

THE GEOGRAPHY OF MATERNAL MORTALITY IN NIGERIA

Jane Ebeniro, B.Sc

Thesis Prepared for the Degree of

MASTER OF SCIENCE

UNIVERSITY OF NORTH TEXAS

May 2012

APPROVED:

Joseph Oppong, Major Professor
Ami Moore, Minor Professor
Chetan Tiwari, Committee Member
Paul Hudak, Chair of the Department of
Applied Geography
James D. Meernik, Acting Dean of the
Toulouse Graduate School

Ebeniro, Jane. The geography of maternal mortality in Nigeria. Master of Science (Applied Geography), May 2012, 67 pp., 9 tables, 21 figures, references, 55 titles.

Maternal mortality is the leading cause of death among women in Nigeria, especially women aged between 15 and 19 years. This research examines the geography of maternal mortality in Nigeria and the role of cultural and religious practices, socio-economic inequalities, urbanization, access to pre and postnatal care in explaining the spatial pattern. State-level data on maternal mortality rates and predictor variables are presented.

Access to healthcare, place of residence and religion explains over 74 percent of the spatial pattern of maternal mortality in Nigeria, especially in the predominantly Muslim region of northern Nigeria where poverty, early marriage and childbirth are at its highest, making them a more vulnerable population. Targeting vulnerable populations in policy-making procedures may be an important strategy for reducing maternal mortality, which would also be more successful if other socio-economic issues such as poverty, religious and health care issues are promptly addressed as well.

Copyright 2012

by

Jane Ebeniro

ACKNOWLEDGEMENT

I would like to thank my major professor, Dr. Joseph Oppong, who believed in me from the very first day I set foot on the University of North Texas campus in 2009. I would also like to acknowledge all his assistance during the months of the collection of data and the coming together of this research work. Many thanks to Dr. Ami Moore, Dr. Chetan Tiwari, my graduate committee and other Faculty in the Applied Geography Department, who contributed in one way or another in my intellectual and social upbringing these past two years.

I would acknowledge Dr. Eke and Professor Nte for their assistance during the collection of the maternal mortality data at the University of Port Harcourt Teaching Hospital in Port Harcourt, Nigeria. You are greatly appreciated!

Lastly, I appreciate the UNT GIS and Public Health research group members whose criticisms and suggestions helped in the completion of this research work. Stephanie, Mara, David, Libbey and Bink, it has been a great year! And for those I failed to mention, you are not forgotten. THANK YOU!

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
LIST OF TABLES.....	vi
LIST OF FIGURES.....	vii
Chapters	
1. INTRODUCTION	1
1.1 Background of the Study	
1.2 Aims and Objectives of the Research	
1.3 Background of the Study Area	
2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW	6
2.1 The Human Ecology Model and Maternal Health	
2.2 Vulnerability Theory and Maternal Health	
2.3 Maternal Mortality in Nigeria	
2.4 Non-Medical Determinants of Maternal Mortality in Nigeria	
2.4.1 Prenatal Care and Maternal Mortality	
2.4.2 Poverty and Maternal Mortality	
2.4.3 Cultural Practices, Religion and Maternal Mortality	
2.4.4 Maternal Age and Maternal Mortality	
2.4.5 Urban/Rural Differences in Maternal Death Rate	
2.4.6 Newborn Survival, Mortality and Maternal Health	
2.4.7 Literature Review Summary	
2.5 Hypotheses and Research Questions	
3. METHODOLOGY AND DATA SOURCES.....	23
3.1 Data Sources	
3.2 Methodology	
4. RESULTS	25
4.1 The Geography of Maternal Mortality in Nigeria	
4.1.1 Access to Healthcare and Maternal Mortality	

4.1.2	Socioeconomic Status and Maternal Mortality	
4.1.3	Quality of Healthcare Services	
4.1.4	Age and Maternal Mortality	
4.1.5	Religion and Maternal Mortality	
4.2	Factor Analysis	
5.	CONCLUSION.....	40
5.1	Conclusion	
5.2	Limitations and Future Research	
	APPENDIX: SUPPLEMENTAL FIGURES.....	44
	REFERENCES.....	63

LIST OF TABLES

	Page
Table 2.1: Neonatal mortality rate by state.....	18
Table 4.1: Maternal mortality rates by state	25
Table 4.2: Total variance explained	32
Table 4.3: Component matrix.....	33
Table 4.4: Access to prenatal care correlation matrix.....	34
Table 4.5: Socioeconomic status correlation matrix.....	35
Table 4.6: Quality of healthcare correlation matrix.....	36
Table 4.7: Age correlation matrix	37
Table 4.8: Religion correlation matrix.....	38

LIST OF FIGURES

	Page
Figure 1.1: Map of Nigeria showing 6 major geopolitical zones and states	4
Figure 2.1: The triangle of human ecology	6
Figure 2.2: Map showing neonatal mortality rates by state (2011)	20
Figure A.1: Map showing the maternal mortality rates by state	45
Figure A.2: Map showing women with no postnatal care visits	46
Figure A.3: Map showing women with no health insurance.....	47
Figure A.4: Map showing women who require permission to visit a hospital.....	48
Figure A.5: Map showing women who received skilled postnatal care.....	49
Figure A.6: Map showing women who delivered in a healthcare facility.....	50
Figure A.7: Map showing percentage urban population by state.....	51
Figure A.8: Map showing percentage rural population by state.....	52
Figure A.9: Map showing percentage of the population living in poverty.....	53
Figure A.10: Map showing women with less than secondary education.....	54
Figure A.11: Map showing women who had difficulty accessing drugs	55
Figure A.12: Map showing women with access to skilled birth assistance.....	56
Figure A.13: Map showing women with 1 st sexual encounter before 20 years	57
Figure A.14: Map showing women with their 1 st marriage before 20 years	58
Figure A.15: Map showing women with 1 st childbirth between 15-19 years	59
Figure A.16: Map showing women with 1 st childbirth between 25-49 years	60
Figure A.17: Map showing the total Muslim population by state.....	61
Figure A.18: Map showing the Total Christian population by state.....	62

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Maternal mortality remains a serious concern in Nigeria, especially in the northern region and in the rural south. In 2005, the estimated total of global maternal deaths recorded was 536,000; developing countries, such as Nigeria, accounted for over 99 percent or 533,000 of the recorded deaths (WHO 2007). While having only 2 percent of the world's total population, Nigeria accounted for 10 percent of the world's total maternal deaths in 2010. Nigeria's maternal mortality rate exceeds 1000 deaths per 100,000 live births and is much higher than the African continent average of 800 deaths per 100,000 live births (Zozulya 2010).

Maternal mortality is the death of a woman while pregnant or within 42 days after termination of pregnancy, irrespective of the duration of the pregnancy, from any cause related to or aggravated by the pregnancy excluding all accidental causes of death (Lindroos 2010). Because a large number of maternal deaths occur late or later than 42 days after termination of pregnancy, some definitions extend the period up to a year after termination of pregnancy (Koonin et al. 1988). Using this definition, this study examined the spatial pattern of maternal mortality in Nigeria and the factors that explain this spatial variation. The goal was to illumine the geographical factors and contribute to our understanding of the geographical determinants of vulnerability to maternal mortality.

1.2 Aims and Objectives of the Research

This research used the human ecology conceptual and vulnerability frameworks to examine and attempt to explain the spatial pattern of maternal mortality in Nigeria. It argues that life situations and circumstances do not affect populations uniformly. Certain locations and places make people more susceptible to diseases and infections. For example, social and economic factors in a location place people at a higher risk for vulnerability. Examining these vulnerabilities spatially is crucial to the prevention and control of these risks. To this end, the research attempts to determine where maternal mortality occurs the most and whether the spatial pattern is dispersed, random or concentrated. Specifically, the research addressed the following questions:

- (a) What is the spatial pattern of maternal mortality in Nigeria?
- (b) Which parts of Nigeria have the highest and lowest mortality rates and why?
- (c) What factors influence the spatial distribution of maternal mortality?
- (d) What can be done to reduce the risk of maternal mortality in Nigeria, particularly in the areas with the highest rates?

1.3 Background to the Study Area

The Federal Republic of Nigeria is made up of thirty-six states or administrative regions and the federal capital territory, Abuja. The country is bordered by the Republic of Benin on the west, Chad and Cameroon on the east, and Niger on the north and is made up of 250 different ethnic groups with the most dominant ethnic groups in the country being Hausa and Fulani 29 percent, Yoruba 21 percent, Ibo 18 percent, Ijaw 10 percent, Kanuri 4 percent, Ibibio 3.5 percent and Tiv 2.5 percent (CIA World Factbook 2010).

Nigeria is the most populous country in Africa but the exact population figures are a subject of speculation. There have been a number of census exercises carried out in the country with the most recent being in 2006 but the results are still being disputed today, although, the United Nations estimated the population at 154.7 million in 2009 (CIA World Factbook 2010).

Health care and living conditions of a large proportion of Nigerians are very poor as they have limited access to potable water and adequate sanitary conditions. Due to the rapid urbanization of Nigerian cities, increased waste generation continues to be a serious problem in Nigeria (Omofonmwam et al. 2008). The most prevalent sickness outbreaks in the country are cholera, malaria, trypanosomiasis, HIV and polio.

Education levels are also low as the educational system has been described as dysfunctional due to the decaying institutional infrastructure and constant academic strikes especially at the tertiary levels. A large percentage of the Nigerian population is said to be illiterate with women having a higher rate of illiteracy (75.7 percent) than men (60.6 percent) (USLC 2008).

The Nigerian economy is heavily dependent on the oil sector and has been since the discovery of crude oil in Oloibiri, Rivers State in the early 1950s. According to the International Monetary Fund, the oil sector accounts for 95 percent of the country's export earnings and 65 percent of government revenues (USEIA 2010). Access to potential energy from oil and gas, in addition to good communication with the outside world, due to its close proximity to large water transportation ports, created favorable conditions for the southern region to become one of Nigeria's most important industrial areas. For example, the majority of the multinational oil prospecting and producing

companies, including Shell Petroleum Development Company, National Agip Oil and Gas Company, Totalfinalelf, ExxonMobil and Schlumberger all have major offices or headquarters in this region. A 2006 study showed that there were about 1183 discovered oil fields and 254 producing on land, swamp, shallow and deep waters (Saka 2006). The CIA Factbook (2009) estimates that the gross domestic product of the country stood at \$357.2 billion with a 5 percent growth rate and an exchange rate at \$1 to N150 (N = Naira) in 2009.

Nigeria is made up of 6 major geopolitical zones; north-west, north-east, north-central, south-west, south-east and south-south zones.

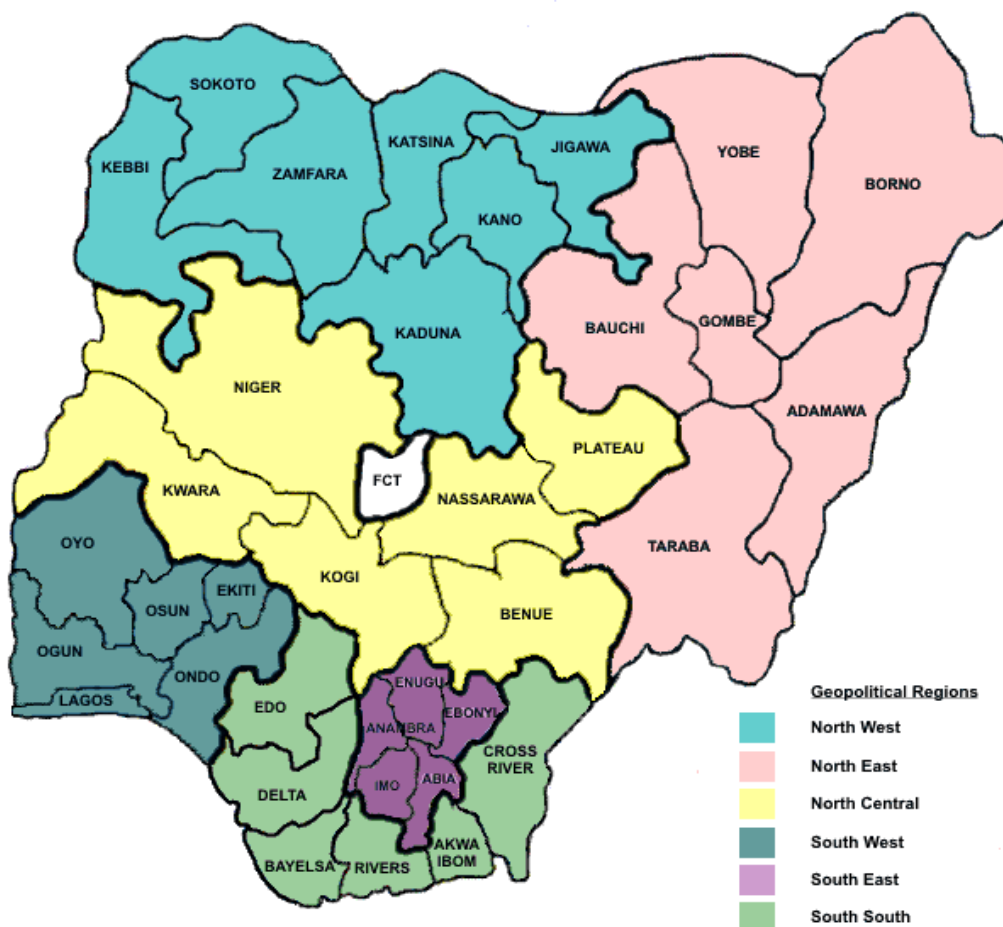


Figure 1.1 Map of Nigeria showing 6 major geopolitical zones and states. (Source: Adapted from Bankole et al. 2008)

Nigeria is culturally and religiously diverse while economic development and illiteracy also varies spatially. The north-west and north-east regions are vastly rural and have a predominantly Muslim population. The north-central region has a large Muslim population but a larger Christian makeup, especially in the urbanized parts of the states. The south-east, home of the Ibo people, is more urbanized and developed than the northern regions and is predominantly Christian. The south-west region has a mixed distribution of Muslim and Christians but a larger Christian population. Lagos state, the former capital of Nigeria, is located in the south-west region and is the most urbanized and commercialized state in the country. Finally, the south-south region is the least urbanized of all southern regions and has the largest Christian composition in the country with about 97 percent of the population being Christians (National Bureau of Statistics 2011).

CHAPTER 2

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 The Human Ecology Model and Maternal Health

The human ecology model (Figure 2.1) provides a framework for understanding maternal mortality and its spatial patterns in Nigeria. Used by geographers, epidemiologists and other behavioral scientists to explain the patterns of human interaction with their physical and social environment, it suggests that human health variations over the surface of the earth are due to habitat, population and behavior differences (Meade and Emch 2010).

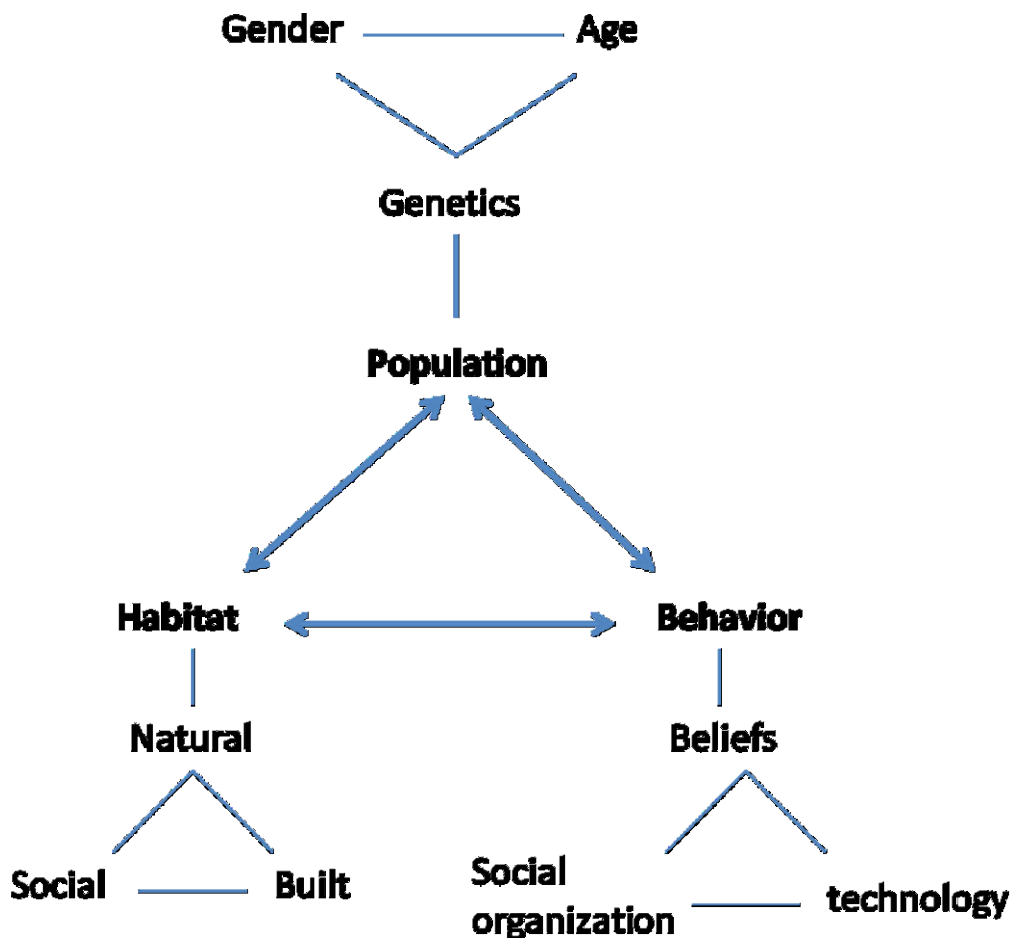


Figure 2.1 The Triangle of Human Ecology. (Source: Adapted from Meade & Emch 2010)

The human ecology model shows the different subsystems of a larger habitat divided into the natural, social and built environment. The built environment consists of the type and size of housing, condition of the housing and the settlement pattern in which they reside. Health care facilities, road networks and other amenities such as schools and family planning centers are part of the built environment. The absence or presence of these facilities differs across space and therefore affects us differently. The social environment consists of the societies and groups in which people live. Social interactions with neighbors and family would also play a role in health status. Thus, people with strong personal relationships with many people are more likely to have a healthier state of being than those who are secluded from their neighbors and family.

