

Predicting Maternal Complication among Underserved Women based on the Demographic Composition

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ABSTRACT

Maternal complications remain a significant public health issue in Nigeria, particularly among underserved women. Underserved women, particularly those from low-income backgrounds, are at higher risk of maternal complications due to limited access to quality healthcare services. This study aimed to identify the factors that contribute to the maternal complications among underserved women based on the demographic composition. The research was carried out in Ondo State, Nigeria. The research designed a well-structured questionnaire (primary data), and each copy of the questionnaire was distributed among the pregnant women who visited the maternal centers in the state. The data collected was collected in the urban city of Ondo State, Nigeria. The participants are pregnant women within the reproductive age (15 – 49 years) and their gestation period are between 10 to 36 weeks or women who have undergone caesarean section before. The population of the pregnant women varied according to the maternity centers. The study was analyzed using logistic regression analysis. The study concluded that maternal complications are multifactorial, which means that a number of different variables, including maternal age, pre-existing medical conditions, prenatal care use, access to healthcare facilities, and level of education. While occupation may be one of the contributing factors, in the absence of other pertinent factors, it may not independently predict maternal complications. The study, therefore, recommended that it is crucial to improve access to prenatal care, tackle socioeconomic disparities, and enhance cultural competence in healthcare delivery.

Keywords: Inference, Demographic Composition, Maternal Complications, Medical Condition, and Reproductive Age.

INTRODUCTION

Maternal complications refer to any medical issue or condition that arises during pregnancy, childbirth, or the postpartum period that affects the mother's health. Maternal complications can range from mild to severe and can include physical, psychological, or emotional problems. Some examples of maternal complications include gestational diabetes, pre-eclampsia, postpartum hemorrhage, infections, hypertension, depression, and anxiety. These complications can cause significant health problems for the mother and may require medical intervention to manage or treat.

Despite the efforts to improve maternal health outcomes, Nigeria still accounts for a significant proportion of maternal deaths worldwide. According to the World Health Organization (WHO), Nigeria has one of the highest maternal mortality rates in the world, with an estimated 512 maternal deaths per 100,000 live births (WHO, 2019). Maternal complications remain a significant public health issue in Nigeria, particularly among underserved women. Underserved women, particularly those from low-income backgrounds, are at higher risk of maternal complications due to limited access to quality healthcare services. According to Jenifer et al. (2013), underserved women are more likely to experience complications such as hemorrhage, hypertension, sepsis, and obstructed labor, due to pre-existing medical conditions, lack of prenatal care, and limited access to skilled birth attendants during pregnancy and childbirth.

Understanding the impact of demographic factors on maternal health outcomes among underserved women

is critical for developing effective interventions and policies that can reduce maternal morbidity and mortality in Nigeria. The Sustainable Development Goal (SDG) 3 aims to reduce maternal mortality to less than 70 per 100,000 live births by 2030, but this target may not be achieved in Nigeria without addressing the underlying factors that contribute to maternal complications among underserved women.

Research has shown that the risk of maternal complications is higher among underserved women in Nigeria due to a range of factors, including poor access to healthcare services, inadequate antenatal care, and limited education (WHO, 2019 & Tukur et al. 2020). However, the extent to which demographic factors contribute to these disparities is not well understood. Thus, the main objective of this paper is to discover the variables that lead to maternal complications among underserved women in Nigeria. The demographic variables to be considered in this study include age, socioeconomic status, health status, marital status, healthcare access and utilization, maternal health behaviors, and maternal health interventions. By identifying the key demographic factors associated with poor maternal health outcomes, this study can inform targeted interventions and policies to improve maternal health outcomes in Nigeria. This study aimed to identify the factors that contribute to the maternal complications among Underserved Women based on the Demographic Composition. The study used demographic characteristics such as maternal's age, place of residence, occupation, level of education, frequency of visiting the antenatal, marital status, religion, and birth order.

