to inform the public, especially mothers susceptible to pregnancy complications, on possible actions that will enhance their well-being. Scholars and healthcare practitioners can understand the breadth of the maternal mortality problem and come up with innovative and evidence-based solutions.

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