The second arm of the human ecology triangle shows beliefs, technology and social organization as subsystems of behavior. Human behavior stems from cultural beliefs, values and perceptions which ultimately affect the decisions we make. The type of food we eat, marriage customs, and help seeking behavior – whether to use traditional medicine or modern medicine – are influenced by religious beliefs, level of education or other exposure. For example, when cultural practices and beliefs require a woman to obtain permission from her husband or nearest male relative before seeking or obtaining medical care, it limits the woman's access to timely healthcare (Abdulkarim 2008). Similarly, traditional medicine and diet practices such as drinking concoctions of roots or herbs and women eating after men may contribute to maternal health and mortality (Chukuezi 2010).

Eclampsia, the third leading cause of maternal mortality in Nigeria, provides an excellent example of how religious belief influences maternal health outcomes.

Eclampsia is a life-threatening complication in pregnancy that occurs in the form of convulsions, usually in a patient with pre-existing hypertensive disorders and could occur before, during or after childbirth (Dahiru 2010). Symptoms of eclampsia include headaches, nausea, vaginal bleeding, liver and kidney failure. Early detection and control of eclampsia are important parts of prenatal care. In northern Nigeria, where eclampsia is common, women who have these convulsions are believed to be possessed by evil spirits. These women are put in the care of traditional healers, which delays prompt access to trained medical treatment, and often leads to death (Zozulya 2010).

The last arm of the human ecology triangle looks at humans as susceptible to insults and health risks but their ability to cope with these insults depends on their gender, age and genetic composition. Gender and age are important factors in understanding human health status. Men are less likely, if ever, to develop breast cancer or pregnancy-related complications, which is what this research looks at. For example, women younger than 20 and older than 35 years have a higher incidence of maternal mortality associated with high risks from hemorrhage, sepsis and hypertensive disorders than women between the ages of 21-34 years (Okwerekwu 1991).

2.2 Vulnerability Theory and Maternal Health

Vulnerability has been used in medical geography and other related fields, to explain different contexts such as poverty, status inequality, underdevelopment and human ability to acquire resources (Ghosh and Kalipeni 2005). The inability to secure resources such as safe living conditions, education and employment puts the less

privileged at a higher risk for exposure to shock, stress and disempowerment in society (Chambers 1989).

Opong (1998) applied the vulnerability theory to Ghana's HIV/AIDS situation stating that certain adverse life situations such as poverty, hunger and disease, do not affect social groups uniformly. Although all sexually active humans are at risk of HIV infection, certain social and economic factors place some social groups at a higher risk than others. The vulnerability theory focuses on the differences in access to resources and socioeconomic status among various social groups that puts some people at a higher risk of disease than others.

The perspective of vulnerability can be applied to maternal health in Nigeria looking at the rural-urban, regional and cultural differences across the country and their effects on maternal mortality rates. The woman's vulnerability in Nigeria is linked to a patriarchal society where decisions about reproduction, finances and education are made by men, especially where early marriage and childbirth are encouraged (Hodges 2001).

The importance of female education is widely recognized (Chakrapani et al. 2010; Ghosh and Olson 2007). Lack of education restricts women from independence and financially supporting themselves. Not only would spending more time in a formal school extend a woman's time before she gets married, but one extra year of secondary school would also increase her eventual wages by 15-25 percent increasing her economic independence in the future (Psacharopoulos and Patrinos 2002) .

Poverty is a multifaceted condition with different dimensions including poor access to public services and infrastructure, unsanitary environmental conditions, poor

health, illiteracy and ignorance, as well as low household income levels and food insecurity (Hodges 2001). Poverty limits access to healthcare services, transportation and adequate nutrition especially for women who are financially incapable of providing for themselves (Harrison 1997).

Nigeria today is said to be among the 20 poorest countries in the world. An estimated 66 percent of the country lives below US \$1 a day compared to only 43 percent in 1985 (Lanre-Abass 2008). This puts Nigerian women at a higher risk to a lower health status than women who live in parts of the world with higher incomes, better healthcare services and resources such as the United States of America or Britain. Thus, Nigerian women are more vulnerable to poor maternal health conditions than their counterparts in Britain or the United States. In 2008, United States and Britain had an estimated 24 and 12 deaths per 100,000 live births, respectively. In contrast, Nigeria had an estimated 840 deaths per 100,000 live births which is 35 and 70 times more than the estimated deaths recorded in the same year in both the United States and Britain (UNICEF 2010).

2.3 Maternal Mortality in Nigeria

Maternal deaths could be defined as either direct or indirect. Direct maternal deaths result from complications of the pregnancy (pregnancy, labor and post-delivery), from interventions, omissions, incorrect treatment, or from a chain of events arising from any of the above. Indirect maternal deaths are due to previously existing diseases or diseases that develop during pregnancy, and not due to direct obstetric causes (Oxaal et al. 1996).

Pregnant women's perception of blood loss or other complications varies and affects how they act and whether or not they seek prompt medical attention during an emergency (Thaddeus and Nangalia 2004). While some women believe that bleeding during pregnancy is healthy and necessary as it eliminates impurities in the woman that are caused by pain and swelling (Sargent 1982), other women fear excessive bleeding which they believe can drain the life out of a new mother but also fear the retention of bad blood they believe can poison her (Obermeyer 2000). In northern Nigeria, most women were admitted into medical facilities in a critical state due to excess bleeding, having delivered several hours prior at home. Recognizing the danger of excessive bleeding or postpartum hemorrhage may be confounded by the beliefs that excess bleeding is necessary for the cleansing process and these beliefs contribute to the late recognition of dangerous pregnancies which could lead to morbidity or mortality.

Postpartum hemorrhage/bleeding, the leading medical cause of maternal mortality, is caused by one or more of the following; trauma to the genital tract, retention of placenta or placental fragments, past history of postpartum hemorrhage, uterine fibroid and cesarean section (Ujah and Ejeh 1999).

Tuberculosis, malaria, syphilis, worm infestations, chlamydia, gonorrhoea and HIV are challenging problems in Nigeria that contribute to high maternal mortality and morbidity (Okereke et al., 2005). These infections, as illustrated in Figure 2.2, account for 27 percent of the total maternal deaths in Nigeria.

2.4 Non-Medical Determinants of Maternal Mortality in Nigeria

2.4.1 Prenatal Care and Maternal Mortality

According to the Nigerian Population Commission (1999), in the demographic and health surveys (DHS), 64 percent of Nigerian women received some form of prenatal care or health care services during pregnancy; although, access is much lower in rural areas relative to the more urbanized cities in the country. Prenatal care provides women with the knowledge to learn what to do if complications arise during pregnancy, childbirth, or the risky period immediately after childbirth when many maternal deaths occur. It also provides education on proper maternal nutrition, treatment for infections (e.g., malaria, syphilis, and tetanus), and testing for HIV/AIDS. The World Health Organization recommends that pregnant women should have at least 3 prenatal care hospital visits to ensure a normal pregnancy (Lindroos 2010).

An important component of prenatal care visits is counseling on safe sex practices and contraceptive use to prevent unwanted pregnancies and sexually transmitted diseases. Good prenatal care can detect high risk pregnancies and mostly prevent the major pregnancy complications that require emergency obstetrical care. But several socioeconomic and environmental challenges such as cost and distance from hospitals, influences use of available maternal care services.

Although some patients make the effort to seek prenatal care in a timely manner, some may still experience service delay due to the problem of access to healthcare services especially in the rural areas. In the rural areas, a woman experiencing an obstetric emergency may find the closest accessible healthcare facility equipped with only basic treatments that are not sufficient to address the emergency at hand. She may

also have no transportation to access a better equipped healthcare facility thereby compounding and complicating further the pregnancy (Thaddeaus and Maine 1994). Moreover, due to shortage of staff, drugs and supplies, arriving at the healthcare facility may not necessarily lead to immediate commencement of treatment (Hodges 2001).

2.4.2 Poverty and Maternal Mortality

Poverty has a grave impact on maternal deaths and the decisions women make in utilizing health care services (Graham et al. 2004). Poor pregnant women die more disproportionately than those who are more financially stable due to two main issues. First, poorer people are less likely to get medical care or go to a healthcare facility (Prata et al. 2009). Second, poor people spend a very large portion of their yearly income on healthcare, regardless of the quality of service being administered to them (Filipi et al. 2006).

Demographic and Health Survey (NPC 2008) data on place of delivery shows that poor women are less likely to give birth in a healthcare facility with skilled healthcare providers. In addition, 30 percent of Nigerian women identified lack of money to pay for health care as a major obstacle to accessing health care. Another 24 percent identified the distance to a healthcare facility and another 24 percent listed the cost of transportation as the obstacle (NPC 2008).

Moreover, increasing poverty in Nigeria has become a barrier to education for many Nigerian women thereby economically disempowering them in society. About 41.6 percent of Nigerian women had no education at all, 21.4 percent had primary education, and 31.1 percent had secondary education while only 5.9 percent had a college degree

(NPC 2003). There is a strong negative correlation between level of education and access to financial resources or the wealth quintile. Because the lowest wealth quintile for women was 68.7 percent and the highest was 5.8 percent, unless these disadvantaged populations are targeted as high risk populations, progress in safe delivery efforts will be compromised.

2.4.3 Cultural Practices, Religion and Maternal Mortality

Being a patriarchal society, in the rural areas of Nigeria especially, gender inequality exists in access to food, work allocations and access to medical services, and is compounded by social, cultural and religious norms.

Women living in rural areas tend to engage in more strenuous activities such as farm work and carrying heavy loads from the farm to the house on their heads which could have disastrous effects on the health of both mother and the unborn child. Boserup (1990) discusses the cultural requirements of Nigerian women to include serving and attending to male members of the family and the children. These services include taking care of the children, household chores, fetching water, planting crops and harvesting them, and taking care of small animals on the farm. Boserup (1990) argues that these factors contribute to high maternal mortality rates in the rural areas because frequent child bearing and hard physical work deteriorate the woman's health.

The predominantly Muslim northern region of Nigeria records some of the highest maternal death rates in comparison to the southern states (Federal Ministry of Health 2011). The highest mortality rates occur in the northern, predominantly Muslim states and the lowest mortality rates occur in the southern, predominantly Christian states.

Contributing to maternal mortality and morbidity is an Islamic culture that undervalues the female gender, encourages a social need for women's reproductive capacities to be under strict male supervision and control, practices *purdah* (also known as wife seclusion), often restricting medical care of the woman, produces high rates of female illiteracy and, encourages early marriages and pregnancies often occurring before pelvic maturity (Wall 1998).

In some societies, the church is also seen as a favored place of childbirth as it is believed that the holy environment of the church would protect both mother and child from evil spirits and witchcraft. Also, certain religions do not believe in blood transfusions and most times this leads to the death of mothers after childbirth (Chukuezi 2010).

These cultural and religious practices that discriminate against the female gender significantly contribute to maternal mortality and morbidity in Nigeria. Given the complex reality of the influence of these practices on maternal health, developing strategies for improvement, especially in the northern region and the rural areas, remains a considerable challenge.

2.4.4 Maternal Age and Maternal Mortality

Higher mortality rates have been observed among women who have babies at high and low extremes of maternal age (women younger than 20 and above 40 years of age). In fact, pregnancy is the highest cause of death in women ages 15-19 years of age in Nigeria (World Bank 2006). This is because the reproductive organs of women within that age group are not mature enough to carry a pregnancy. Women age 15-19

are two times more likely to die from pregnancy or childbirth as women over 20 years of age while women less than 15 years are 5 times more likely to develop complicated pregnancies leading to death (UNFPA 2004). Teenagers frequently have adverse social consequences, especially regarding educational attainment, since women who become mothers in their teens are more likely to curtail their education as soon as they become mothers.

Every year at least two million women under the age of 19 die from complications resulting from unsafe abortions in the developing world (WHO 2006). Globally, 72 percent of all deaths in women under age 19 are attributed to complications of unsafe abortions with complications such as cervical tearing, hemorrhage, pelvic infection, infertility and death (Zabin and Kiragu 1998).

Modern contraceptive use is low among sexually active Nigerian high school students and this contributes to the high number of teenage pregnancies especially in the rural areas and the impoverished urban areas. About 47 percent of the high school females in Nigeria use the rhythm method of contraception; 21 percent use oral contraceptive pills and, shockingly, only 6 percent use condoms (Okpani and Okpani 2000). Therefore, Nigerian women below 19 years have a higher risk of developing pregnancy-related complications that could result in death and should be seen as a target population for the provision of education, family planning services and prenatal care in order to reduce their maternal mortality.

2.4.5 Urban/Rural Differences in Maternal Death Rate

Access to healthcare services, which includes prenatal care, childbirth and

postnatal care, is largely determined by geographical location and cost. Proximity to the pregnant woman, affordability of healthcare services, quality of service, level of education and gender equality are important determinants of access to healthcare. The Federal Ministry of Health (2011) states that approximately 71 percent of Nigerians have a primary healthcare facility within a 5km radius to their homes but many of these facilities are not functional due to a lack of equipment, essential supplies and qualified staff. Consequently, rural and urban differences in wealth or financial capability, distance between homes and hospitals, educational levels and culture are important factors in maternal mortality. Studies show large rural-urban disparities in maternal mortality with a 1997 Multiple Indicator Cluster Survey finding a significantly higher rural mortality rate of 828 versus an urban rate of 531 (Federal Office of Statistics 2000).

Rural areas in developing countries, such as Nigeria, tend to receive less healthcare attention compared to the urban areas. For example, India and Nigeria, the two countries with the highest maternal mortality rates in the world, have large rural populations, 73.9 percent and 59.5 percent respectively, as well as highly under-served rural communities with regards to healthcare service (Wall 1998; World Bank 1995).

As with many health outcomes, mothers in the poor rural areas and the impoverished urban areas are at an increased risk of developing illnesses and complicated pregnancies, have poorer nutrition, and face more challenges in accessing timely healthcare compared to their wealthier counterparts located in the rich urban areas. The few healthcare facilities located in rural areas are often poorly equipped, under- and poorly-staffed and inaccessible due to distance, bad roads, and high cost of transportation.

2.4.6 Newborn Survival, Mortality and Maternal Health

Every year millions of babies are born in Nigeria. One quarter of the deaths of under-5 children that occur in Nigeria, is newborns that die within their first 28-30 days of life (Federal Ministry of Health 2011). Because 6 out of 10 women, especially in the rural and urban poor areas, give birth at home without access to skilled healthcare during childbirth, it is during the first few days after delivery that the lives of both mother and child are at a much higher risk (Aminu 2011).

Neonatal mortality rates also vary by region, state and rural-urban areas in Nigeria. Table 2.1 shows the neonatal mortality in Nigeria by state while Figure 2.3 shows the spatial pattern. Northern Nigeria and the rural south, where early childbearing is more predominant, appear to have the highest rates of neonatal mortality.

Table 2.1 *Neonatal mortality rates by state*

No.	State	Maternal Mortality Rate
1	Abia	700
2	Adamawa	700
3	Akwa-Ibom	900
4	Anambra	1000
5	Bauchi	1100
6	Bayelsa	400
7	Benue	100
8	Borno	1000
9	Cross River	700
10	Delta	1000
11	Ebonyi	500
12	Edo	800
13	Ekiti	600
14	Enugu	800
15	Federal Capital Territory - Abuja	300
16	Gombe	600

(table continues)

Table 2.1 (continued)

No.	State	Maternal Mortality Rate
17	Imo	900
18	Jigawa	1000
19	Kaduna	1400
20	Kano	2200
21	Katsina	1400
22	Kebbi	800
23	Kogi	800
24	Kwara	600
25	Lagos	2100
26	Nassarawa	400
27	Niger	1000
28	Ogun	900
29	Ondo	800
30	Osun	800
31	Oyo	1300
32	Plateau	800
33	Rivers	1200
34	Sokoto	900
35	Taraba	500
36	Yobe	500
37	Zamfara	800
National Average		545

Source: Adapted from Federal Ministry of Health, Port Harcourt (2011).

Complications during childbirth account for 25 percent of newborn deaths, especially among adolescent mothers (Save the Children 2006). Globally and especially in developing countries, low birth weight, preterm delivery and immature reproductive tracts all contribute to infant death in adolescent mothers (Phipps et al. 2002).