LITERATURE REVIEW

Maternal complications during childbirth remain a significant public health concern in developing countries, where access to quality obstetric care may be limited. The most common maternal complications during childbirth in these settings include postpartum hemorrhage, preeclampsia/eclampsia, and sepsis (Betts et al. (2019)). The incidence of these complications is often higher in developing countries than in developed countries, leading to increased maternal morbidity and mortality (Getachew et al. 2011). Obvious strategies to reduce maternal morbidity and mortality during childbirth in developing countries include improving access to quality obstetric care, emergency obstetric services, and the use of evidence-based guidelines for the management of common complications.

Numerous studies have delved into the risk factors that indirectly contribute to the prevalence of maternal complications in developing countries. Kabali, Gourbin, and De Brouwere (2011) have shed light on the significant impact of financial resources and social influence on women's survival in Kinshasa, Democratic Republic of the Congo. Women who lack financial resources may be deprived of care, increasing their likelihood of severe complications that may lead to dire consequences. Similarly, Der et al. (2013) have identified infections outside the genital tract, anemia, sickle cell diseases, pulmonary embolism, and disseminated intravascular coagulation as risk factors for maternal complications in Ghana. This finding has been corroborated by Kumar and Dhillon (2021) in India. In fact, Kumar and Dhillon (2021) have developed a structuring equation model to construct two latent variables – maternal complications and delivery. The authors have found that socioeconomic and demographic risk factors significantly affect these latent variables, including age, household wealth index, education, place of residence, mass media usage, and antenatal care visits.

Research has consistently shown that education plays a crucial role in improving maternal health outcomes. In fact, studies have found that women with lower levels of education are at a higher risk of maternal complications and mortality, even when they have access to facilities providing intrapartum care in Africa, Asia, and Latin America (Karslen et al., 2011). Furthermore, education has been found to decrease the likelihood of unwanted pregnancies, which can result in unsafe abortions and maternal complications (Weitzman et al., 2017). A study conducted in Ethiopia using multilevel modeling also found that women with secondary or higher education had a lower risk of maternal mortality compared to those with no

education (Ketema et al., 2019). The link between low educational attainment and increased maternal complications can be attributed to a lack of knowledge about proper prenatal and postnatal care (Lee et al., 2016).

Based on empirical data, the World Health Organization (WHO) reported in 2023 that women in low-income countries face a higher lifetime risk of maternal complications. Similarly, a study conducted by Lee et al. in 2016 found their modeling that women from low socioeconomic backgrounds were more likely to experience maternal complications such as obstetric hemorrhage, hypertensive disorders, and sepsis. The study also revealed that these women were less likely to receive appropriate care, such as skilled attendance at delivery and emergency obstetric care, which further increased their risk of complications. Expectedly, income has been identified as a significant predictor of maternal complications. Women from low-income backgrounds may lack access to quality healthcare services, leading to delayed or inadequate treatment of complications. This was corroborated by empirical data obtained from the work of Titaley et al. in 2010 in Indonesia. Kane's (2016) study found that married women tend to have a greater sense of responsibility when it comes to engaging in health-promoting activities, which ultimately reduces their risk of complications. This could be due to the support and encouragement they receive from their spouse and family. However, Barr et al. (2019) came to a different conclusion. They found that unmarried women are less likely to engage in healthy behaviors and receive appropriate care, social support, and financial assistance. This lack of support and resources can increase their risk of experiencing complications during pregnancy and childbirth.

Maternal health behaviors are crucial in predicting maternal complications in underserved populations. Smoking, alcohol consumption, and poor nutrition are some of the factors that can lead to adverse outcomes during pregnancy. A study conducted in the Guelinckx et al. (2008) revealed that women who consume high-energy and high-fat diets, are physically inactive, and smoke are more likely to become obese. This finding is significant because obesity is a risk factor for early and late postpartum complications, as reported by Hassan et al. (2022). Moreover, poor nutrition during pregnancy has been linked to a higher risk of maternal complications, such as preeclampsia and anemia (UNICEF, 2010). These complications can have serious consequences for both the mother and the baby. Therefore, it is essential to promote healthy behaviors and provide adequate nutrition to pregnant women and provide sound health facilities for intervention planning and execution, especially in underserved populations regions. Studies have shown that women who receive these interventions have a lower risk of experiencing complications during childbirth. For example, a study conducted by Graham et al. (2018) found that women who gave birth in healthcare facilities with skilled birth attendants had a lower risk of maternal complications, such as postpartum hemorrhage and sepsis.