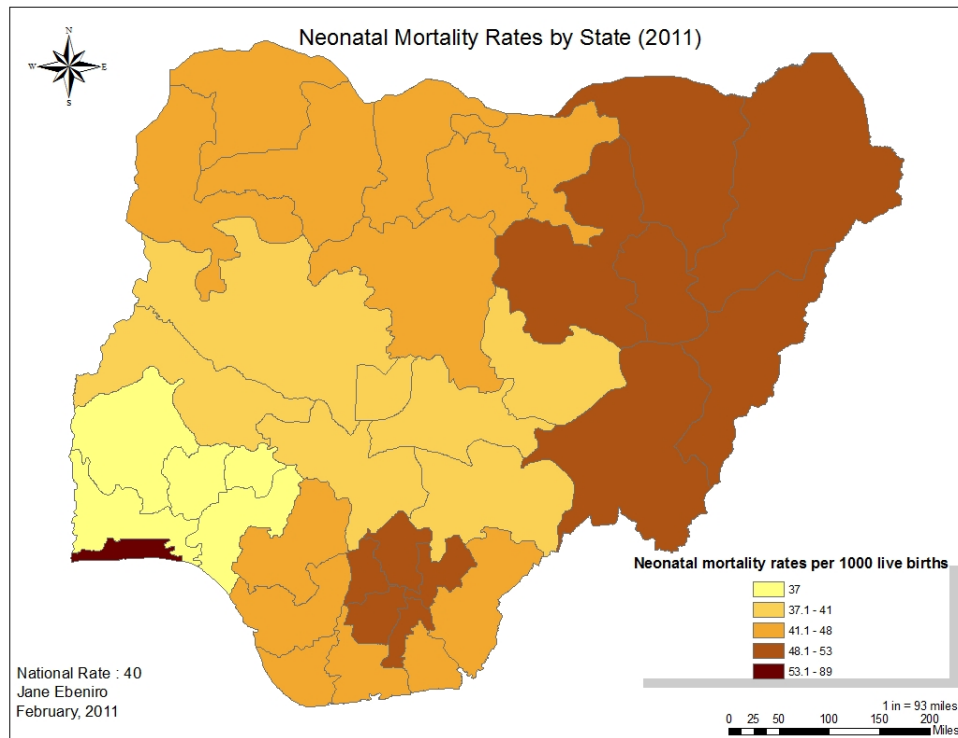


Figure 2.2 Map showing neonatal mortality rates by state 2011

To summarize, poverty and access to healthcare play a major role in maternal-child health and priority must be given to reaching the poorest families with essential and adequate care. Healthy home practices and community-based care are necessary to prevent complicated pregnancies and newborn deaths as well. The Federal Ministry of Health (2011) suggests that 70 percent, up to 90,000 newborn deaths a year, can be prevented if essential interventions in existing health practices were able to reach all women and newborns at that early period after childbirth.

2.4.7 Literature Review Summary

This research seeks to examine and explain the geography of maternal mortality in Nigeria. Based on previous research reviewed above, percentage living in poverty,

educational attainment, religion, access and quality of health care, and age at marriage and childbirth are expected to explain maternal mortality variations in Nigeria. Understanding the variations of maternal mortality in Nigeria, especially at the state level will assist local authorities in determining specific vulnerable people and places in order to develop intervention programs and services to reduce mortality cases in preparation for meeting the Millennium Development Goals of 2015.

2.5 Hypotheses and Research Questions

Five main hypotheses are tested in this research;

- Hypothesis 1: Maternal mortality rates are influenced by access to prenatal care.

Areas with a higher number of women with no postnatal care, low percentage of women who received prenatal care from a skilled provider, high percentage of women with no health insurance coverage, low percentage of women who delivered in a healthcare facility and high percentage of women that require permission to go to the hospital will have a higher maternal mortality rate.

- Hypothesis 2: Socioeconomic status, defined by percentage residing in urban or rural areas, people living in poverty – measured by percentage of women living below \$1.25 a day, and percentage of women with less than secondary education, will have a negative relationship or influence on mortality rates. In other words, urban areas with more educated and higher incomes will have lower maternal mortality rates.

- Hypothesis 3: Quality of healthcare services, defined by women who were delivered by a skilled birth attendant, access to drugs and medication, will influence

mortality rates. Women, who have access to medication, deliver in hospitals with skilled birth attendants will have a lower risk of dying from childbirth.

- Hypothesis 4: Age at first sexual intercourse, first marriage and childbirth, will have a negative relationship with maternal mortality. Women younger than 20 years at first marriage, women who fall within the age extremes at first childbirth and have sexual intercourse before 20 years will have a higher risk of pregnancy-related complications resulting in death.

- Hypothesis 5: Religious beliefs are a predictor of maternal mortality. Areas that are predominantly Muslim will have a higher mortality rate than areas that are predominantly Christian.

CHAPTER 3

METHODOLOGY AND DATA SOURCES

3.1 Data Sources

Maternal mortality, in this research, is defined by rate as the number of women who die from childbirth per 100,000 live births. Data on maternal mortality rates were obtained from the Federal Ministry of Health, Port Harcourt for the year ending 2010 since that was the only accessible and most current data available.

All the explanatory variables were obtained from the Nigerian Demographic and Health Survey 2008. This is a nationally representative sample survey taken in Nigeria. The target of the DHS sample was to obtain 36,800 completed interviews in all 37 Nigerian states. The goal was to interview all women between the ages of 15-49 and get a minimum of 950 completed interviews in all 37 states. So out of a population of 31,624,485 women in Nigeria in 2007, a sample size of 36,800 was interviewed as a sample size for the survey (DHS 2008).

Socioeconomic status was defined using the percentage of women living in both urban and rural areas, percentage of women living in poverty, and the percentage of women with less than secondary education. Access to healthcare services was defined as the percentage of women who delivered in a healthcare facility, percentage of women who required permission from their husbands or a male relative to go to the hospital, percentage of women with no postnatal care, percentage of women who received postnatal care from a skilled provider and the percentage of women with no health insurance.

Quality of healthcare services was defined by the percentage of women who complained about unavailability of drugs or medication in healthcare centers and the percentage of women who had childbirth assistance from skilled birth attendants.

Variables measuring socioeconomic status, access to healthcare, quality of healthcare services and religion were extracted from the 2008 Demographic and Health Survey (DHS) conducted in Nigeria. Other variables used in this study were the percentage of women who were less than 20 years at first marriage, at first sexual intercourse, percentage of women 15-19 and 25-49 years at first childbirth.

3.2 Methodology

A correlation matrix was developed using the factor analysis tool to examine the relationships between all the tested variables and the level of influence the independent variables – socioeconomic status, access and quality of healthcare services, maternal age and religious beliefs have on maternal mortality. Thus, the factor analysis tool is used to determine which variables or factors play the most important roles in influencing maternal mortality in Nigeria. Therefore, the independent variables are used as predictor tools.

Finally, ArcGIS is used to produce maps illustrating the spatial patterns of maternal mortality and the independent variables.

CHAPTER 4

RESULTS

4.1 The Geography of Maternal Mortality in Nigeria

The geography of maternal mortality in Nigeria shows a high concentration in the North West and North Eastern regions of the country, although, smaller pockets of high maternal deaths occur in the rural south as well as in some major urban areas such as Lagos and Rivers State. Table 4.1 shows the maternal mortality rates by state in the country. More than 80% of the states in the country have rates above the national average of 545 maternal deaths per 100,000 live births.

Table 4.1 *Maternal mortality rates by state*

No.	State	Maternal Mortality Rate
1	Abia	700
2	Adamawa	700
3	Akwa-Ibom	900
4	Anambra	1000
5	Bauchi	1100
6	Bayelsa	400
7	Benue	100
8	Borno	1000
9	Cross River	700
10	Delta	1000
11	Ebonyi	500
12	Edo	800
13	Ekiti	600
14	Enugu	800
15	Federal Capital Territory - Abuja	300
16	Gombe	600
17	Imo	900
18	Jigawa	1000
19	Kaduna	1400

(table continues)

Table 4.1 (continued)

No.	State	Maternal Mortality Rate
20	Kano	2200
21	Katsina	1400
22	Kebbi	800
23	Kogi	800
24	Kwara	600
25	Lagos	2100
26	Nassarawa	400
27	Niger	1000
28	Ogun	900
29	Ondo	800
30	Osun	800
31	Oyo	1300
32	Plateau	800
33	Rivers	1200
34	Sokoto	900
35	Taraba	500
36	Yobe	500
37	Zamfara	800
National Average		545

Source: Adapted from the Federal Ministry of Health, Port Harcourt (2011)

Kano State, a predominantly Muslim state with a large urban population, records the highest mortality rate at 2200 deaths per 100,000 live births. Lagos State, also with a large urban area, has the second highest mortality rate at 2100 deaths per 100,000 live births. These high rates may be attributed to a large urban impoverished population, in the case of Lagos State and early child marriages and child birth due to religious beliefs in the case of Kano State. Figure A.1 also shows the geographical distribution of maternal mortality in Nigeria by state. It shows that the further north you go, the higher the maternal mortality rates and the more concentrated the spatial patterns relative to the southern region of the country.

4.1.1 Access to Healthcare and Maternal Mortality

The first hypothesis proposes that maternal mortality rates are influenced by access to healthcare which is measured by prenatal and postnatal care visits, childbirth at a healthcare facility, health insurance coverage and women who require permission to go to a healthcare facility. The area that has a large concentration of women with no postnatal care is illustrated in Figure A.2. Kebbi, Sokoto, Niger, Zamfara, Katsina, Kano, Bauchi and Adamawa states in the northeast and northwest have the highest rates of women who had no postnatal care visits.

Figure A.3 shows the percentage of women who had no health insurance coverage. Lack of health insurance is widespread in Nigeria. Between 81.9 percent and 100 percent of the population are without health insurance and the Federal Capital Territory of Abuja has the highest percentage of no coverage at 81.8 percent of the population.

The northern states have the highest concentration of women who require permission from their husbands or a male family member to seek medical services from a healthcare facility (Figure A.4). Thus, Kebbi, Niger, Kano, Bauchi and Borno states, all in the northeast and northwest have the highest rates at 18-40 percent while Lagos, Ondo, Edo and Osun states in the southeast having the lowest rates at 0.9-4 percent of the women requiring permission from a male family member. The southwestern states of Lagos, Ogun, Oyo, Ekiti and Ondo; southsouth states of Abia, Imo and Anambra; and the Federal capital territory had the highest percent of women who received postnatal care from a skilled provider at 84-97 percent (Figure A.5). The southern states of Lagos, Osun, Ekiti, Edo, Imo, Abia and Anambra had the highest rates at 67-94 percent of

women who delivered in a healthcare facility while states such as Sokoto, Kebbi and Zamfara in the north only had 4-21 percent delivery in a healthcare facility (Figure A.6).

4.1.2 Socioeconomic Status and Maternal Mortality

The second hypothesis proposed that socioeconomic status, defined by place of residence, poverty and educational attainment, would determine mortality rates in Nigeria. Thus, women who reside in rural areas, who are living in poverty and who have less than secondary school education would be at a higher risk of developing pregnancy-related complications resulting in death. Access to health care services varies geographically in the rural/urban areas in Nigeria as prenatal care is more easily accessible in the urban areas relative to the rural areas. Figures A.7 and A.8 show the urban and rural population distributions by state in Nigeria, respectively. The largest urban areas are concentrated in the Southwestern part of the Country with a smaller pocket in the Northeastern state of Borno. The Federal Capital Territory of Abuja, Osun, Lagos and Anambra States have the highest urban populations in the country. Rural areas are highly concentrated in the northern part of Nigeria with Sokoto, Zamfara, Jigawa, Taraba and Benue having the largest rural populations in the country.

Figure A.9 shows the percentage of women living in poverty below \$1.25 a day. Sokoto, Zamfara, Katsina, Jigawa, Yobe and Bauchi states in the north and Ebonyi state in the southeast record the highest rates of female poverty in Nigeria at 42-92 percent of the female population living in poverty.

The population distribution of educational attainment – focusing on women who have less than a secondary school education - is illustrated in Figure A.10. This

population would have a higher risk for early age pregnancies and would therefore develop complications during pregnancy. The northern region of Nigeria has the highest concentration of populations with the least educational attainment. Northern border states, which are predominantly Muslim, such as Sokoto, Zamfara, Jigawa, Katsina, Borno and Yobe have some of the largest low educational attainment populations with 91-96 percent of the population having less than secondary school education. The southern states of Rivers, Imo, Anambra and Abia record lower populations with less than secondary education (37-56 percent). In other words, the southern region records a higher educational attainment relative to the northern region.

4.1.3 Quality of Healthcare Services

The third hypothesis proposes that quality of healthcare services received which is defined as access to medication at the healthcare facility, and access to skilled birth assistance would influence maternal mortality rates. Women who have problems accessing medication and vitamins, and do not have access to doctors, nurses and midwives during childbirth have a higher risk of developing pregnancy-related complications resulting in death.

The percentage of women who complained they had difficulty receiving or accessing medication at the healthcare facilities had the highest rates in Borno, Bauchi, Kano, Taraba, Zamfara and Niger states in the north and Bayelsa, Enugu and Ebonyi states in the south (Figure A.12). Between 60 and 80 percent of women in these states did not get the medication they needed at the healthcare facility. In contrast, the lowest rates occurred in the Federal Capital Territory of Abuja, Osun and Cross River states

where only 2-17 percent of the total population reported difficulties in accessing medication.

The total percentage of women who had skilled assistance from a doctor, midwife or nurse during childbirth is shown in Figure A.12. The northeastern and northwestern states all had a low population of women with 4-17 percent who had access to skilled birth assistance during childbirth. Lagos, Edo, Osun, Ekiti, Anambra and Imo states had the highest rates of women with 76-98 percent of women who had access to skilled birth assistance during childbirth.

4.1.4 Age and Maternal Mortality

The fourth hypothesis proposes that age at first sexual intercourse, age at first marriage and age at first childbirth influences maternal death rates in Nigeria. Areas with a high percentage of women who had their first sexual encounter and got married before 20 years and areas with a high percentage of women who had their first childbirth between the ages of 15-19 are at a higher risk of developing pregnancy-related complications resulting in death. Figure A.13 is the distribution of women who had their first sexual encounter before they were 20 years of age. The northern states of Katsina, Jigawa, Gombe, Borno, Yobe and Zamfara; southern states of Bayelsa, Akwa Ibom, Delta and Cross River had the highest rates of women who had their first sexual encounter before they turned 20 years of age. Between 50 and 93 percent of the female population in these states had their first sexual encounter before they reached 20 years.

Figure A.14 shows the percentage distribution of women who had their first marriage before 20 years of age. All the northeastern and northwestern states recorded

the highest percentage of females who were married before 20. In fact, about 86-93% of the population had their first marriage before age 20. Lagos, Imo and Abia states in the southern region recorded the lowest percentage of the population with 32-37 percent of the female population having their first marriage before they were 20 years of age.

Sokoto, Zamfara, Katsina, Jigawa, and Borno states in the northern region had the highest population with 42-65 percent of women who had their first childbirth between 15-19 years (Figure A.15). On the other hand, Lagos, Anambra, Imo and Enugu states in the southern region had a low population with only 2-6 percent of women who had their first childbirth in the same age range.

Lagos, Anambra, Abia and Imo states in the south had 24 percent of the population having their first childbirth between 25-49 years compared to 17 percent in the northern states of Sokoto, Katsina, Kano, Yobe and Borno (Figure A.16).

4.1.5 Religion and Maternal Mortality

The fifth hypothesis proposes that maternal mortality rates will vary among the different religions and that due to early marriages and child birth, the Muslims are at a higher risk to developing pregnancy-related complications and dying as a result of those complications. Figures A.17 and A.18 show the percentage distribution of Muslims and Christians, respectively, in Nigeria. Muslims are mostly concentrated in northern Nigeria with percentage Muslim population ranging between 78-99 percent. In contrast, Christians comprise 86-99 percent of the population the southern states of Nigeria.

4.2 Factor Analysis

A factor analysis was ran on the independent variables : prenatal care, religion, quality of healthcare, socioeconomic status and age of mother, first to determine which factors had the strongest relationships and second, which factors had the strongest influence on maternal mortality rates in Nigeria. Seventeen factors were chosen and a factor analysis ran on them. The resulting correlation matrices were used to examine the relationships between the variables.

Table 4.2. *Total variance explained*

Component	Rotation Sum of Squares		
	Total	% of Variance	Cumulative %
1	7.896	46.446	46.446
2	4.691	27.596	74.043
3	1.307	7.688	81.731

The total variance explained in Table 4.2 shows that component 1 accounts for 46.4 percent of the total variation in maternal mortality, component 2 accounts for 27.6 percent of the total variation, and component 3 accounts for 7.7 percent of the total variation in maternal mortality in Nigeria. These three components alone account for a cumulative percentage of approximately 82 percent of maternal mortality in Nigeria and can be used to give a better understanding of the spatial pattern of maternal death rates in the country.

Table 4.3. *Component matrix*

	Component		
	1	2	3
	Access to healthcare	Place of residence and religion	Healthcare quality
15-19 at 1 st childbirth	.919	-.233	-.133
25-49 at 1 st childbirth	-.938	.070	.091
No postnatal care	.834	.042	.333
Delivered through a skilled provider	-.944	.012	.057
Delivered at a healthcare facility	-.910	.014	.123
Postnatal care through a provider	-.915	.034	.125
Urban	-.716	-.603	.050
Rural	.716	.603	-.050
Christian	-.792	.536	.052
Muslim	.784	-.543	-.074
Less than secondary education	.957	.025	.031
Access to drugs (medication)	.611	.247	.505
Required male permission	.607	-.020	.494
No health insurance	.422	.367	.134
Less than 20 at 1 st marriage	.964	-.124	-.096
Less than 20 at 1 st sexual intercourse	.266	.335	-.724
Living in Poverty	.938	.000	-.033

Seventeen factors were chosen and five hypotheses proposed to explain the spatial pattern of maternal mortality in Nigeria. After running a factor analysis, three components were extracted. These components explained the influence of access to healthcare, religion/place of residence and quality of healthcare on the spatial pattern of maternal mortality in Nigeria.

Component 1 suggests that an area with low access to healthcare is characterized by a high percentage of early childbirth (women age 15-19 at first childbirth), no postnatal care, and low percentage of women who had skilled birth assistance or delivered at a healthcare facility. This area is also characterized by a low

percentage of women who had postnatal care administered by a skilled provider, a high Muslim and rural population, low educational attainment, difficulty accessing drugs, women who required male permission to seek medical assistance, no health insurance and early marriage.

Component 2 examines the influence of religion and place of residence. This area would be characterized by a predominantly Christian, rural population with limited access to drugs and no health insurance.

Finally, component 3 examines quality of healthcare services and is an area with a high percentage of women who did not receive postnatal care, had difficulty accessing drugs and required male permission to seek medical attention.

Access to prenatal care, defined by no postnatal care, no health insurance, and required male permission to seek medical treatment, had strong positive relationships with early childbirth, rural population, Muslim, low education, low access to medication, early marriage and high poverty. There was a strong negative relationship with women who delivered at a healthcare facility, urban areas, Christians, skilled birth assistance and first childbirth at 25-49 years (Table 4.4).

Table 4.4. *Access to prenatal care correlation matrix*

Correlation	No postnatal care	Postnatal care with provider	Insurance	Healthcare facility	Required permission
15-19 at 1 st childbirth	.754	-.868	.326	-.821	.505
25-49 at 1 st childbirth	-.689	.831	-.335	.865	-.465
No postnatal care		-.736	.381	-.703	.630
Delivered through a skilled provider	-.773	.896	-.233	.954	-.516
Delivered at a healthcare facility	-.703	.896	-.182		-.521

(table continues)

Table 4.4 (continued)

Correlation	No postnatal care	Postnatal care with provider	Insurance	Healthcare facility	Required permission
Postnatal care through a provider	-.736		-.299	.896	-.497
Urban	-.607	.606	-.428	.624	-.339
Rural	.607	-.606	.428	-.624	.339
Christian	-.593	.721	-.257	.668	-.473
Muslim	.583	-.713	.248	-.659	.443
Less than secondary education	.793	-.815	.470	-.837	.548
Access to drugs (medication)	.597	-.566	.315	-.558	.599
Required male permission	.630	-.497	.304	-.521	
No health insurance	.381	-.299		-.182	.304
Less than 20 at 1 st marriage	.744	-.874	-.343	-.881	.494
Less than 20 at 1 st sexual intercourse	-.009	-.358	.210	-.336	.043
Living in poverty	.793	-.826	.419	-.826	.524

Low socioeconomic status had strong positive relationships with early childbirth, no postnatal care, Muslim, rural population, low educational attainment, no health insurance, poverty and early marriage. Socioeconomic status was negatively related to childbirth at a healthcare facility, urban population, Christians and skilled birth assistance (Table 4.5).

Table 4.5. Socioeconomic status correlation matrix

Correlation	Urban	Rural	Poor	Education
15-19 at 1 st childbirth	-.524	.524	.831	.843
25-49 at 1 st childbirth	.635	-.635	-.895	-.928
No postnatal care	-.607	.607	.793	.793
Delivered through a skilled provider	.655	-.655	-.884	-.899
Delivered at a healthcare facility	.624	-.624	-.826	-.837

(table continues)

Table 4.5 (continued)

Correlation	Urban	Rural	Poor	Education
Postnatal care through a provider	.606	-.606	-.826	-.815
Urban			-.657	-.705
Rural			.657	.705
Christian	.289	-.289	-.729	-.739
Muslim	-.283	.283	.720	.729
Less than secondary education	-.705	.705	.941	
Access to drugs (medication)	-.466	.466	.508	.541
Required male permission	-.339	.339	.524	.548
No health insurance	-.428	.428	.419	.470
Less than 20 at 1 st marriage	-.621	.621	.912	.942
Less than 20 at 1 st sexual intercourse	-.294	.294	.252	.177
Living in poverty	-.657	.657		.941

Skilled birth assistance had a strong positive relationship with women who had their first childbirth between 25-49 years, delivery at a healthcare facility, Christians, urban population and women who received postnatal care from a skilled provider. On the other hand, women who complained of difficulty in receiving medication at a healthcare facility were more likely to live in areas with poverty, early childbirth, early marriage, low educational attainment, lack of insurance, rural areas, and a high Muslim population (Table 4.6).

Table 4.6. *Quality of healthcare correlation matrix*

Correlation	Skilled birth assistance	Access to drugs
15-19 at 1 st childbirth	-.842	.432
25-49 at 1 st childbirth	.906	-.532
No postnatal care	-.773	.597
Delivered through a skilled provider		-.596
Delivered at a healthcare facility	.954	-.558

(table continues)

Table 4.6 (continued).

Correlation	Skilled birth assistance	Access to drugs
Postnatal care through a provider	.896	-.566
Urban	.655	-.466
Rural	-.655	.466
Christian	.696	-.284
Muslim	-.690	.270
Less than secondary education	-.899	.541
Access to drugs (medication)	-.596	
Required male permission	-.516	.599
No health insurance	-.233	.315
Less than 20 at 1 st marriage	-.917	.520
Less than 20 at 1 st sexual intercourse	-.269	.010
Living in poverty	-.884	.508

Table 4.7 shows a positive correlation between a predominantly Muslim, rural population and early childbirth, poverty, early marriage, low educational attainment, no postnatal care or skilled birth assistance and women who require male permission to seek medical treatment from a healthcare facility. Positive relationships also existed between Christians, urban population, delivery at a healthcare facility, skilled birth assistance and women who received postnatal care from a skilled provider.

Table 4.7. Age correlation matrix

Correlation	1 st marriage	1st sexual intercourse	15-19 childbirth	25-49 childbirth
15-19 at 1 st childbirth	.922	.288		-.860
25-49 at 1 st childbirth	-.966	-.232	-.860	
No postnatal care	.744	-.009	.754	-.689
Delivered through a skilled provider	-.917	-.269	-.842	.906
Delivered at a healthcare facility	-.881	-.336	-.821	.865
Postnatal care through a provider	-.874	-.358	-.868	.831

(table continues)

Table 4.7 (continued)

Correlation	1 st marriage	1st sexual intercourse	15-19 childbirth	25-49 childbirth
Urban	-.621	-.294	-.524	.635
Rural	.621	.294	.524	-.635
Christian	-.817	-.063	-.864	.762
Muslim	.816	-.066	.868	-.755
Less than secondary education	.942	.177	-.843	-.928
Access to drugs (medication)	.520	.010	.432	-.532
Required male permission	.494	.043	.505	-.465
No health insurance	.343	.210	.326	-.335
Less than 20 at 1 st marriage		.247	.922	-.966
Less than 20 at 1 st sexual intercourse	.247		.288	-.232
Living in poverty	.252	.252	.831	-.895

Areas with a predominantly Muslim population were more likely to have high poverty, early marriage and childbirth, no health insurance, require permission from a male family member to seek medical attention, low educational attainment and no postnatal care. In contrast, predominantly Christian areas were more likely to be urban areas, with childbirth at a healthcare facility, have skilled birth assistance and postnatal care, and first childbirth at 25-49 years (Table 4.8).

Table 4.8. *Religion correlation matrix*

Correlation	Muslim	Christian
15-19 at 1 st childbirth	.868	-.864
25-49 at 1 st childbirth	-.755	.762
No postnatal care	.583	-.593
Delivered through a skilled provider	-.690	.696
Delivered at a healthcare facility	-.659	.668
Postnatal care through a provider	-.713	.721
Urban	-.283	.289

(table continues)

Table 4.8 (continued)

Correlation	Muslim	Christian
Rural	.283	-.289
Christian	-.998	
Muslim		-.998
Less than secondary education	.729	-.739
Access to drugs (medication)	.270	-.284
Required male permission	.443	-.473
No health insurance	.248	-.257
Less than 20 at 1 st marriage	.816	-.817
Less than 20 at 1 st sexual intercourse	.066	-.063
Living in poverty	.720	-.729

CHAPTER 5

CONCLUSION

5.1 Conclusion

The objective of this research was to examine the spatial patterns of maternal mortality in Nigeria and the important explanatory factors. Maternal mortality was higher and concentrated in the northern region of Nigeria where Muslims are the more predominant residents. There was a positive relationship between the Muslim population and poverty, difficulty accessing drugs at healthcare facilities, skilled birth assistance, and rural populations. In contrast, low maternal mortality rates were generally found in mostly urban areas with skilled birth assistance and women who had access to quality healthcare. These areas were usually occupied by Christians. The relationship between rural populations and high maternal mortality has been examined by several researchers which may suggest the importance of residential location and proximity to a healthcare facility.

Percentage of women who had less than a secondary school education also had a positive relationship with predominantly Muslim areas suggesting that as the percent Muslim population increases, women with less than secondary school education increases. Finally, female poverty was high in the predominantly rural northern region of Nigeria where the highest maternal mortality rates also exist. Nevertheless, it is important to note that poverty also exists in rural as well as some major urban areas in the southern region of Nigeria. For instance, Lagos state, a major urban area and the economic core of Nigeria, had the second highest maternal mortality rate of 2100 deaths per 100,000 live births while the predominantly rural Benue State had only 100

deaths per 100,000 live births but had over 80 percent female poverty. The low maternal mortality rate in Benue State may be as a result of a lower population in Benue State as well as a lower number of women actually delivering in a healthcare facility where the cause of death would be reported, in comparison to a more urban Lagos State. Therefore this could affect the anticipated influence of poverty on maternal mortality.

It was also hypothesized that as early marriage, early childbirth and women who had their first sexual intercourse before they were 20 years of age increases, maternal mortality would also increase. Results showed positive correlation between early marriage and early childbirth showing that they are higher in the northern states with the highest maternal mortality rates. This suggests that as the percentage of women who had their first childbirth between 15-19 years have a higher risk of developing pregnancy-related complications resulting in deaths.

A factor analysis revealed the importance of three major components characterized by access to healthcare, religion/place of residence and quality of healthcare. These three components suggested that areas with a higher risk of vulnerability to developing pregnancy-related complications resulting in death would be predominantly Muslim, rural and would have a high percentage of poverty. It also suggested that low educational attainment, early childbirth, early marriage and no health insurance would be characteristics of these vulnerable populations. The three extracted components labeled as access to healthcare, religion/place of residence and quality of healthcare in Table 4.2, accounted for about 82 percent explanation of the spatial pattern of maternal mortality in Nigeria. Therefore, mothers 15-19 at first childbirth

residing in the predominantly rural areas, especially in the rural northern regions and impoverished urban southern regions of Nigeria should be targeted as a vulnerable population by policymakers in the development of intervention programs such as accessible and better quality healthcare facilities, free prenatal and postnatal care. Although educating these vulnerable populations on the importance of prenatal care visits in order to prevent and monitor complicated pregnancies is an important step in the reduction of maternal mortality in Nigeria, empowerment of these women is paramount to reaching this goal especially in societies where women are totally dependent on male supervision and control which has been shown to limit influence timely access to healthcare.

5.2 Limitations and Future Research

As with most medical data being used, there is always the problem of the accuracy and under-reporting of data that has been collected, especially in a developing country like Nigeria where medical data is not readily available and accessible. So although medical data may not be completely accurate, it gives some representation of where the issue is occurring and what populations are more vulnerable or what areas should be given higher priority. The maternal mortality data collected for this research was collected at the state-level and may be suspect for inaccuracy. For future research, it may be important to collect data at a finer scale, perhaps at the district level, not only for a more accurate confirmation of the findings of this research, but to also give us a picture of what is happening within the states as maternal mortality rates will not be uniform within each state. Future research should also look at the proximity to and

distribution of hospitals as well as the total number of physicians and mid-wives in each state, as another measure examining if ready access to healthcare services and skilled birth assistance has an impact of maternal mortality in Nigeria.