Nigeria is home to several women at risk of maternal complications. Studies have shown that access to healthcare and utilization of healthcare services are the crucial factors in predicting maternal complications in underserved populations in Nigeria (Fawole & Adeoye 2015). Women who have limited access to healthcare services or who do not seek healthcare services during pregnancy and childbirth are at a higher risk of experiencing complications. Shockingly, a study conducted by Doctor et al. (2013) found that only 25% of women in rural areas of Nigeria received antenatal care during their pregnancy, which is significantly lower than the national average of 61%. This lack of access to healthcare services has resulted in a higher incidence of maternal complications, such as eclampsia and postpartum hemorrhage, among women who did not receive antenatal care. Furthermore, a study conducted by Duru et al. (2017) in Imo state, Nigeria, reported a general poor health-seeking behavior and attitude among households. This finding was corroborated by the study of Sharma et al. (2017) where the authors further concluded that demand for health service in Jigawa state of Nigeria is far relatively higher than the supply. In addition, health care centers struggle with low quality care and unavailability of health workers, which consequently discourage the populace from using health care services. More recently, Oghenetega et al. (2020) identified environmental pollution, such as oil pollution, to be a risk factor of maternal complication in the Niger Delta of Nigeria and suggested that women and health workers should consider oil pollution to be a consequential

impact on complication.

Although several studies in Nigeria have identified risk factors for maternal complications, there has been a lack of focus on developing predictive models for these complications. Many of these studies have relied solely on empirical evidence and multilevel modeling, which may not provide a comprehensive understanding of the likelihood of a woman experiencing complications during childbirth. Therefore, it is crucial to develop a locally based predictive model that can accurately predict the likelihood of a pregnant woman experiencing complications before, during, and after birth based on demographic factors. This model could potentially improve maternal health outcomes and inform healthcare providers on appropriate interventions to prevent or manage complications.

METHODOLOGY

The research was carried out in different maternity centers, Ondo State, Nigeria. Ondo State is in the southern part of Nigeria with an estimated population of 5.3 million. The state covers 15.049km² and the population density is currently pegged at 410.3/km². The research designed a well-structured questionnaire (primary data), and each copy of the questionnaire was distributed among the pregnant women who visited the maternal centers in the state. The data was collected in six (6) maternity centers in the urban city of Ondo State, Nigeria.

The underserved women were chosen based on the wealth index. The people whose household income has less than the federal poverty level (30, 000 naira) and experiencing poverty are interviewed. Also, the women whose age are between less than <18 years are also interviewed because we believed that women within the age bracket might not meet up with income within the age bracket.

The participants are pregnant women within the reproductive age (15 – 49 years) and their gestation period are between 10 to 36 weeks or women who have undergo caesarean section before. The population of the pregnant women varied according to the maternity centers. For the purpose of the study, two hundred (200) copies of questionnaire were printed and distributed during the survey but only 183 copies of questionnaire were used and coded accordingly.

We adopted a Bayesian approach for the data analysis and the data was coded using SPSS (Statistical Package for the Social Sciences) version 25 to analysis the primary data distributed among the pregnant women. The data was analyzed using logistic regression model and the function was link to covariate probability. The logistic regression model is defined as:

$$\text{logit}(P) = \ln\left(\frac{P}{1-P}\right) = a + bx$$

Where P indicates that the pregnant women has expressed complication either during the current pregnancy or previous one.

RESULTS AND DISCUSSION

A total of 183 pregnant women were eligible and participated in the research with only 17 (8.5%) didn't meet the criteria for the underserved women defined in the methodology. The demographic characteristics of the participants showed that the participants lived in the urban area of Ondo State, Nigeria with only 39 (21.3 percent) of the total participants lived in the rural area of Ondo State, Nigeria. About half of the participants (41.5 percent) are between 15 – 24 years; 37.2 percent are 25 – 34 years; and 2.2 percent of the participants are < 15 years with no pregnant women > 49 years. With respect to the martial status, 159 (86.9

percent) of the pregnant women are married; 13.1 percent are single, and no pregnant women was either separated, widowed or divorced.

The interviewed pregnant women had a secondary school leaving certificate showing 55.2 percent; 29.5 percent had primary school certificate, and 15.3 percent had higher level of education which include OND, NCE and HND and none of the participant has no education. The study also showed that most of the pregnant have one business or the other they are involved in. Most of them are self-employed (49.7 percent) and their businesses include hairdressing, tailoring, trading, among others. 26.2 percent worked in private organizations, and they worked as secondary school teacher, receptionists, secretariats, salesgirls, and others. Despite all these kinds of occupation, 24.1 percent of the pregnant women are unemployed, and the working type earned less than 30, 000 naira on a monthly basis. All the three types of religion practiced in Nigeria are interviewed even though most of the participants are Christian and the participants had previous child through vaginal birth. The majority of the participants are pregnant with their first child or their second child. 60.7 percent always visit the health facilities during their antenatal care even though some respondents said they either visit sometimes and some could not determine their visitation to the health facilities during antenatal.

The result of the posterior mean showed that there is a difference between the pregnant women who lived in urban area and the rural area. The pregnant women living in the urban area are less likely to develop maternal complication. This is a result of the women living in the rural area might have a lower socio-economic status which is associated with limited access to quality health care, inadequate nutrition and insufficient prenatal care as these contributed to an increased risk of maternal complications. Lack of access to healthcare facilities, skilled birth attendants, and emergency obstetric care can all contribute to higher rates of maternal complications. The pregnant women whose age ranges between 15 to 34 years might not developed complication during and after childbirth and they are significant while mothers whose ages are > 35 years might develop a maternal complication. Also, the mothers whose ages are > 35 years can either increased their risk of complications during pregnancy and childbirth because they are likely involved in ageing of the maternal cardiovascular and endocrine systems which impacted upon placental function.

Women's education level is an important aspect of this research. Educational level is insignificant, and the primary and secondary categories of education do not determine whether the mother would develop a complication or not. Women with higher level of education are less likely to develop the complication. Limited education can impact a woman's knowledge about pregnancy, childbirth and proper prenatal care, potentially increasing the risk of complications. The marital status of the woman does not determine their maternal complication during or after birth.

The range of available occupations in underserved areas with limited economic opportunities may be limited. This may lead to a fairly uniform distribution of occupations among women, making it challenging to make direct connections between a person's profession and maternal complications. Hence, occupation is insignificant. With regards to the religion of the pregnant women, there is significant difference between the religion and women with others might not develop a maternal complication either during the pregnancy or after the childbirth. Cultural beliefs, practices, and norms may have an impact on how women seek healthcare and make decisions, which may have an impact on how maternal complications are managed. A significant difference occurs in the birth order because women who childbirth is more than 1st or 2nd birth might develop complications.

It's essential to receive prenatal care on schedule if you want to identify and treat any potential complications early on. Utilizing antenatal care services insufficiently can raise the risk of complications for the mother. This leads to reason why women who always visit the antenatal regularly might not develop maternal complication when compared with women who do not visit the antenatal. A key factor in preventing and managing maternal complications is the accessibility of well-equipped healthcare facilities,

including qualified medical staff and crucial obstetric services, therefore, women who visited the health facilities might have the opportunities to prevent maternal complication.

Table 1: Socio-demographic Characteristics and effect of Maternal Complications.

Variable	Socio-demographic Characteristics		Effect of Maternal Complication	
	Frequency Distribution	Percentage Distribution	P.Mean	95% CI
Place of residence				
Rural	39	21.3	Ref	
Urban	144	78.7	-0.065	(-0.012, -0.105)
Total	183	100		
Age of the Respondent				
< 15 years	4	2.2	Ref	
15 – 24 years	76	41.5	0.014	(-0.015, 0.076)
25 – 34 years	68	37.2	0.039	(-0.010, 0.043)
35 – 49 years	35	19.1	-0.058	(-0.018, -0.071)
Ø 49 years	0	0	-0.156	(-0.011, -0.081)
Total	183	100		
Marital Status				
Single	24	13.1	Ref	
Married	159	86.9	0.012	(0.011, 0.023)
Divorced/Widowed	0	0		
Total	183	100		
Level of Education				
No Education	0	0	Ref	
Primary School	54	29.5	0.121	(-0.011, -0.033)
Secondary	101	55.2	0.014	(-0.011, -0.041)
Higher	28	15.3	-0.065	(-0.071, 0.061)
Total	183	100		
Occupation				
Unemployed	44	24.1	Ref	
Self-employed	91	49.7	0.123	(-0.010, 0.043)