APPENDIX
SUPPLEMENTAL FIGURES

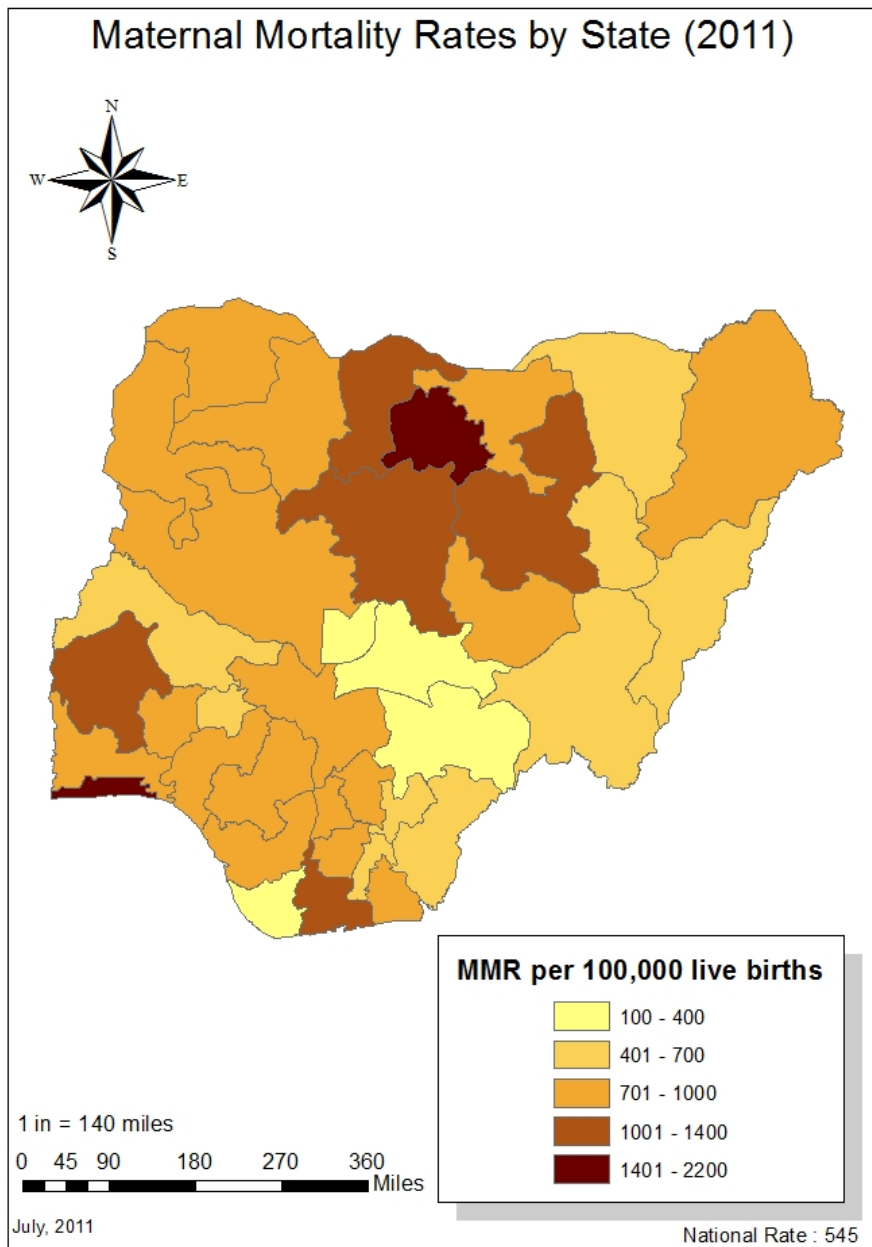


Figure A.1: Map showing the maternal mortality rates by state

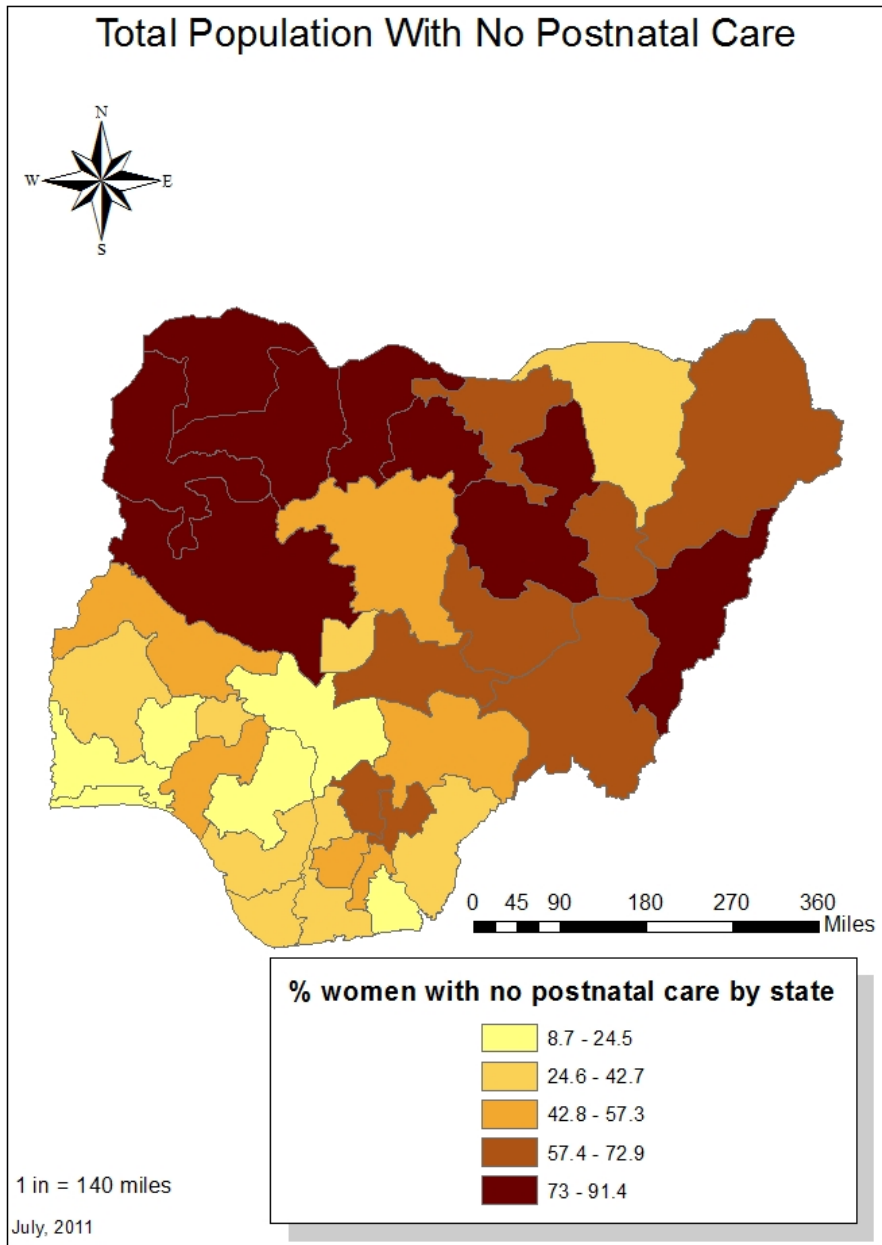


Figure A.2: Map showing women with no postnatal care visits

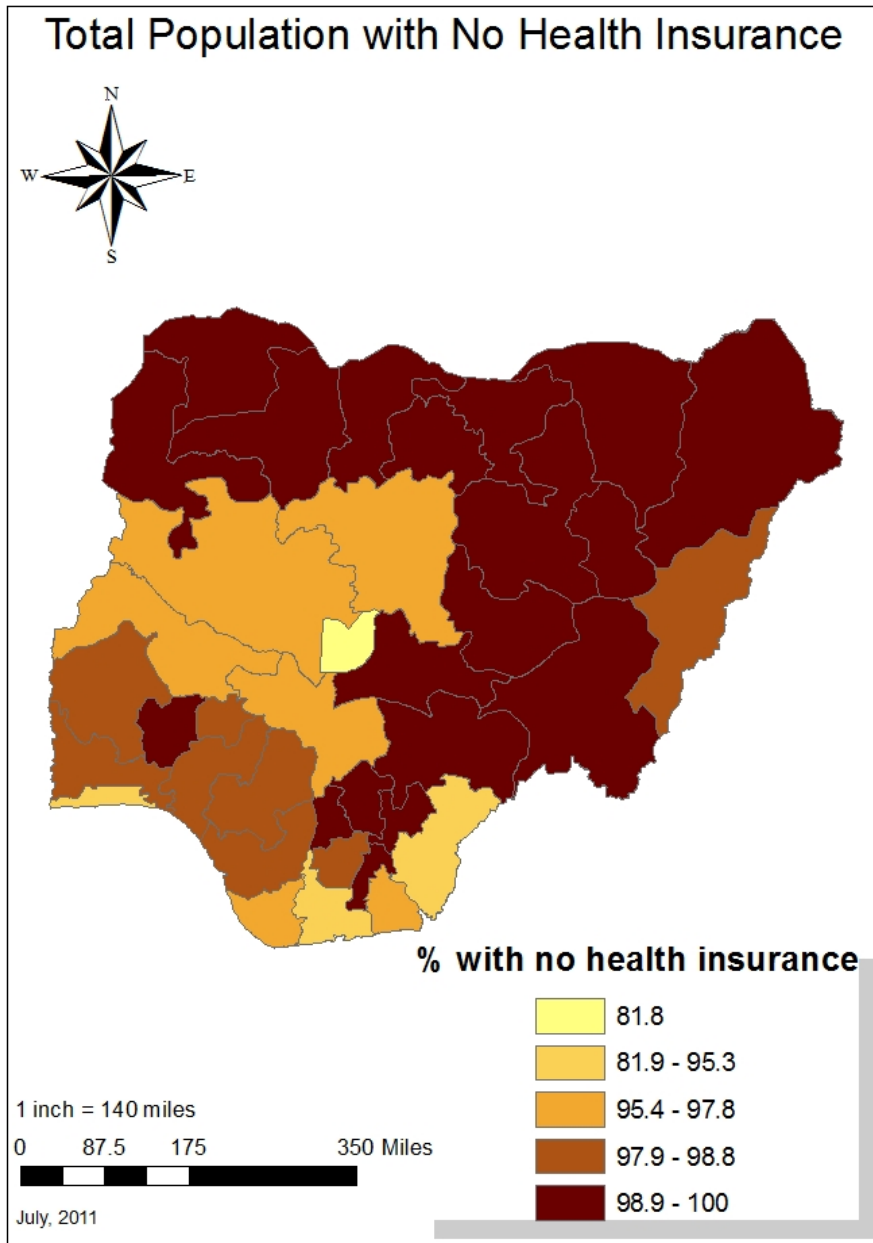


Figure A.3: Map showing women with no health insurance

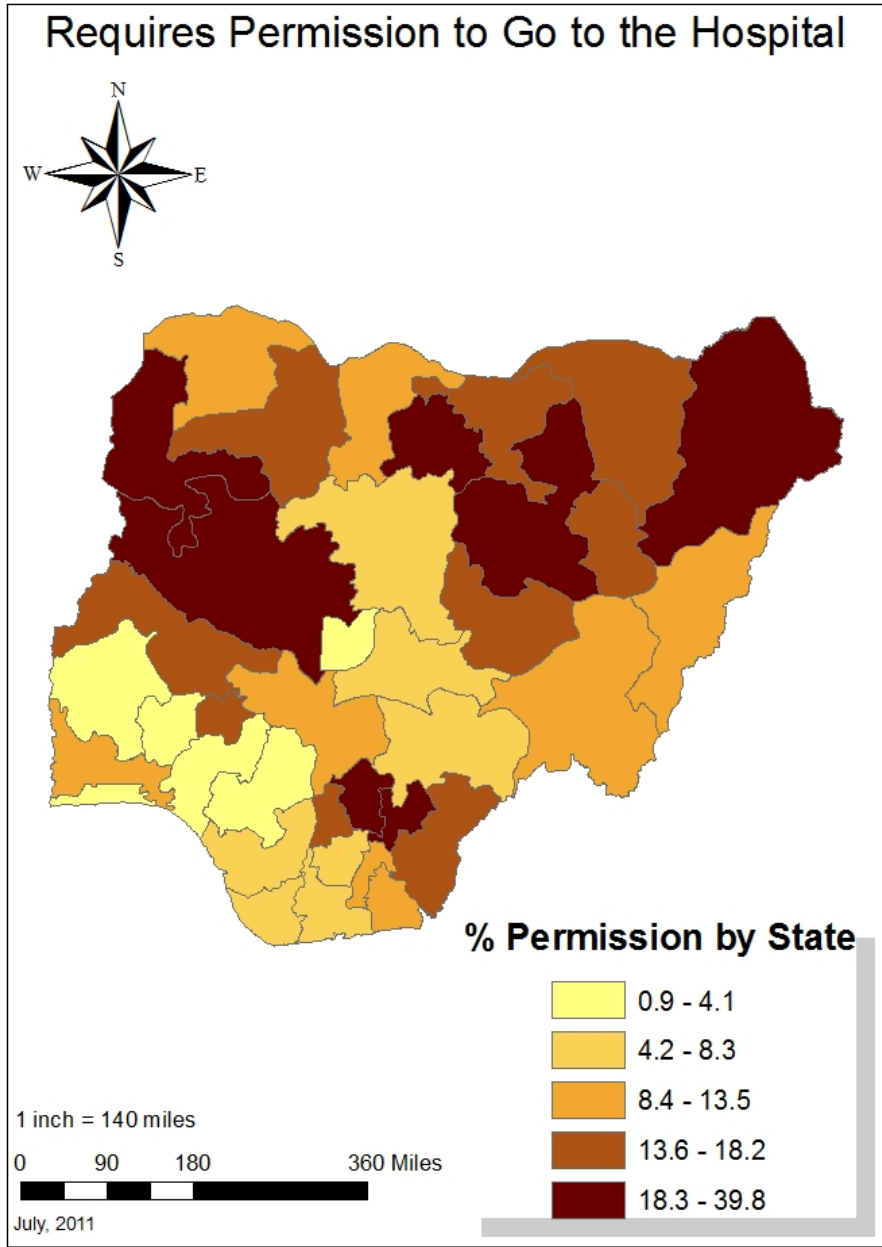


Figure A.4: Map showing women who require permission to visit a hospital

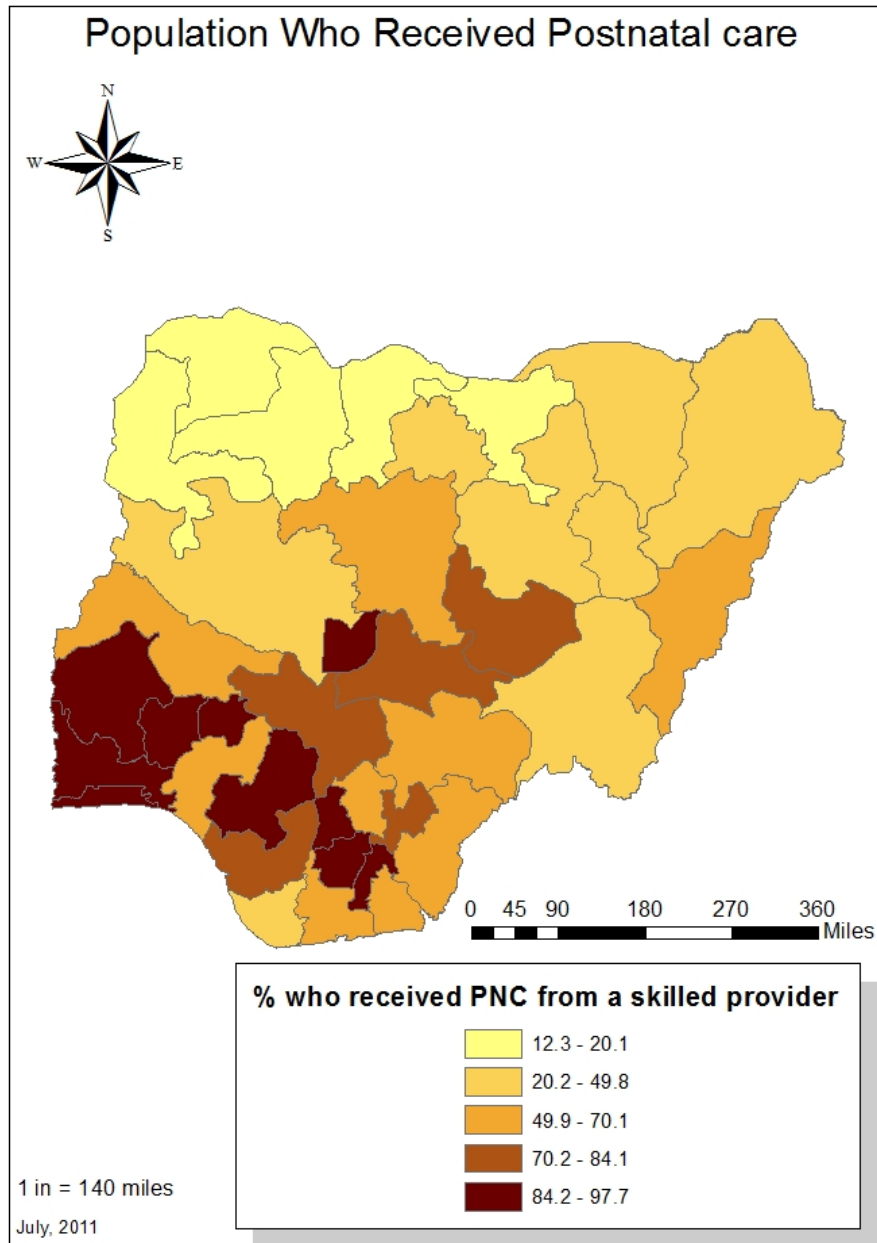


Figure A.5: Map showing women who received skilled postnatal care

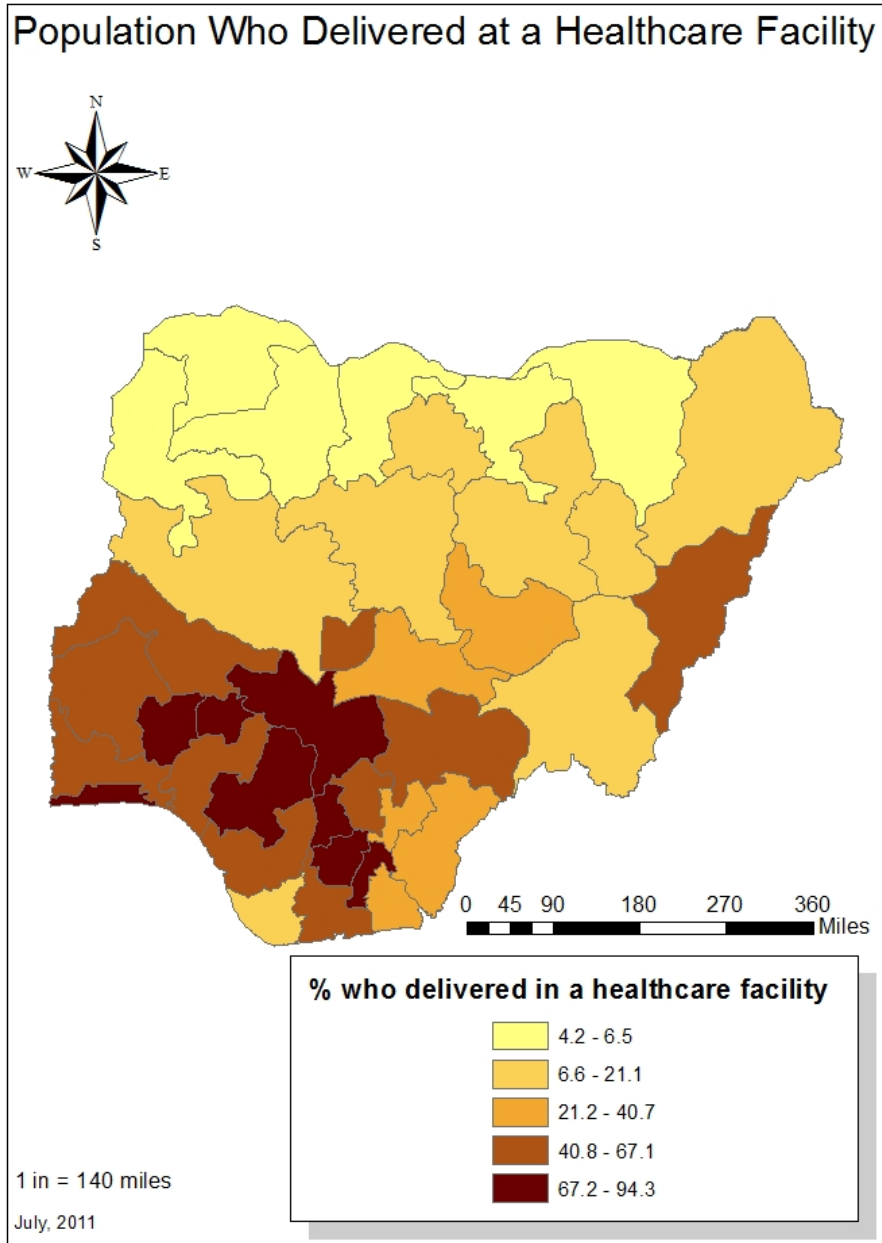


Figure A.6: Map showing women who delivered in a healthcare facility

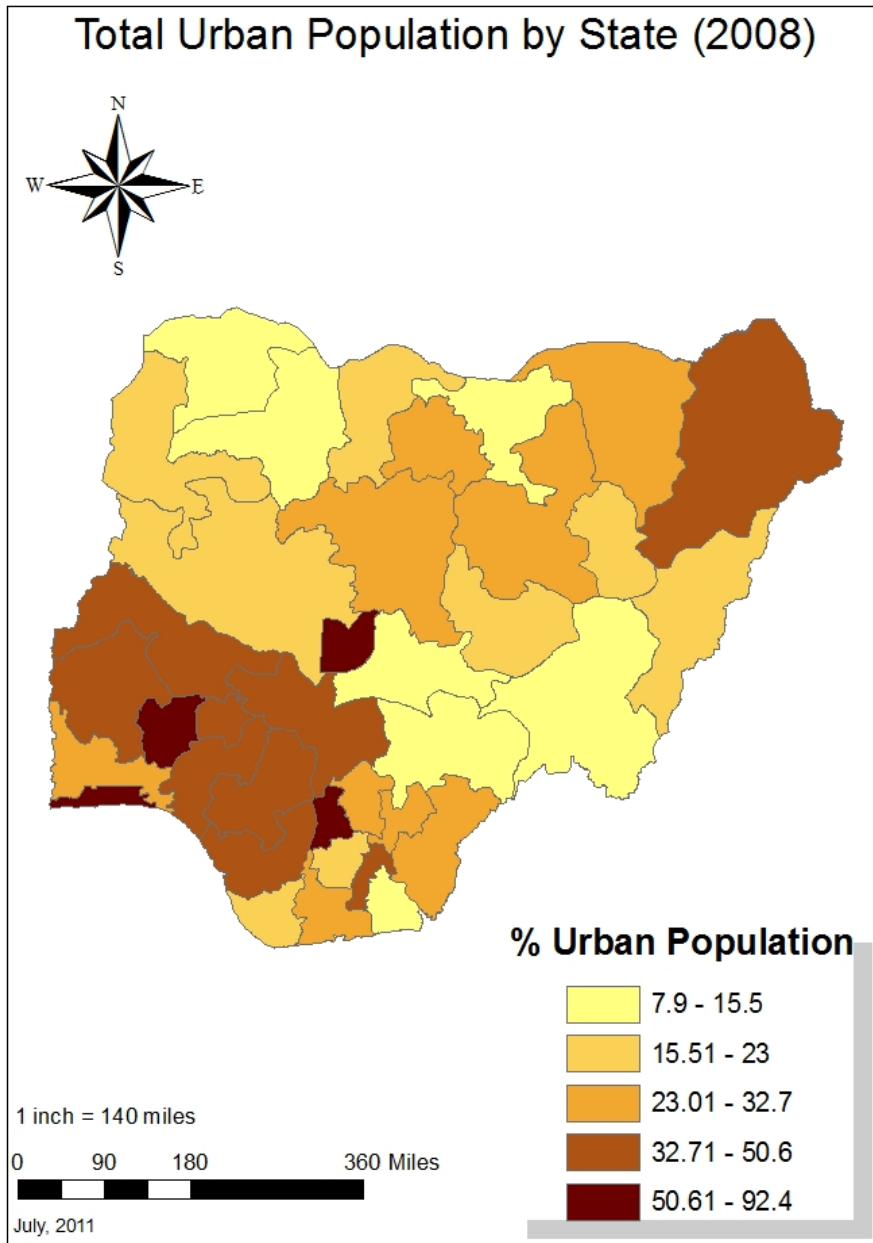


Figure A.7: Map showing percentage urban population by state

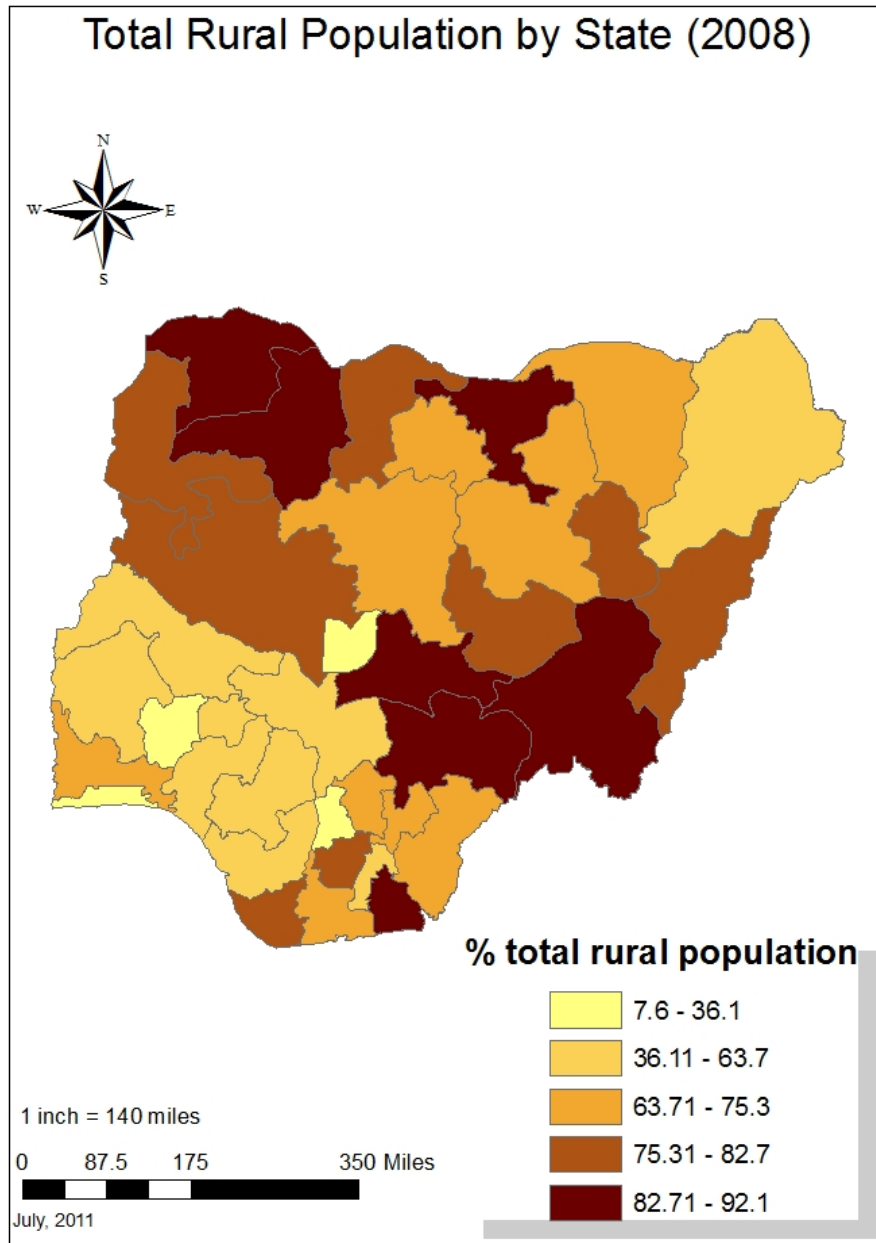


Figure A.8: Map showing percentage rural population by state

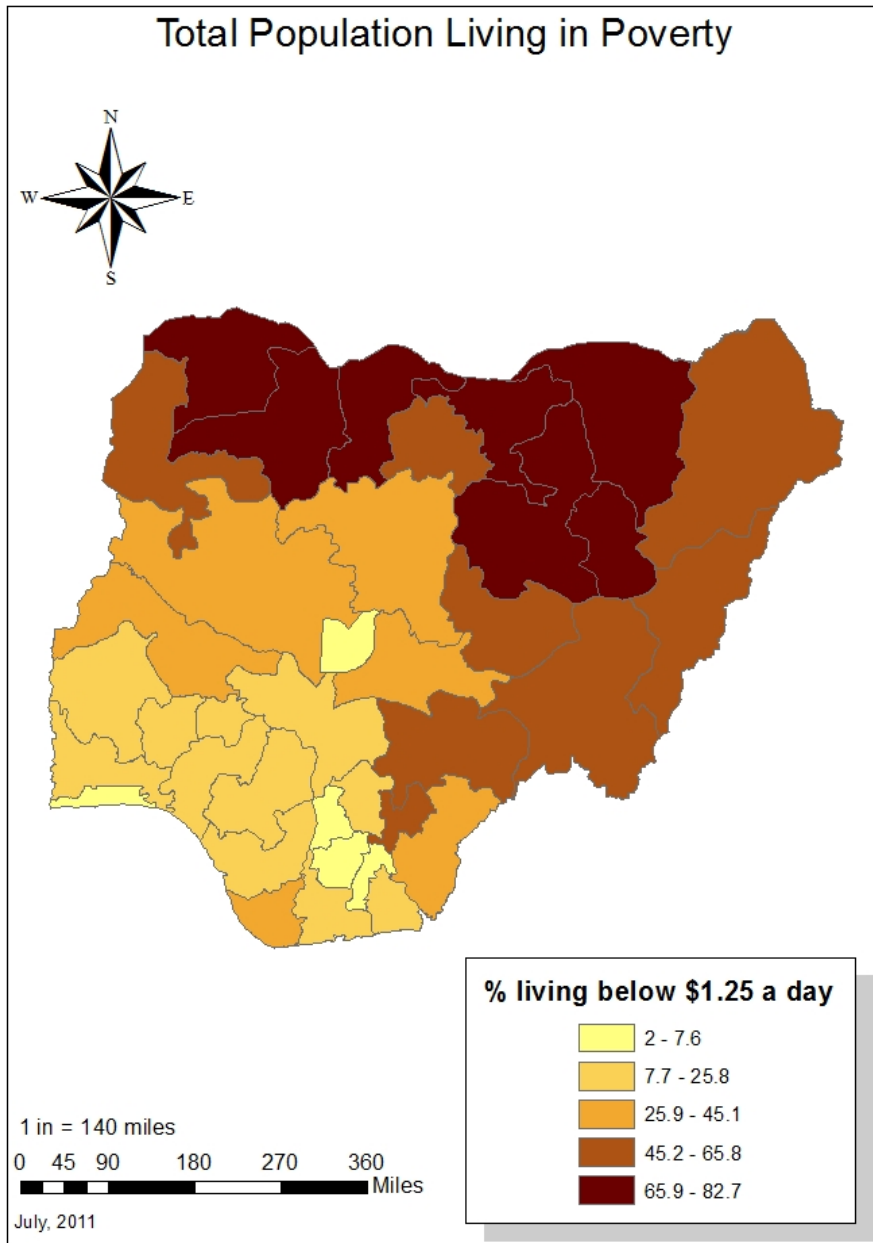


Figure A.9: Map showing percentage of the population living in poverty

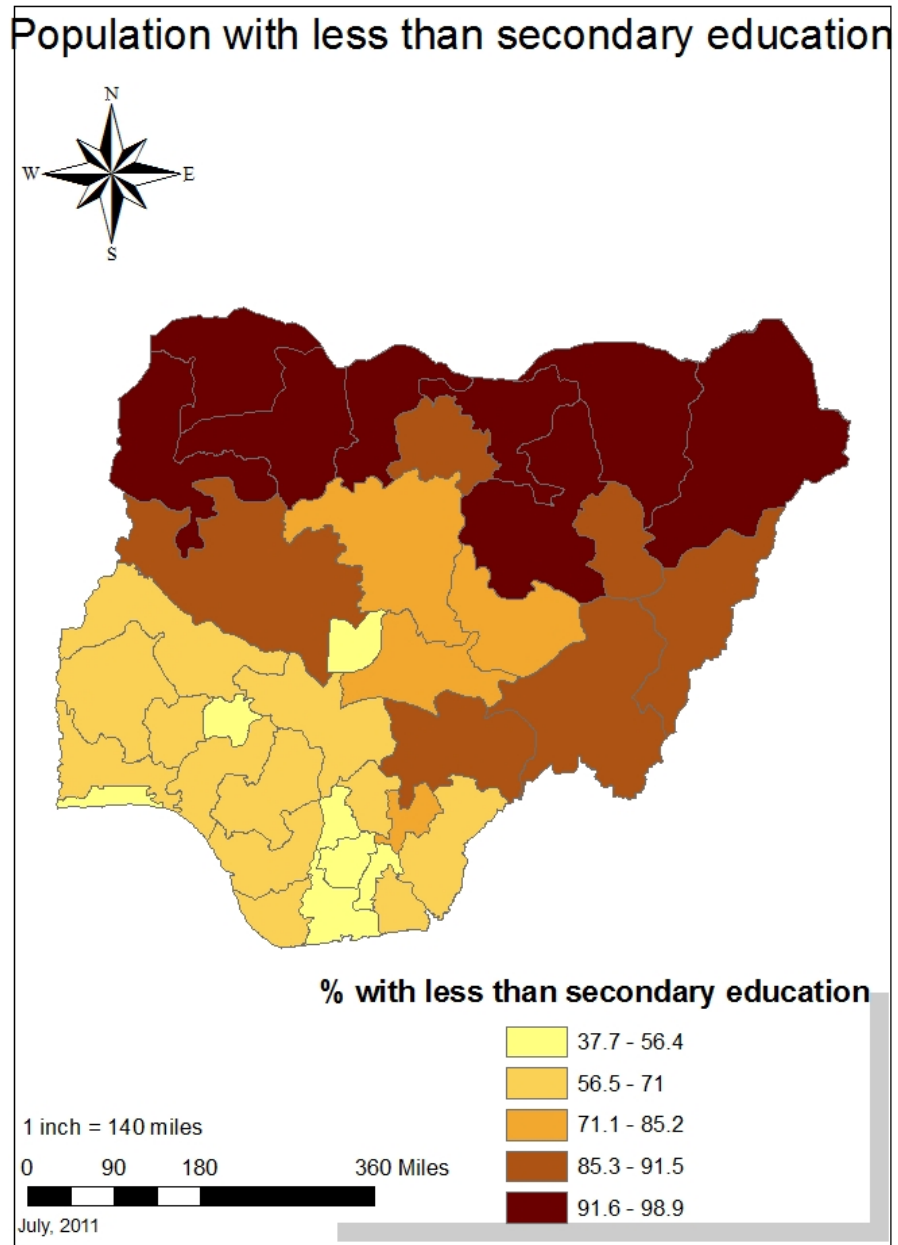


Figure A.10: Map showing women with less than secondary education

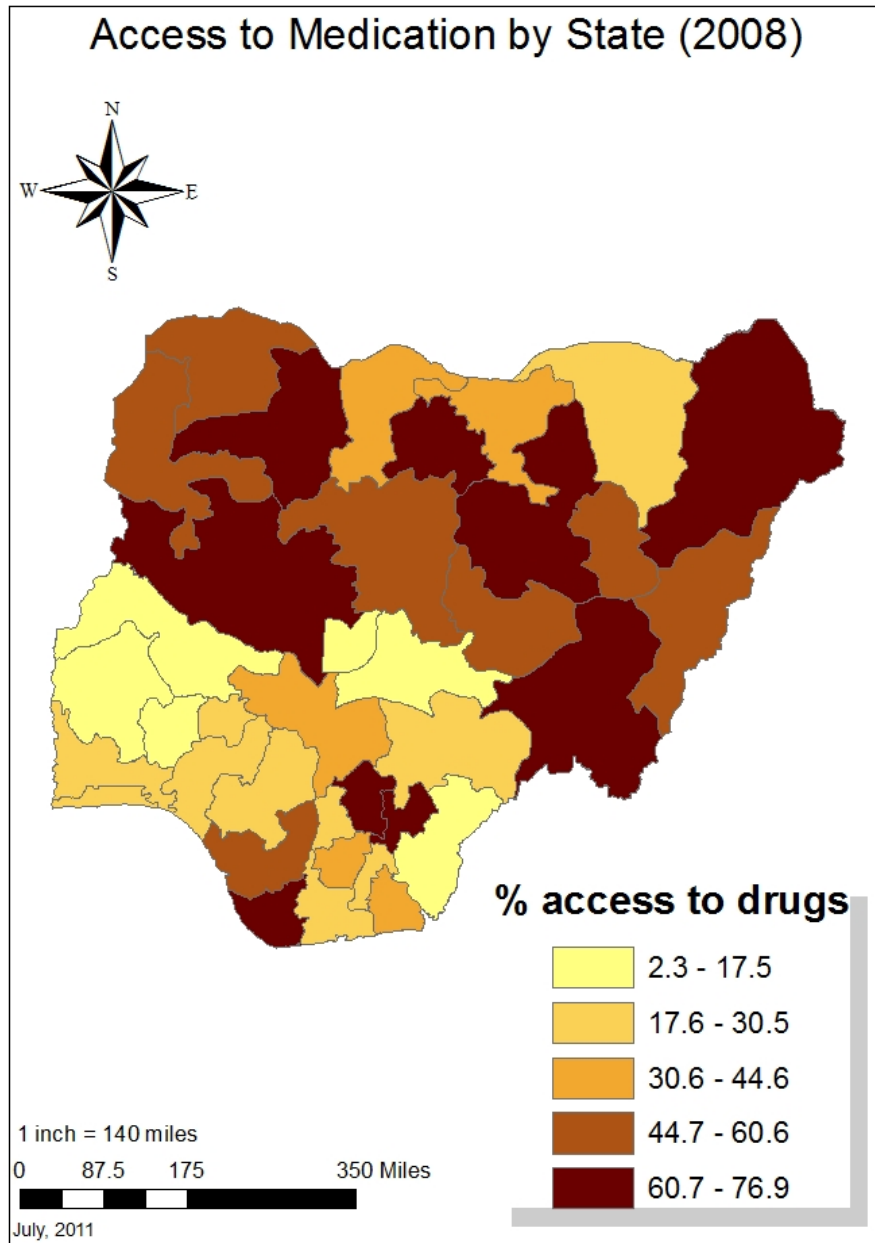


Figure A.11: Map showing women who had difficulty accessing drugs

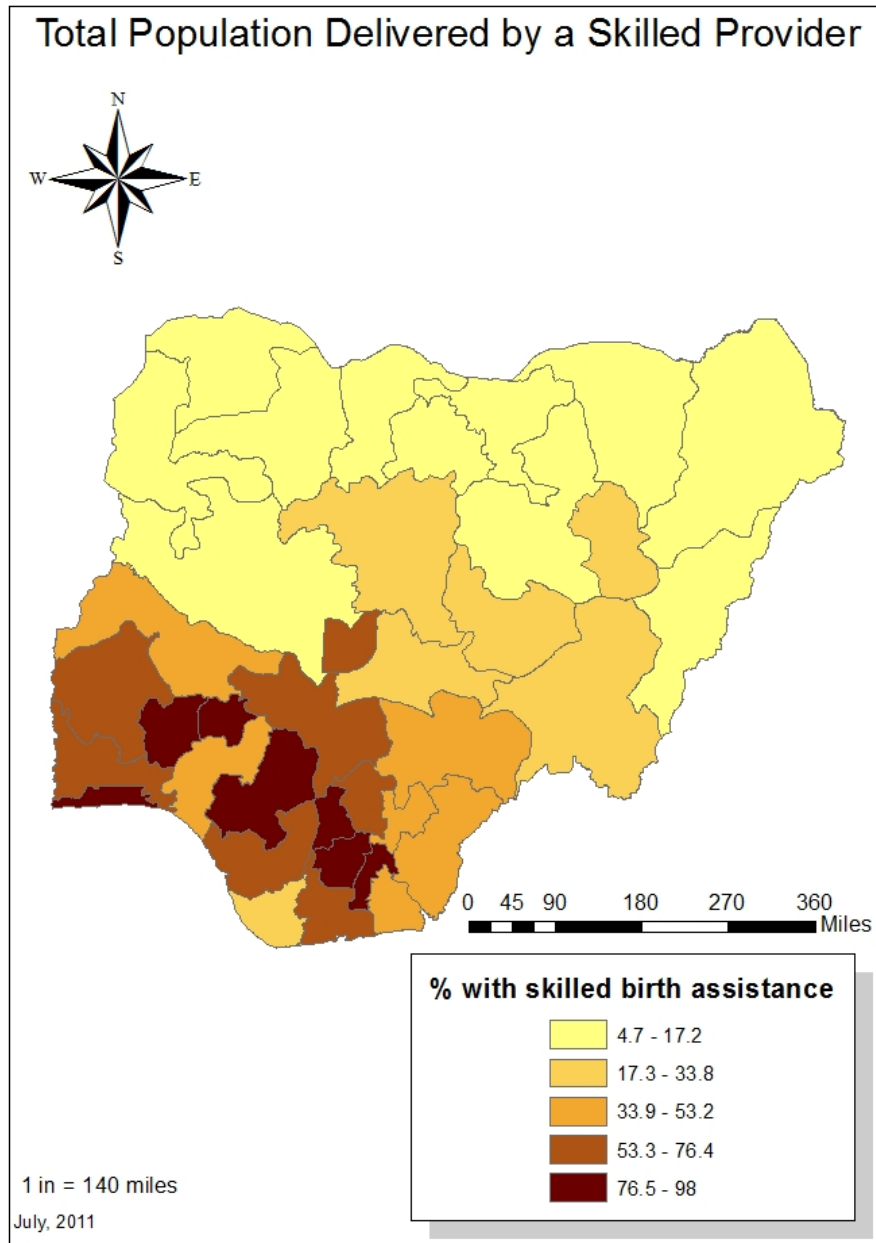


Figure A.12: Map showing women who had access to skilled birth assistance

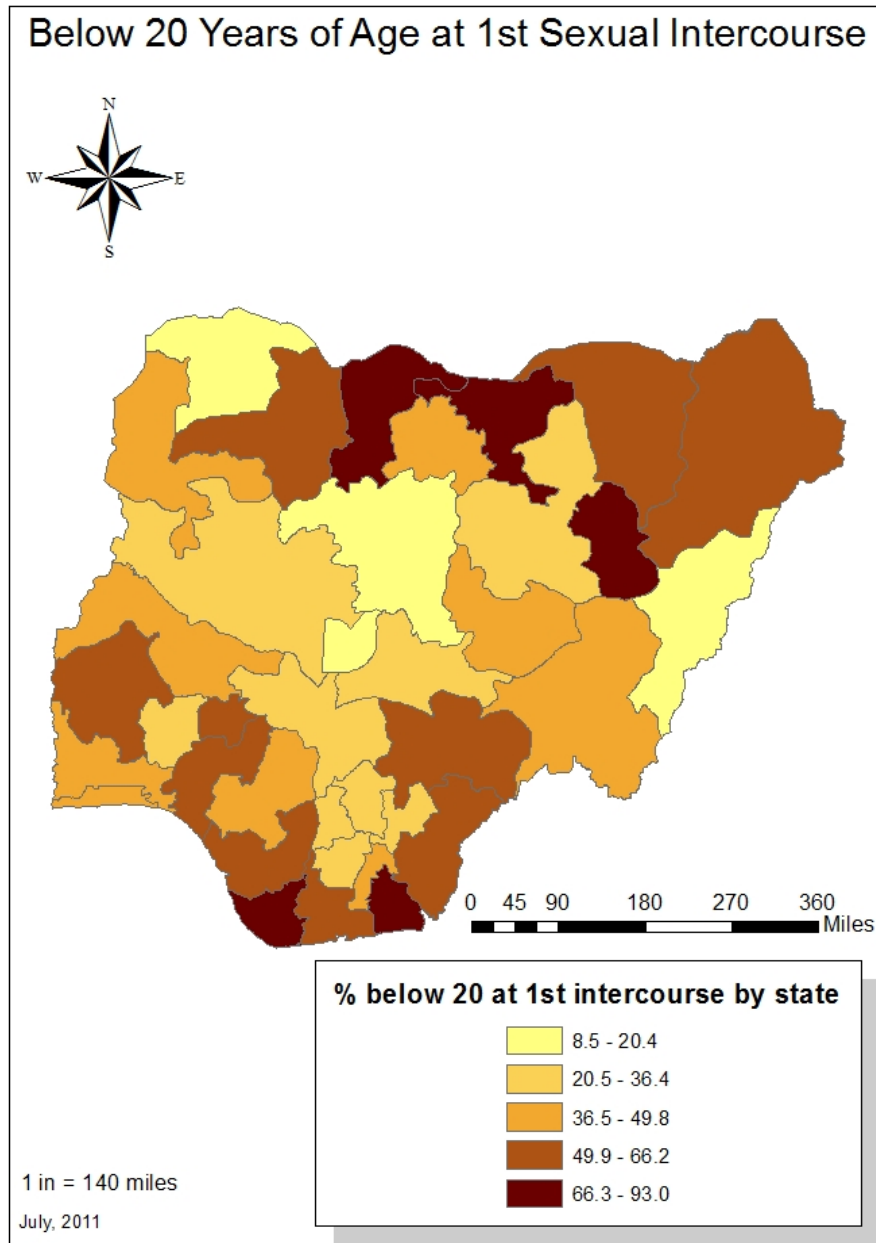


Figure A.13: Map showing women with 1st sexual encounter before 20 years

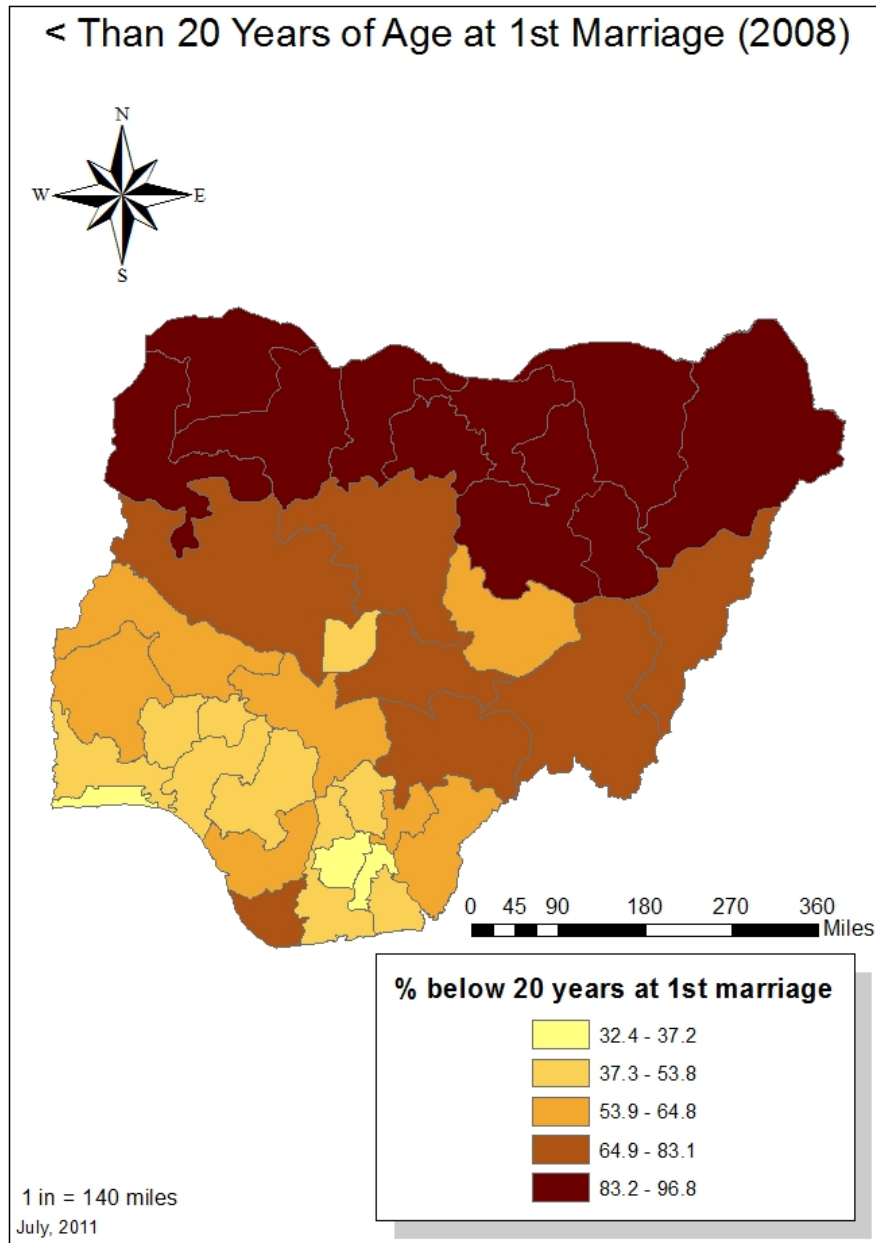


Figure A.14: Map showing women with their 1st marriage before 20 years

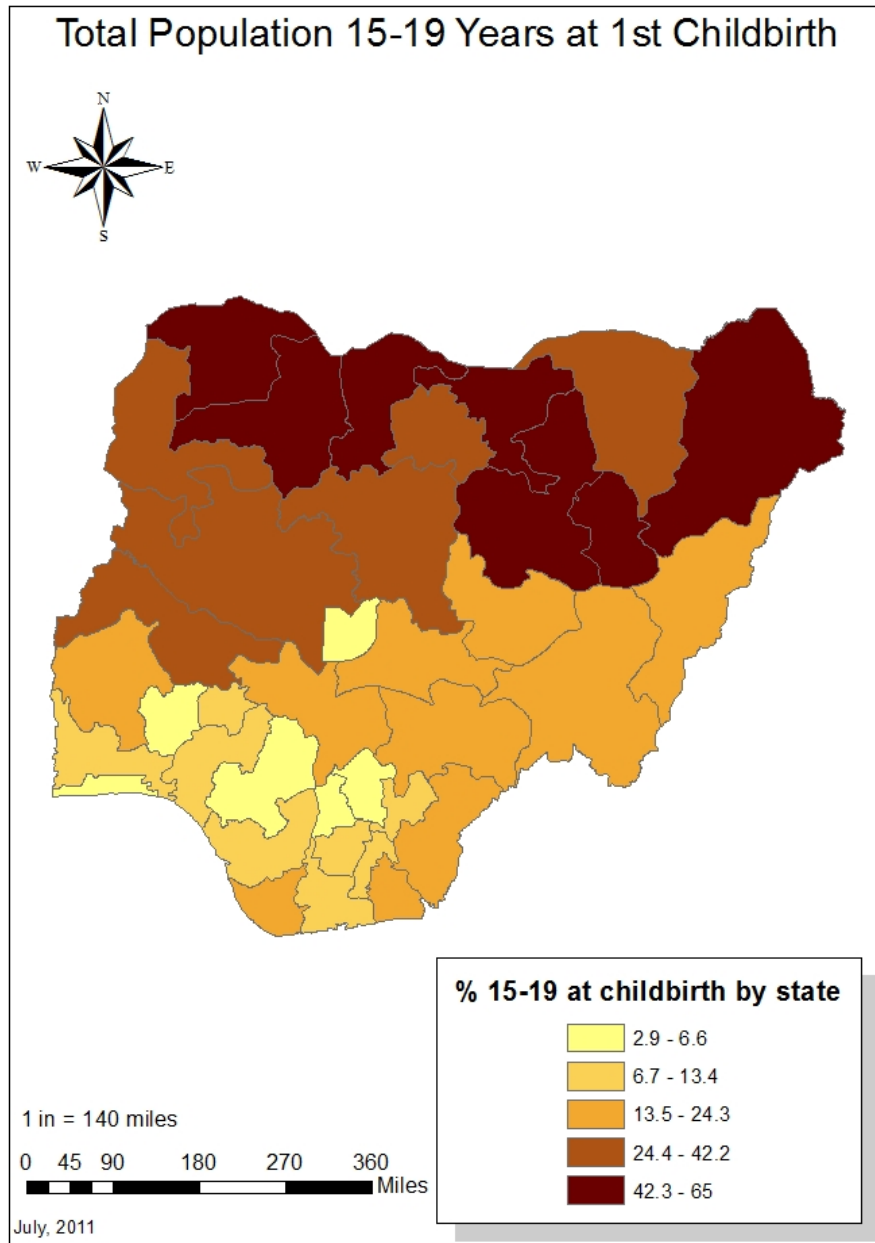


Figure A.15: Map showing women with 1st childbirth between 15-19 years

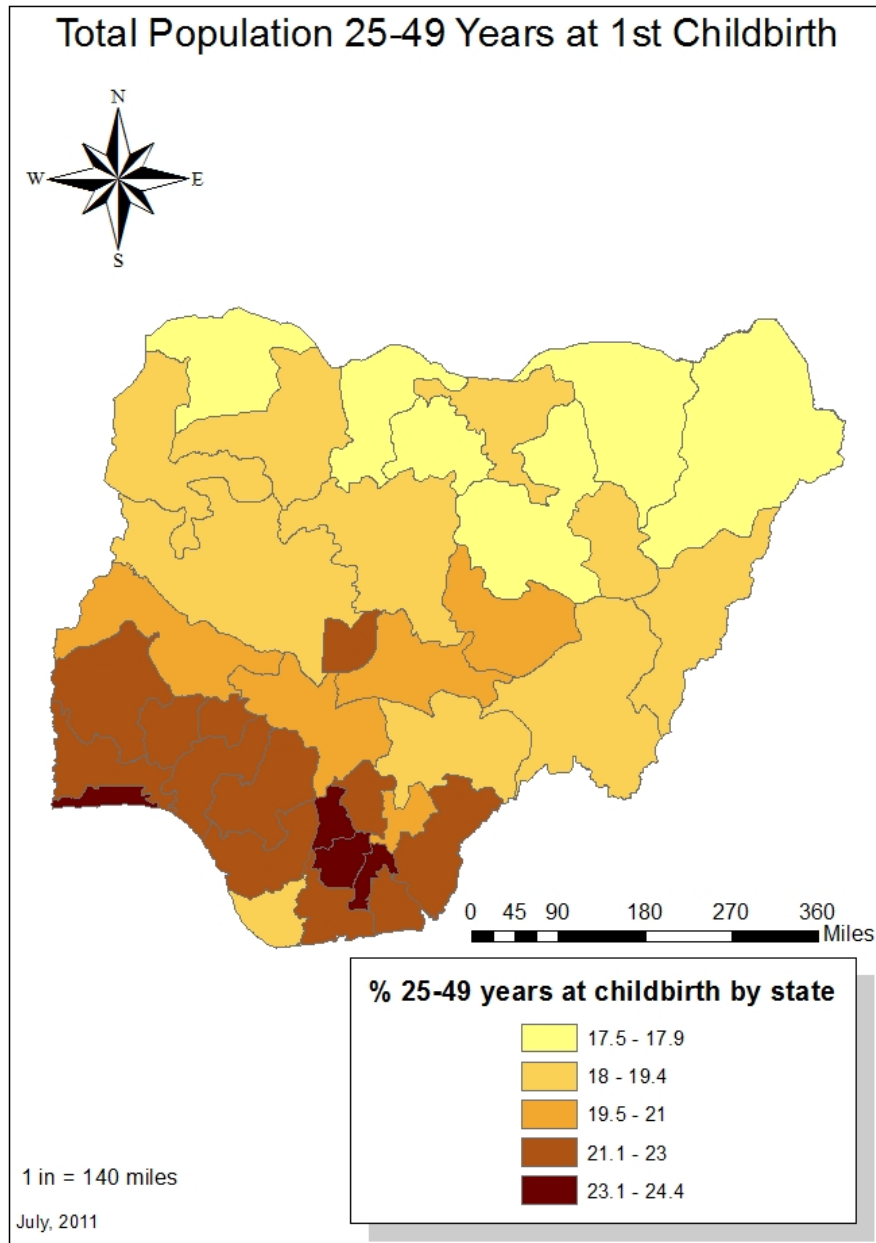


Figure A.16: Map showing women with 1st childbirth between 25-49 years

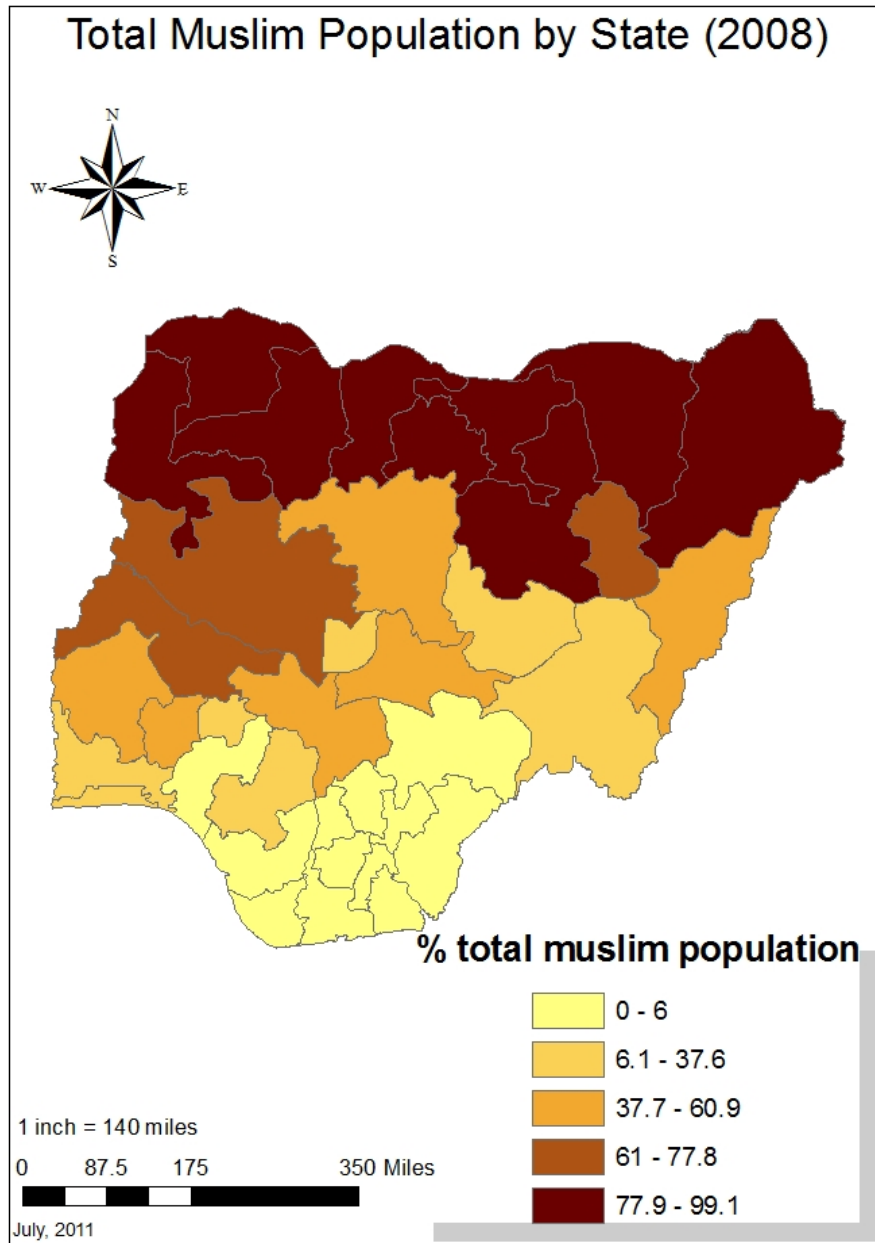


Figure A.17: Map showing the total Muslim population by state

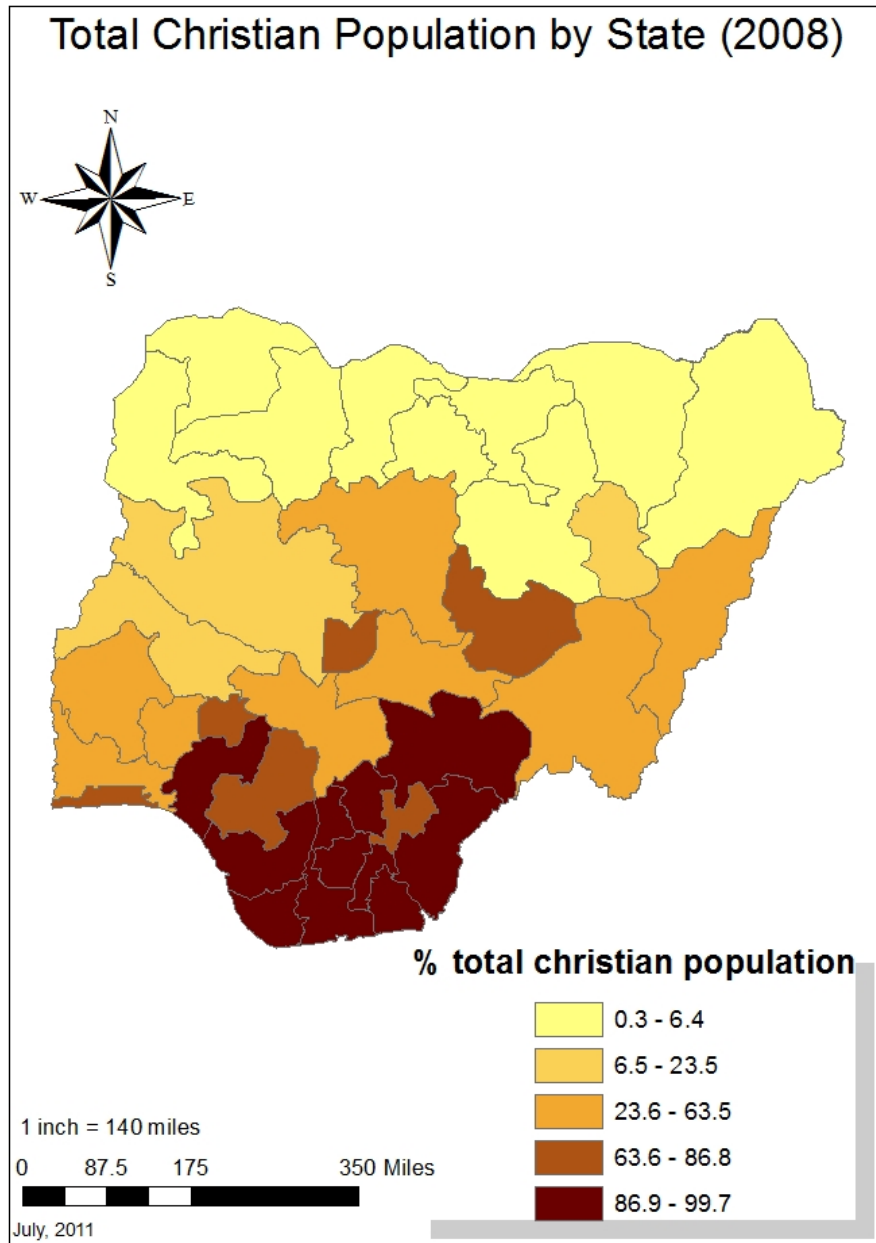


Figure A.18: Map showing the total Christian population by state

REFERENCES

- Abdulkarim, G.; Mohammed B.; and Abubakar, K. 2008. Community Perception of Maternal Mortality in NorthEastern Nigeria. *African Journal of Reproductive Health* 12 [3] :27-34.
- Aminu, H. 2011. Nigeria's Newborn Death Toll Highest in Africa. Press Release for the Partnership for Maternal, Newborn and Child Health. Available at http://www.who.int/pmnch/media/membernews/2011/20110112_savingnewbornlives_nigeria/en/index.html.
- Bankole, P. and Surajudeen, A. 2008. Major Environmental Issues and the Need for Environmental Statistics and Indicators in Nigeria. Paper Presented at the ECOWAS Workshop on Environment Statistics, Abuja, Nigeria 19-23 May.
- Boserup, E. 1990. Population, the Status of Women, and Rural Development. *Population and Development Review* 15: 45-60.