Private worker	48	26.2	0.149	(-0.018, 0.081)
Total	183	100		
Religion				
Others	19	10.4	Ref	
Christian	91	49.7	0.051	(-0.043, 0.061)
Muslim	73	39.9	0.064	(-0.014, 0.103)
Total	183	100		
Birth Order				
1 st & 2 nd birth	113	61.7	Ref	
3 rd – 7 th birth	67	36.6	0.017	(0.011, 0.019)
7 th birth	3	1.7	0.165	(0.033, 0.131)
Total	183	100		
Respondent health Care during pregnancy/ frequency of visiting antenatal				
Not often	12	6.6	Ref	
Sometimes	47	25.6	0.021	(0.005, 0.041)
Always	111	60.7	-0.035	(-0.103, -0.061)
I can't determine	13	7.1	0.015	(0.009, 0.040)
Total	183	100		

P. Mean indicates Posterior Mean and 95% – 95 credible interval.

Source: Researcher's Field Survey, 2023.

Discussion of Findings

Predicting maternal complications among the underserved women based on the demographic composition is an essential step in improving maternal healthcare outcomes. The study requires an approach that considers the diverse factors contributing to complications and leverage data-driven insights to develop targeted interventions. The research shows a significant difference between people who lived in rural and urban areas even though the number of people from rural area is small compared with the number of people living in the urban area. Differences in predicting maternal complications among underserved women in rural and urban areas result from variations in healthcare access, socio-economic conditions, demographic factors (Barnett et. al., 2014). The work of Case et. al., (2018) and Gu et. al., (2017) was in line with this research which tailored interventions and healthcare policies on improving maternal health outcomes in both settings.

In the study, the result of Kim, (2016) found that marital status can be a significant factor influencing maternal complications among underserved women, with single women often facing higher risks due to

limited social support and resources. The effect of employment status, whether unemployed, self-employed, or in private work may not be significant when healthcare quality is relatively uniform across employment categories. This indicated that maternal complication rates in this context might be more influenced by broader socio-economic factors and quality of healthcare services rather than the specific employment status of the women as explained in the study of Joseph et. al., (2007) and Kozhimannil et. al., (2016).

The frequency of antenatal visits may not significantly affect the maternal complications like the quality of care, socioeconomic conditions, and access to healthcare are relatively uniform across visit frequencies. The research of Hobel et. al., (2008) discovered that there are more complication rates which may be strongly influenced by these broader determinants of health rather than the frequency of prenatal visits. Pregnancies can vary by birth order and influence maternal health. Short interpregnancy intervals are associated with an increased risk of complications, and this can differ between first and subsequent pregnancies (Conde-Agudelo et. al. 2006). Also, the research of Lutomski et al., (2013) showed that birth order can influence the accumulation of maternal health experiences that affect future pregnancies. The study also implied that birth order corresponds to differences in maternal age with first time mothers typically being younger and older mothers having experienced prior pregnancies.

CONCLUSION AND RECOMMENDATION

The study has provided an insight into predicting maternal complication among underserved women based on the demographic composition. Maternal complications are multifactorial, which means that a number of different variables, including maternal age, pre-existing medical conditions, prenatal care use, access to healthcare facilities, and level of education. While occupation may be one of the contributing factors, in the absence of other pertinent factors, it may not independently predict maternal complications.

It is critical to emphasize that accurate prediction of maternal complications necessitates detailed through the involvement of healthcare professionals and researchers with expertise in the specific region. Furthermore, because maternal complications are frequently influenced by a complex interplay of numerous factors, concentrating on individual risk factors may not give a complete picture. It is advisable to consult health facilities, medical experts, and pertinent research studies that specifically address the region's demographic makeup and healthcare infrastructure in order to gain precise insights into predicting maternal complications among underserved women in Ondo State, Nigeria.

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