- Chakrapani, V., Newman, P. A., Shunmugan, M., and Dubrow, R. 2010. Prevalence and Contexts of Inconsistent Condom Use among Heterosexual Men and Women Living in India: Implications for Prevention. *AIDS Patient Care and STDS* 24(1), 49-58.
- Chambers, R. 1989. Vulnerability, Coping and Policy. *IDS Bulletin* 20(2), 23-32.
- Chukuezi, C. 2010. Socio-Cultural Factors Associated with Maternal Mortality in Nigeria. *Research Journal of Social Sciences* 1(5): 22-26, 2010.
- CIA World Factbook 2010. Africa : Nigeria. Available at the Central Intelligence Agency website at <https://www.cia.gov/library/publications/the-world-factbook/geos/ni.html> (last updated on 24 June 2010).
- Dahiru, A. 2010. Eclampsia as a Common Cause for Maternal Mortality. Available at <http://www.nigeriavillagesquare.com/articles/abdullahi-dahiru-md/eclampsia-as-a-common-cause-of-maternal-mortality-in-nigeria.html>.
- Federal Ministry of Health 2011. Saving Newborn Lives in Nigeria: Newborn Health in the Context of the Integrated Maternal, Newborn and Child Health Strategy. *2nd edition. Abuja: Federal Ministry of Health, Save the Children, Jhpiego; 2011.*
- Federal Ministry of Health, Port Harcourt 2011. State-Level Statistics on Maternal Mortality Figures in Nigeria.
- Federal Ministry of Health, Port Harcourt 2011. State-Level Statistics on Neonatal Mortality Figures in Nigeria.
- Filippi, V.; Ronsmans, C.; Campbell, O. et al. 2006. Maternal Health in Poor Countries: The Broader Context and a Call for Action. *Lancet* 368(9546), 1535–1541.

- Ghosh, J. and Kalipeni, E. 2005. Women in Chinsapo, Malawi: Vulnerability and Risk to HIV/AIDS. *Journal of Social Aspects of HIV/AIDS* 2(2), 320-332.
- Ghosh, J. and Olson, B. 2007. HIV/AIDS in South Africa and India: Understanding the Vulnerability Factors. In G. Pomeroy, C. Cusak and B. Thakur (eds.), *Geographic Perspectives on Cities, Regions and Society*. New Delhi: Concept Publishing Co.
- Graham, W.; Fitzmaurice, A.; Bell, J.; Cairns, J. 2004. The Familial Technique for Linking Maternal Death and Poverty. *Lancet* 2004, 363:23-27.
- Harrison, K. 1997. Maternal mortality in Nigeria: The Real Issues. *African Journal of Reproductive Health* 1:7-13.
- Hodges, A. 2001. Children's and Women's Rights in Nigeria: A Wake-Up Call, Situation, Assessment and Analysis. UNICEF/National Planning Commission, Nigeria.
- Ibrahim, A. 2008. Little Progress on Maternal Mortality in Nigeria. An Article Written for the Inter Press Service Agency on 30 July 2008. Available at <http://ipsnews.net/africa/nota.asp?idnews=43379>.
- Koonin, L.; Atrash, H.; Rochat, R. and Smith, J. 1988. Maternal mortality Surveillance, United States 1980-1985. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/00001754.htm>.
- Lanre-Abass, B. 2008. Poverty and Maternal Mortality in Nigeria : Towards a More Viable Ethics of Modern Medical Practice. *International Journal For Equity in Health* 7, 11. Available at <http://www.equityhealthj.com/content/7/1/11>.
- Lindroos, A. 2010. Antenatal Care and Maternal Mortality in Nigeria. *Public Health Program – Exchange to Nigeria*.
- Meade, M. and Emch, M. 2010. *Medical Geography* - Third Edition. The Guilford Press, New York, NY. pg 27-43.
- National Bureau of Statistics, Port Harcourt 2011. State-Level Statistics on Poverty, Total Number of Hospitals, Education, Family Planning, Prenatal Care and Religious Composition in Nigeria from 2004-2007.
- Nigerian Academy of Science 2009. *Reducing Maternal and Infant Mortality in Nigeria* (Workshop Summary) Nwosu J., Odubanjo MO, Osinusi BO, ed. West African Publishers, Lagos, Nigeria.
- Nigerian Population Commission (NPC) [Nigeria] 1999. Nigerian Demographic and Health Survey 1999. Abuja, Nigeria :National Population Commission and ICF Macro 2000.

- Nigerian Population Commission (NPC) [Nigeria] 2003. Nigerian Demographic and Health Survey 2003. Abuja, Nigeria :National Population Commission and ICF Macro 2004.
- National Population Commission (NPC) [Nigeria] 2008. Nigeria Demographic and Health Survey 2008. Abuja, Nigeria: National Population Commission and ICF Macro 2009.
- Obermeyer, C. 2000. Pluralism and pragmatism: Knowledge and Practice of Birth in Morocco. *Medical Anthropology* 14, 180-201.
- Okereke, H.; Kanu, I.; Nwachukwu, N.; Anyanwu, E.; Ehiri, J. and Merrick, J. 2005. Maternal and Child Health Prospects in Nigeria. *Internet Journal of Pediatrics and Neonatology*.
- Okpani, A. and Okpani, J. 2000. Sexual Activity and Contraceptive Use among Female Adolescents: A Report from Port Harcourt, Nigeria. *African Journal of Reproductive Health* 4(1), 40-47.
- Okwerekwu, F. 1991. Maternal Mortality in Nigerian Women Aged 35 Years and Above. *Asia Oceania Journal of Obstetrics and Gynaecology* 17(1), 37-44.
- Omofonmwan, S. and Osa-Edoh, G. 2008. The Challenges of Environmental Problems in Nigeria. *Journal of Human Ecology* 23(1), 53-57.
- Omoruyi, G. 2011. Causes of Maternal Mortality in Nigeria. *Sunday Observer*. Available at <http://www.nigerianobservernews.com/21112010/21112010/sundayobserver/features/features4.html>.
- Opping, J. 1998. A Vulnerability Interpretation of the Geography of HIV/AIDS in Ghana, 1986-1995. *Professional Geographer* 50(4), 437-449.
- Oxaal, Z. and Baden, S. 1996. Challenges to Women's Reproductive Health: Maternal Mortality. A Report Prepared at the Request of the Social Development Department, Department for Overseas Development, U.K. Available at <http://www.bridge.ids.ac.uk/reports/re38c.pdf>.
- Phipps, M. G. et al. 2002. Young Maternal Age Associated with Increased Risk of Neonatal Death. *Obstetrics and Gynecology* 100:481-486.
- Prata, N.; Sreenivas, A.; Vahidnia, F.; Potts, M. 2009. Saving Maternal Lives in Resource-Poor Settings: Facing Reality. *Health Policy* 89(2), 131-148.

- Psacharopoulos, G. and Patrinos H. 2002. Returns to Investment in Education: A Further Update. Policy Research Working Paper 2881. World Bank, Washington, DC, 2002. Available at http://www.wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2002/09/27/000094946_02091705491654/Rendered/PDF/multi0page.pdf
- Saka, D. N. 2006. *The Niger Delta: A Web of Environmental Hazards*. Postgraduate Research Study for Lancaster University, UK.
- Sargent, C. 1982. Solitary Confinement : Birth Practices among the Bariba of the People's Republic of Benin. In *Anthropology of Human Birth*, ed Kay, M.A.; Philadelphia : F.A. Davis; 1982. pg 193-209.
- Save the Children 2006. *State of the World's Mothers*. Washington, DC.
- Thaddeus, S. and Maine, D. 1994. Too Far To Walk : Maternal Mortality in Context. *Social Science and Medicine Journal* Volume 38 Issue 8. pg 1091-1110.
- Thaddeus, S. and Nangalia, R. 2004. Perceptions Matter : Barriers to Treatment of Postpartum Hemorrhage. *Journal of Midwifery and Women's Health* 2004; 49 (4).
- UNFPA 2004. State of World Population, 2004. Available at <http://www.unfpa.org/swp/2004/english/ch9/page5.html>.
- Ujah, I. and Ejeh I. 1999. *Postpartum Hemorrhage and Maternal Mortality in Nigeria*. Available at http://www.sapienspublishing.com/pph_pdf/PPH-Chap-52.pdf.
- UNICEF 2010. *State of the World's Children*. New York, UNICEF.
- United States Energy Information Administration - USEIA 2010. Independent Statistics and Analysis. *Country Analysis Briefs of Nigeria* 2010.
- United States Library of Congress -USLC 2008. Federal Research Division. Country Profile – Nigeria. Available at <http://www.lcweb2.loc.gov/frd/cs/profiles/Nigeria.pdf>.
- Wall, L., (1998) Dead Mothers and Injured Wives: The Social Context of Maternal Morbidity and Mortality among the Hausa of Northern Nigeria. *Studies in Family Planning* 29(4): 341-359
- World Bank 1995. *Improving Women's Health in India*, Washington DC.
- World Health Organization 2006. UNFPA. *Pregnant Adolescents*. Geneva : WHO, 2006.
- World Health Organization 2007. *Maternal mortality in 2005*. Maternal Mortality Estimates Developed by WHO, UNICEF and UNFPA. Geneva, World Health Organization, 2007.

Zabin, L. and Kiragu, K. 1998. The Health Consequences of Adolescent Sexual and Fertility Behavior in Sub-Saharan Africa. *Studies in Family Planning* 29 : 210-232.

Zozulya, M. 2010. Maternal Mortality in Nigeria: An Indicator of Women's Status.

Available at

http://www.consultancyafrica.com/index.php?option=com_content&view=article&id=358:maternal-mortality-in-nigeria-an-indicator-of-womens-status&catid=59:gender-issues-discussion-papers&Itemid=267.